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THE POTENTIAL IMPACT OF THE MEDIEVAL CLIMATIC ANOMALY ON HUMAN POPULATIONS IN THE WESTERN MOJAVE DESERT

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ABSTRACT

The Potential Impact of the Medieval Climatic Anomaly on Human Populations in the Western Mojave Desert

by

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During the late 1980s and early 1990s, a model was proposed for changing settlement and subsistence patterns in the western Mojave Desert. The model posits that environmental fluctuations over the last 4,000 years were potential causal mechanisms for culture change in this region. One of these fluctuations was the environmental episode known as the Medieval Climatic Anomaly (MCA), a series of droughts that took place between about 1,200 and 650 B.P. The intent of this study was to determine whether apparent culture changes that began about 1,200 years ago in the western Mojave Desert are associated with the MCA. To accomplish this goal, a comparison of site and regional archaeological data sets was made in order to illuminate the effects proposed in this study.

Examining numerous archaeological assemblages from sites in the western Mojave Desert that were excavated between the 1970s and 2000s, certain trends became apparent. As such, the data from this study support the hypothesis that various culture traits evident

in the western Mojave Desert were either directly or indirectly impacted by the MCA, including an extreme subsistence focus on lagomorphs during the Rose Spring Period, expansion of the bow and arrow at about the same time, a severe reduction in obsidian use during the Late Prehistoric Period, human population increase during the Rose Spring Period and subsequent population decrease during the Late Prehistoric Period, and the Numic expansion.

To what degree environmental episodes play a role in cultural transitions depends largely on the severity and duration of such episodes. The conclusion of this study is that the MCA was of sufficient severity and duration to have been a motivating factor for much of the culture change discussed in detail within this study.

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My children were in high school when I decided to return to college. I was not sure how they would respond to that decision. But I feel blessed that not only were they always supportive, they were my biggest cheerleaders. Both my daughter and son, Randi and Rob, have told me that I inspired them to continue their educations after high school, and both now have college degrees. How could a mother ask for more than that? My children are also *my* inspiration. My parents had somewhat disparate reactions. My mother teased me that she should have known I would become an archaeologist, because as a child I liked to play in the dirt. My father was a bit perplexed by my choice of careers as a returning student, but supported me anyway. I know that both of my parents are very proud of me, and that makes the journey so much more satisfying.

While this study was greatly enhanced by my discussions and emails with various people, most notably (and most frequently) Robert Yohe and Mark Sutton, I take full responsibility for any mistakes, errors in logic, or omissions that may be contained within its pages.

This dissertation is dedicated posthumously to my wonderful grandmother, Eugenia (Jeanie) Gardner, who was a "great" grandmother and a caring friend to me. I know she would have been very proud of me for this accomplishment.

CHAPTER 1

INTRODUCTION

To present the wealth of information collected in this investigation without wearying one reader or another is a difficult task.

(D. G. Thompson 1929:3)

During the late 1980s and early 1990s, Sutton (1990, 1991a, 1991b) proposed a model for changing settlement and subsistence patterns in the western Mojave Desert of the extreme southwest Great Basin (Figure 1), based primarily on the results of his excavations at the Koehn Lake site (CA-KER-875) in the Fremont Valley. The model posits that several environmental fluctuations over the last 4,000 years were potential causal mechanisms for culture change in this region. One of these fluctuations was the environmental episode known as the Medieval Climatic Anomaly (MCA), a series of prolonged droughts that took place between roughly 1,200 and 650 years ago (ca. A.D. 800 to 1350), and is of particular interest in understanding apparent shifts in settlement and subsistence patterns and population movements in the Mojave Desert at that time (e.g., Jones et al. 1999).

It is the hypothesis of this study that culture changes that began about 1,200 years ago in the western Mojave Desert are associated, at least to some degree, with the MCA. Consequently, the primary question that is the focus of this dissertation is: What were the potential effects of the MCA on prehistoric settlement and subsistence patterns—as well

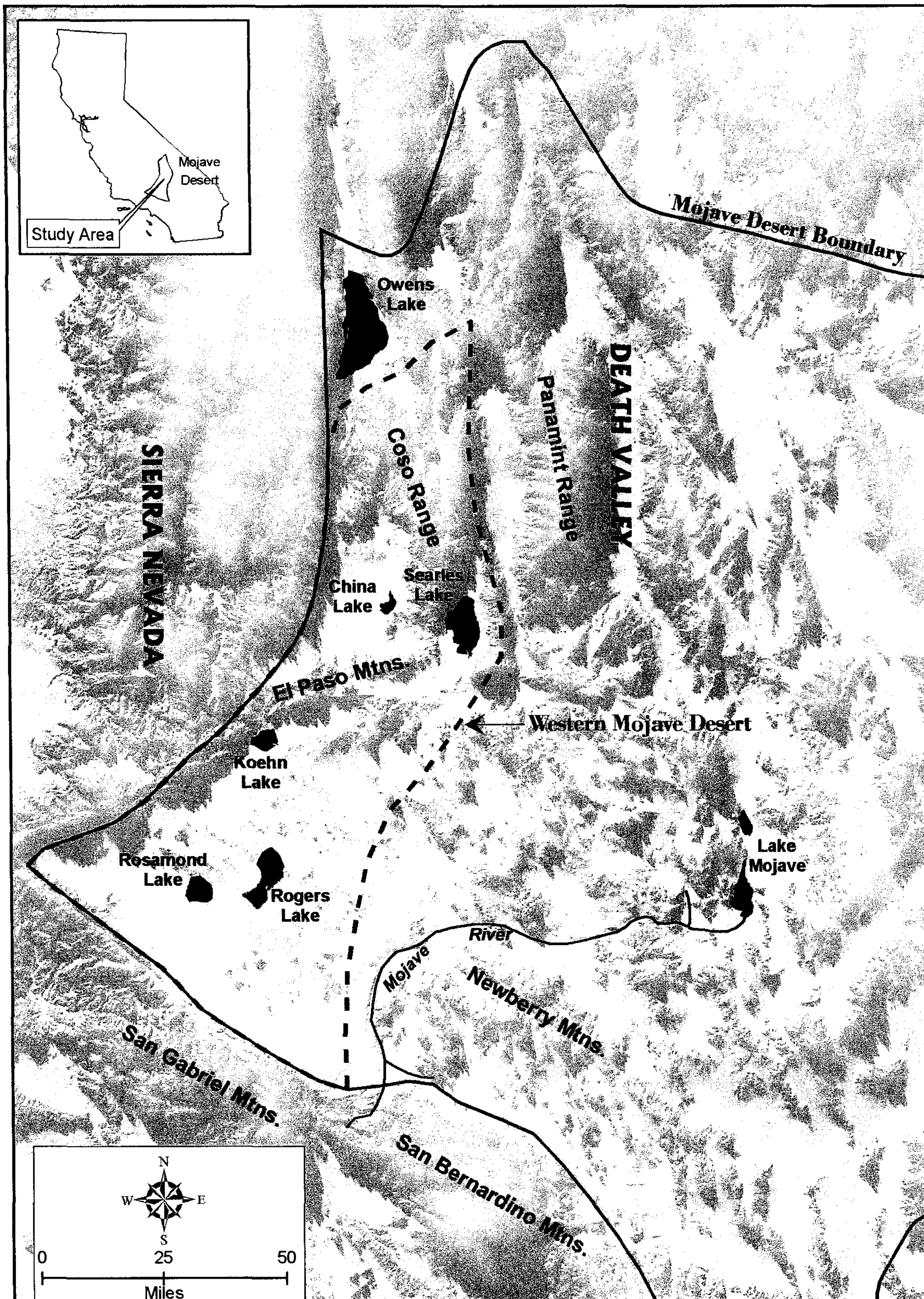

Figure 1. The Mojave Desert of southeastern California and surrounding areas. As the focus of this study is on the western Mojave Desert, this map excludes a portion of the eastern Mojave Desert that extends into southern Nevada and the extreme southeastern end of the Mojave Desert of California. The boundary of the western Mojave Desert is approximate. (Map by H. Switalski.)

as other aspects of culture—in the western Mojave Desert, and can we detect these effects in the archaeological record? While we should always be careful to avoid assigning sole causation for culture change to environmental factors like the MCA, such significant episodes would certainly have affected prehistoric cultures in the Mojave Desert.

In an attempt to determine the potential effects of the MCA on the prehistoric inhabitants of the western Mojave Desert, archaeological assemblages from a large number of western (and a few central) Mojave Desert sites are compared in an attempt to ascertain what those effects may have been and how they may have been manifested in the cultures that resided there. Below is a discussion of the theoretical framework for this study, followed by a summary of the settlement and subsistence model proposed by Sutton for this desert region. The complete research design that includes these issues is presented in Chapter 2.

Theoretical Framework

This study takes an ecological view of prehistoric life in a predominantly hot and dry desert. In recent years, proponents of the role of the environment in influencing culture change have faced heavy criticism. This is due largely to the desire on the part of many researchers to shy away from any connotations of environmental determinism (for example, that cultures *must* do such-and-such if a drought occurs). As a consequence, the pendulum probably swung too far the other way; today, it is beginning to swing back, as it is now recognized that any interpretations rejecting environmental or climatic causes for culture change will produce unrealistic characterizations of prehistoric populations (Jones et al. 1999:137). This argument should not be construed as a rejection of other

causes for culture change, only that the environment cannot be dismissed so easily in places such as the Mojave Desert.

Ecological approaches have always been appealing in archaeology because they are based largely on the technology and economics of human groups, aspects of culture that are much easier to extrapolate from the archaeological record than, for example, religion or ideology. Despite early criticism, in the last few years there has been a resurgence of research into potential environmental causes for at least some of the culture change that is observable in the archaeological record, particularly in arid regions around the world (see Jones et al. 1999). Two such ecological approaches, cultural ecology and behavioral ecology, are discussed below (also see Chapter 6).

Ecological Approaches

The relationship between the environment and culture change has long been a subject of controversy in archaeology, with Steward (1938, 1955, 1977) generally recognized as the progenitor of this debate with his introduction of the theory of cultural ecology. In order to survive, people must cope effectively with their physical environment (Gardner 2002:3). Thus, one of the goals of cultural ecology is to determine whether people living in similar environments will adapt in similar ways, or conversely, whether different cultures will adapt differently, even if they live in the same environment (Steward 1955). This is especially true of hunter-gatherer groups, which are the focus of this study. While there is no doubt that environment can influence patterns of cultural adaptation, how, why, and to what degree are seldom clearly demonstrated in the archaeological record.

Cultural ecological theory has generated a number of studies in North America since Steward's time, (e.g., Davis 1996; Erlandson 1988; D. Fowler 1972; O'Connell and Hayward 1972). For example, in his study of sites along the southern California coast,

Erlandson (1988:69) maintained that local environmental variability likely influenced the economic success of subsistence strategies at various sites. He added that considerable cultural variation was apparent even among temporally and geographically related groups residing along the coast between about 6,000 and 5,000 years ago (Erlandson 1988:69). As a result of his study, Erlandson (1988:72) concluded that the interaction between environmental change and population growth accounted for many of the changes he observed among the sites in the study. He argued that environmental differences along the southern California coast best explain the variability in settlement, subsistence, and technology observed there, although other factors cannot be ignored (Erlandson 1988:73).

As a result of their work in the Surprise Valley of northwestern Nevada, along the western margin of the Great Basin, O'Connell and Hayward (1972:27) observed that the environment provides a broad spectrum of potential resources to people living in a particular environment. While these resources will be unevenly distributed, their distribution will nevertheless display patterns that have spatial, seasonal, and temporal implications, which will influence the nature of human adaptation (O'Connell and Hayward 1972:27). They concluded that human behavior is best interpreted "as an adaptive response to the opportunities and constraints posed by the structure of the environment, and that patterns of settlement and subsistence represent aspects of this response" (O'Connell and Hayward 1972:27).

Other ecological approaches have been developed since Steward's (1938, 1977) studies of native groups in the Great Basin, California, and the Northwest Coast, such as behavioral and evolutionary ecology, related theories that are of particular interest for this study. As defined by Cronk (1991:25), behavioral ecology is the study of the evolutionary ecology of human behavior. One of the key aspects of behavioral ecology

(BE) is that it expressly utilizes evolutionary theory (Kelly 1995:50). However, unlike other evolutionary approaches, such as evolutionary archaeology or selectionism, behavioral ecology does not rely explicitly on the concept of selection, except as it is assumed to be the process that created the human mind (Broughton and O'Connell 1999; Cronk et al. 2000). One of the central ideas behind BE is the discovery of modern human behaviors that may be reflected in human history via natural selection. Or, as Kelly (1995:50) put it, BE looks at how evolutionary processes shape human societies.

Numerous studies have utilized human BE as a theoretical approach, such as those dealing with reciprocity (e.g., Bliege Bird and Bird 1997; Cronk 1991), resource intensification (e.g., Broughton 1999; Raab 1996), central place foraging (Zeanah 2002), and kinship (e.g., Chagnon 2000), to name a few. It began in the mid-1970s with the application of optimal foraging models to hunter-gatherer decisions regarding resource selection and land use. Irons and Cronk (2000:3) observed that while evolutionary studies were being conducted as early as the 1970s, the newer approach of BE allowed for the use of such data to test hypotheses of human behavior that would demonstrate strategies for enhancing inclusive fitness throughout human history. This opened up new avenues of research, such as the idea that humans tend to help kin more often than non-kin and that such behavior can influence family and village formation (Cronk et al. 2000).

In his behavioral ecological study of hunter-gatherer groups in the Great Basin, Simms (1987) employed BE by examining foraging models, such as diet breadth optimization models, to analyze aspects of subsistence decision-making by prehistoric populations in the basin. Ranking of resources, encounter rates, and handling time are three concepts typically used in diet breadth models. Based on these models, Simms (1987) proposed several applications of behavioral ecology, with accompanying

predictions. One of the intriguing aspects of his study was his predictions based on gender. In terms of diet breadth and composition, for example, he posed two lines of inquiry related to gender; that is, under what conditions plant resources would be excluded from the women's strategy and under what conditions plants (particularly in relation to mammals) would be excluded from the men's strategy (Simms 1987:79). He also asked under what conditions meat from large animals would comprise the majority of the diet (Simms 1987:86). Such conditions would be subject to various factors, including environmental stress and human choice. He also suggested that because of all these variables, subsistence strategies among Great Basin hunter-gatherer groups could be characterized as a generalized technology that was constantly in flux (Simms 1987:89).

Bettinger's (1991) study of the ecology of hunter-gatherers worldwide included discussions of topics such as optimal foraging models, including patch choice, diet breadth, and central place foraging, issues typically addressed by behavioral ecologists. In his application of optimal foraging theory among groups in North America, he measured forager affluence (in terms of caloric efficiency) of aboriginal populations in California, including the relative importance of acorns as a dietary staple in this region of North America. While the natural abundance of acorns has traditionally been argued to account for the affluence and extreme complexity of native California groups, Bettinger (1991:100) maintained that because of the high processing costs of acorns (pounding, leaching, and cooking), there is actually a low rate of return. He further argued that the superabundant acorn probably entered the native Californian economy late in time when other resources that may have been preferred or higher ranked could no longer support the population (Bettinger 1991:100).

In his study of resource intensification along the California coast, Raab (1996:66) maintained that the economies of post-Pleistocene hunter-gatherer societies tended toward diet breadth expansion. This intensification included two main trends: the addition of increasingly marginal resources to the diet and an increase in the technological complexity for exploiting these new resources in the most cost-efficient manner. This would have led to the intensification of more diverse resources, such as smaller animals and plant species; in other words, it would inaugurate a more broad-spectrum adaptation. Employing optimal foraging principles, Raab (1996:66) argued that these changes would occur as a result of periodic stress due to an imbalance between population size and food supply. Among some prehistoric populations in California, for example, Raab (1996:66) reported evidence of such intensification, noting that small food items often required higher technological, pursuit, and processing costs, indicating a loss of foraging efficiency.

Under the theoretical approach of central place foraging, Zeanah (2002:242) observed that one of the issues regarding the spatial and temporal variability evident in prehistoric pinyon procurement strategies in the Great Basin has to do with the ubiquity of ground stone milling tools in pinyon-juniper woodlands, especially in the Owens Valley (e.g., Bettinger 1976, 1977; Delacorte 1990). This has led to the argument that pinyon was an economically valuable resource for Great Basin populations. On the other hand, ground stone implements are relatively rare in other areas in the Great Basin, suggesting several possibilities. Perhaps pinyon was not as important in some regions, or pinyon use may have developed later in areas where ground stone tools are rare (Zeanah 2002:242; also see Bettinger 1999; Kelly 2001; Simms 1985; Thomas 1973; Thomas and Bettinger 1976). Tool curation, scavenging, and site vandalism are other mechanisms to explain

this discrepancy, in that the quantity of ground stone tools may have become obscured as a result of such activities (Zeanah 2002:242).

Zeanah (2002:242) suggested another possibility for the differential recovery of ground stone tools in the forests of the Great Basin. Noting the ethnographic evidence for the use of ground stone tools to remove hulls from pinyon seeds and to grind them into flour, he observed that such processing "should be economically undertaken only at a home base or when the pinyon is to be transported for distances that far exceed those typical of ethnographic Great Basin foragers" (also see Rhode 1990). Thus, under models of transport cost and central place location, when pinyon harvests were highly profitable, people would have set up camps in the pinyon zones more frequently than in lowland areas, as the transport cost to the more favorable valley bottom locations would have been too great. If the harvests were less productive, people may have chosen to transport the pinyon to lowland base camps for processing (Simms 1985; Zeanah 2002). In the latter case, ground stone densities would be less at the point of pinyon procurement.

According to Zeanah (2002:247), however, such a scenario does not explain all of the spatial and temporal variation in pinyon-juniper settlement patterns. Other possible explanations for such differences in pinyon procurement strategies include local differences in the availability of alternative resources, paleoenvironmental fluctuations, population growth, and resource intensification. Using the example of the Owens Valley, Zeanah (2002:247) noted high densities of ground stone, yet there were no pinyon camps there until 1,350 B.P. (e.g., Bettinger 1977, 1989; Delacorte 1990). This suggested a shift from logistic to residential use of pinyon woodlands, perhaps as the result of "demographic packing" in the central Owens Valley (Zeanah 2002:251).

In their evolutionary perspective on hunting in California, Hildebrandt and McGuire (2002:231) noted that increased population densities during the middle and late Holocene in California have been inferred from a variety of proxy data as well as optimal foraging models. These data appear to account for the appearance of shell mounds along the coast and the spread of bedrock mortar complexes in California. They viewed this as evidence of resource intensification "in the face of increasing imbalances between human populations and the availability of highly ranked food resources" (Hildebrandt and McGuire 2002:231). If this were true, then according to optimal-foraging theory, foraging efficiency should decline, with a concomitant increase in reliance on smaller prey. In contrast, Hildebrandt and McGuire (2002:231) argued that large-game procurement throughout California was actually increasing during the middle and late Holocene.

On that assumption, Hildebrandt and McGuire (2002:231-232) posed the question "why, when there is a consensus that human populations were increasing and subsistence activities intensifying, would there be a corresponding *increase* in the taking of higher-ranked, large-animal taxa, at the expense of lower-ranked small animals?" They suggested that it may have to do with conferring fitness on males in that it would increase mating opportunities, provide favored treatment for their offspring, and facilitate communication with allies and adversaries (Hildebrandt and McGuire 2002:232). In other words, it was linked to sexual selection and prestige (also see Bettinger 1991:200-201), or what Hildebrandt and McGuire (2002:235) referred to as "show-off hunting" (also see Broughton and Bayham 2003; Hildebrandt and McGuire 2003).

Jochim (1981:8) observed that ecology is the study of dynamics. As such, it is important to understand that we cannot examine human behavior as if the environment

were static, but as active and changing, taking into consideration the interrelationships among all of the components of a system (Jochim 1981:8). By implementing an ecological approach in the analysis of the archaeological sites that make up the study area, that consideration is one of the aspects of this study (see Chapter 6).

The Sutton Model of Settlement and Subsistence Changes in the Western Mojave Desert

As noted above, part of the methodology for this study was to examine the MCA in relation to Sutton's (1990, 1991a, 1991b) model of changing settlement and subsistence patterns in the western Mojave Desert, based on his research at a number of sites in the Fremont and Antelope valleys of this region (also see Gardner 2002). The model, the key element of which is the Koehn Lake site (CA-KER-875) in the Fremont Valley, suggests that environmental shifts over the last 4,000 years were at least partially responsible for culture change in the western Mojave Desert. This is a time span that encompasses the Gypsum Period (ca. 4,000 to 1,500 B.P.), the Rose Spring Period (ca. 1,500 to 800 B.P.), and the Late Prehistoric Period (ca. 800 B.P. to historic contact).

The early part of the Gypsum Period was an era of somewhat cooler and wetter conditions than that of the preceding Pinto Period (ca. 7,000 to 4,000 B.P.), during which the Pleistocene lakes in the Mojave Desert had become severely desiccated (Sutton 1996; Warren and Crabtree 1986). Toward the end of the Gypsum Period, it became fairly arid once again (although much less so than during the Pinto Period), and settlement seems to have been focused near stream and spring sources in the adjacent El Paso Mountains and the southern Sierra Nevada (e.g., Davis and Smith 1981; Eckhardt et al. 1982; Leonard 1980; Smith et al. 1957; Yohe 1992; also see Sutton 1990, 1996).

The beginning of the Rose Spring Period witnessed increasing precipitation and elevated lake levels. At Koehn Lake, Sutton (1990, 1991a, 1991b) documented a large village with a cultural deposit dating between 970 and 1,430 RCYBP. Sutton and Hansen (1986:6) argued that significant nonephemeral lake stands at Koehn Lake occurred during the early part of the Rose Spring Period, after which the lake began to desiccate beginning about 1,000 years ago, to the point that the site apparently was eventually abandoned. This desiccation event took place within the time frame of the MCA (see Chapter 3). The model further suggests that during the more mesic interval of the Rose Spring Period, there was intensive exploitation of the lake by local populations. The large village at Koehn Lake lends support for this proposed lacustrine emphasis.

There appears to have been a transitional period between the terminal Rose Spring (post-1,200 B.P.) and Late Prehistoric periods, during which the environment once again became drier and water was scarcer. At that time, settlement and subsistence patterns began to shift away from lakes and toward springs (Sutton 1991a, 1991b). Some evidence for this proposal was provided at CA-KER-2211, a site approximately two miles west of Koehn Lake in the Fremont Valley (Sutton 1991b). This site, which is considerably smaller than the Koehn Lake site, is located adjacent to the southern Sierra Nevada between two creeks and contained both Rose Spring and Late Prehistoric period components, suggesting that the site represents a transitional phase of this adaptation (Sutton 1991b:181).

During the subsequent Late Prehistoric Period, the model posits that as the climate became warmer and drier, subsistence and settlement became focused on streams, springs, and wells located away from Koehn Lake. As with the Gypsum Period, settlement seems to have shifted to habitation sites in the nearby El Paso Mountains,

where alternate water sources were more abundant. Sutton's model also suggests that due to these arid conditions, sites were more seasonal in nature and had smaller populations.

According to Sutton's model, the environmental conditions that existed during the Late Prehistoric Period triggered a major population movement by the Kawaiisu, who are known to have occupied the southern Sierra Nevada at historical contact (e.g., C. Fowler 1972, 1983; also see Sutton 1991b:23). Archaeological evidence suggests that the Kawaiisu originally resided along the shores of Koehn Lake, then moved away from the desert areas and into the mountains as the environment began to dry up, while continuing to maintain their claim to the western Mojave Desert (Sutton 1991a, 1991b; 1993b; Sutton and Everson 1992; also see Zigmond 1986:398). If such a population movement did take place, particular desert resources would likely continue to be exploited on a seasonal basis, a pattern of transhumance that seems to be borne out in the archaeological record of this region (e.g., McGuire et al. 1982; Sutton 1991a, 1993a).

Sutton's model assumes, of course, that there was water in Koehn Lake during at least the early part of the Rose Spring Period. While there have been no studies of the geologic history of Koehn Lake, Sutton (1991a, 1991b) and Sutton and Hansen (1986) argued that there is strong circumstantial evidence for the presence of a substantial body of water at Koehn Lake during this time. Sutton (1991a:2) noted the presence of a fossil lakestand of Koehn Lake that attained an elevation of 586 m., which is 10.6 m. above the level of the current playa, as well as an additional stand at an elevation of 583 m. The existence of these elevated lake levels strongly suggests a major change in precipitation and/or evapo-transpiration rates at some point in time (Sutton and Hansen 1986). Coupled with evidence for neoglacial activity in the southern Sierra Nevada during the

late Holocene (e.g., Scuderi 1987), "it is not unreasonable [to presume] that a decrease in evapo-transpiration rates and concurrent increases in precipitation occurred at some time during the last several thousand years, resulting in the filling of Koehn Lake to the 586-meter level" (Sutton and Hansen 1986:5).

This argument is supported by the abundance of juniper from feature contexts at Koehn Lake, as juniper relies heavily on winter precipitation in order to successfully reproduce. It is also supported by the presence of a sharply angled wave-cut terrace (which continues for miles beyond the site; Mark Q. Sutton, personal communication 2005), on top of which the Koehn Lake site is directly situated. Even prior to commencement of the excavations, the midden could be seen eroding out of this terrace. Along with the presence of a large village alongside the lakeshore, it seems logical to presume that water would have been easily available to the site occupants.

The regional model delineated above takes an ecological approach to culture change. In this model, environmental shifts play a significant role in attempting to explain changing settlement and subsistence patterns in the western Mojave Desert. For the purpose of this study, the challenge is to determine the degree to which the environment may have impacted the inhabitants of this desert region during the MCA.

Other Views

Naturally, not everyone agrees that climate change was a significant factor in culture change in the Mojave Desert. To quote Basgall (1999:157), for example,

> one recognizes some correspondence between certain archaeological data and inferred paleoclimatic anomalies, assumes a causal connection of some sort, and then develops accommodating arguments to explain the linkage. Inasmuch as humans have the capacity to adjust to environmental changes in numerous ways and the archaeological record clearly indicates that many climatic shifts

> apparently had minimal impact on what past peoples were doing, to explain a particular cultural transition in these terms requires more than a gross correlative argument.

While that view probably underestimates too greatly the significance of the environment on prehistoric people's adjustments through time, Basgall (1999) is probably correct in saying that we do not have sufficient data to adequately understand how climatic anomalies affect human systems. Nevertheless, the fact that Basgall (1999:157) stated that people "have the capacity to adjust to environmental changes in numerous ways," belies his argument that climate has little explanatory power. Rather, it is argued here that despite a culture's ability to adjust to environmental fluctuations in numerous ways, a major climate shift will in some way require change, even if it is only a simple technological change or behavioral adjustment. That simple change could result in any number of adjustments and adaptations, large and small. But even small changes should be of interest to archaeologists in our attempts to understand culture change.

The flip side of the argument regarding the impact of the MCA on human populations are the proponents of explanations related to simple adaptive adjustments with no demographic stress due to the environment, arguing instead for gradual population growth coupled with new extractive technologies and other types of adjustments (e.g., Basgall and Giambastiani 1995; Basgall and McGuire 1988; Delacorte and McGuire 1993). For example, Bettinger (1999:69-70) argued that the environmental-climatic scenario is flawed in that if populations were responding to environmental pressures during this time, then similar responses should be evident during earlier climatic intervals that were also less favorable. Further, Bettinger (1999:69-70) maintained that projectile point distributions in the Great Basin demonstrate that populations continued to escalate during and after the MCA (also see Bettinger 1989; Basgall and Giambastiani 1995).

Basgall (1999:158) added that while the relationships between climate and culture change should not be ignored, he cautioned that such relationships should be carefully examined in order to ascertain the "connections between climatic trends, environmental consequences, and those aspects of the cultural systems that articulated directly with resources and landscapes." Bettinger (1999:159) concurred with Basgall, noting that he does not deny the existence or human impact of the MCA, only that there is insufficient evidence for the severity of the putative effects.

In the Southwest, there is continuing debate and controversy regarding climatic explanations for the abandonment of farming by Southwest groups between A.D. 1150 and 1350 (Coltrain and Leavitt 2002). For the Fremont, for example, it has been argued that the abandonment of their land in the Great Basin was due to pressures from Numic intruders (see Madsen and Rhode 1994). Based on linguistic evidence, the argument states that the Numic outcompeted the Fremont with more efficient foraging strategies, subsequently replacing or absorbing them (Bettinger 1994; Bettinger and Baumhoff 1982; Madsen and Rhode 1994; Sutton 1987; Young and Bettinger 1992). This argument denies any climatic explanations for this abandonment.

The argument against this linguistic evidence has been that the timing of such a linguistic divergence has yet to be adequately established (Coltrain and Leavitt 2002: 456). Instead, the proponents of an environmental-climatic explanation for the Fremont abandonment have maintained that Fremont farming localities were at similar elevations and "were balancing available moisture against an adequate frost-free season" (Coltrain and Leavitt 2002:456; also see Lindsay 1986). When rainfall patterns changed, reducing summer moisture, the Fremont were forced to abandon agriculture. This hypothesis has been supported by recent palynological studies that have indicated

a period of increased temperature and growing season moisture during the MCA (D. Newman 1988, 1996).

As a result of their work at Fort Irwin in the central Mojave Desert, Basgall and Hall (1992:5) noted that regional paleoenvironmental data demonstrate an increase in effective precipitation in this region between about 3,500 and 2,200 B.P., as well as subsequent climatic fluctuations during the succeeding 2,000 years. They maintained that these climate changes did not significantly affect the abundance of local plants and animals at the Fort Irwin sites (Basgall and Hall 1992:5). They further argued that late Holocene populations were responding to pressures other than environment, citing archaeological evidence of changes in lithic technology and land use patterns (Basgall and Hall 1992:6).

To further support their argument against the climatic-environmental theory for culture change, Basgall and Hall (1992:6) contended that available paleoenvironmental data demonstrate that "a desert scrub vegetation of one kind or another and near-modern hydrologic conditions . . . have prevailed in the north-central Mojave Desert since humans first occupied the region." This suggested to Basgall and Hall (1992:6) that there was some degree of continuity in residential mobility and subsistence systems over time in this region. They concluded that the "apparent absence of major, correlative changes in biotic circumstance and human behavior thus provides strong reason to explore less deterministic explanations of the basic culture-environment equation in Mojave Desert prehistory" (Basgall and Hall 1992:6).

In a dissenting view, Cleland and Spaulding (1992:1) observed that Basgall and Hall's (1992) claim that the desert scrub botanical regime of the Mojave Desert was established very early and that late Holocene environmental change was only minimally responsible for culture change is flawed and based on a misinterpretation of the

paleoenvironmental record. They maintained that paleoecological reconstructions based on packrat middens and studies of pluvial lake basins clearly demonstrate significant modifications in Holocene vegetation at least comparable to other areas in the west (Cleland and Spaulding 1992:1).

In terms of the availability of water in the Mojave Desert, Cleland and Spaulding (1992:1) put it well in their "ecological notion" of a limiting resource, which they defined as "one that is necessary for the maintenance, growth and reproduction of an organism but is in short supply due to its scarcity in the ecosystem and/or due to intense competition for a finite supply of that resource." They further argued that water is a "critically limiting resource" in the Mojave Desert, and that shortages of water that have taken place there since the early Holocene would have dramatically limited population size and distribution (Cleland and Spaulding 1992:1). They were quick to add, however, that their position should not be construed as promoting environmental determinism, but that interpretations of the available archaeological data should be realistic in terms of addressing various types of human responses to environmental changes in the Mojave Desert during the Holocene (Cleland and Spaulding 1992:4).

In their response to Cleland and Spaulding (1992), Basgall and Hall (1993:4) denied they ever claimed that they dismissed the environment as an explanation for culture change, only that the environment has been overplayed as a factor, to the virtual exclusion of others (e.g., demography, technology, sociological organization). They concluded that "While it would be ridiculous to reject the importance of environment as a determinant of prehistoric adaptive behavior, such explanations must follow from explicit, formally developed linkages between components of the natural and cultural records" (Basgall and Hall 1993:5; also see Cleland and Spaulding 1993).

Discussion

Any explanations of culture change that invoke environmental causes have traditionally been the targets of controversy, primarily because researchers are hesitant to propose that the environment places substantive restrictions on human populations, a view that supports the idea that cultures have the ability to adjust to changing conditions, despite the environment. That cultures have the ability to change is not in dispute here. However, it is argued herein that cultures do not change *despite* environmental conditions, but rather *because* of such fluctuations, at least to some extent.

In order to place these issues into context, Chapter 2 presents the research design for this study, while Chapter 3 is a discussion of previous research on the MCA in western North America. The regional background for the western Mojave Desert is provided in Chapter 4. Chapter 5 presents the archaeological data sets employed as the analytical units in this study, and Chapter 6 is a detailed summary of the data set. The interpretations of these data sets are presented in Chapter 7, and Chapter 8 summarizes the results of the study.

CHAPTER 2

RESEARCH DESIGN

Roughly 300 years after the Rose Spring Period commenced in the western Mojave Desert, the MCA made its appearance in the southwestern Great Basin, culminating within the Late Prehistoric Period. It is apparent from the archaeological record that numerous culture changes occurred in the western Mojave Desert during the Rose Spring Period, including a subsistence focus shift from artiodactyls to smaller game, the expansion of the bow and arrow, and a population increase. During the subsequent Late Prehistoric Period, there appears to have been a severe reduction in obsidian use and a steep population decrease, among other changes. Did these changes take place because of the MCA? In other words, were the changes necessary because of the effects of the MCA on a hunter-gatherer landscape?

While this study is focused on the MCA (ca. 1,200 to 650 years ago), the time frame discussed herein encompasses the Gypsum Period (ca. 4,000 to 1,500 B.P.), the Rose Spring Period (ca. 1,500 to 800 B.P.), and the Late Prehistoric Period (ca. 800 B.P. to historic contact). In the Great Basin, this time frame falls within the climatic era known as the Medithermal (post-5,000 B.P.), a concept introduced by Ernst Antevs in the mid-twentieth century (1948, 1952, 1955). It has also been referred to as the Neopluvial (e.g., Bettinger 1999; Currey and James 1982; Rhode 2000).

An understanding of the potential effects of the MCA on prehistoric human populations of the Mojave Desert has thus far proved somewhat elusive. Therefore, the purpose of this study is to attempt to discover whether the archaeological record of the western Mojave Desert can provide the information necessary to answer the research questions herein. To accomplish that goal, site and regional comparisons of archaeological data sets in this region are made in an attempt to delineate those putative effects. To that end, this chapter includes a discussion of the research questions, data expectations, and research methods for this study.

The Research Questions

As noted earlier, it is the core hypothesis of this study that culture changes that began about 1,200 years ago in the western Mojave Desert are associated, at least to some degree, with the MCA. To address the core hypothesis, the following research questions form the basis of this study. The questions are first stated together here, after which the data expectations for each question are discussed.

1. Was the MCA a significant factor in culture change in the western Mojave Desert?

2. In other words, were specific technological and social changes—such as population fluctuations, settlement shifts, and technological adjustments—a response to this environmental episode?

3. Does the model proposed by Sutton (see Chapter 1) fit in with the core hypothesis?

The Data Expectations

In terms of the data expectations, it is necessary to know what to look for in the archaeological record to answer the research questions. In other words, what kinds of

evidence would one expect to find that would shed light on the question of the influence of the MCA on humans in the western Mojave Desert? To determine whether any of the culture changes discussed above are related to environmental stress as a result of the MCA, climatic data from all of the relevant time periods must be examined in order to detect climate change through time in this desert region. To accomplish this, an examination and assessment of the archaeological record of the times immediately preceding and succeeding the Rose Spring Period (Gypsum and Late Prehistoric periods, respectively) was required. In other words, it is important to determine how people were adapting and surviving before and after the MCA if we are to understand how it may have affected their lives on a long-term basis. With that in mind, the data expectations are presented below for each of the research questions.

1. Was the MCA a significant factor in culture change in the western Mojave Desert?

In order to answer that question, this study includes an examination of archaeological data sets throughout the western Mojave Desert, as well as a few that fall just outside the boundaries of the western Mojave Desert (see Chapter 5). As such, the following are the data expectations from which to determine whether the MCA significantly impacted prehistoric populations in the western Mojave Desert. The hypotheses generated as part of the data expectations herein follow the time line from the Gypsum through the Late Prehistoric periods, a span of time of approximately 4,000 years, although the focus is on the more restricted time frame of about 2,000 B.P. to contact, which encompasses the latter half of the Gypsum Period to the end of the Late Prehistoric Period.

It is important to keep in mind that these time periods for the Mojave Desert are artificial constructs based on limited data, at least in terms of absolute dates; thus, distinguishing between pre-MCA, MCA, and post-MCA sites cannot depend strictly on

these constructs. Rather, the goal here is to make those distinctions by looking at the accepted time frame for the MCA in order to detect changes due to this event, regardless of those time periods. Such a tactic may necessitate a revision of the time periods archaeologists often take for granted.

In the overall Great Basin, the first half of the Gypsum Period witnessed an increase in annual precipitation from the previous Pinto Period, becoming warmer and drier during the second half of this period (e.g., Currey and James 1982:45; Rhode 2000:159; Wigand and Rhode 2002). Beginning about 2,000 years ago, juniper woodlands began to decline and desert scrub vegetation increased in many areas of the Great Basin (Wigand and Rhode 2002:328). This period of increasing aridity appears to have been accompanied by a shift in summer rainfall, resulting in a rise in the abundance of grasses (Wigand and Rhode 2002:341). The xeric conditions during the latter part of the Gypsum Period were followed by a period of more mesic conditions sometime during the early Rose Spring Period.

If these conditions also prevailed in the western Mojave Desert, then evidence of such environmental change during the Gypsum Period would be apparent in wider distribution and greater diversity of xeric-adapted botanical species at this time, which would have decreased at the same time mesic-adapted species increased during the subsequent Rose Spring Period. Whether those species were being exploited by humans at that time would have depended on resource abundance, ranking, and preference. But even if they were not being utilized by people, such species should be present at some level in the botanical assemblages from the Gypsum Period study sites, if only by natural forces.

If such changes occurred with the botanical species, then one would also expect to see an increase in the abundance and diversity of faunal species as the Gypsum Period waned

and the Rose Spring Period progressed, as more forage and water would have been available to the local game populations as a result of this climatic amelioration. If so, this should be evident in the study sites. Once again, however, the choice to exploit those faunal species would depend on abundance, ranking, and diet preference.

If there were greater abundance and diversity of botanical and faunal species as the Rose Spring Period commenced, then one would expect to see an increase in human population of the western Mojave Desert from that of the Gypsum Period, concomitant with documented changes in settlement (e.g., an increase in the number of larger, long-term occupation sites), subsistence (e.g., increased reliance on lagomorphs, especially hares), technology (e.g., expansion of the bow and arrow), and other aspects of culture.

Beginning about the middle of the Rose Spring Period (ca. 1,200 years ago), at the onset of the MCA, arid conditions began to return to the Mojave Desert. Evidence for this has been well-documented by various researchers in the last three decades (e.g., Cole and Webb 1985; Spaulding 1990; Spaulding et al. 1994). Therefore, among the study area archaeological assemblages, one would expect to see a decrease in mesic-adapted botanical species and an increase in xeric-adapted species sometime between the Rose Spring and Late Prehistoric periods in terms of both abundance and diversity, regardless of their utility to human populations.

If these changes in the botanical species did occur, then one would also expect to see a decrease in the abundance and diversity of faunal species during the Late Prehistoric Period as compared to the early Rose Spring Period. This would be the result of less forage and water for animal populations in the region.

If the botanical and faunal species decreased in abundance and diversity during the Late Prehistoric Period, then one would expect to see a decrease in human population,

along with changes in other aspects of culture. This seems to be the case in the western Mojave Desert, as there appears to have been a shift in subsistence reliance toward alternate resources, technological differences (possibly to accommodate changing biotic conditions), and population movements (by aggregation, recession, and/or migration).

2. In other words, were specific technological and social changes—such as population fluctuations, settlement shifts, and technological adjustments—a response to this environmental episode?

In order to answer this research question, which is related to the first question, examination of the study sites should reveal changing patterns in technology and sociopolitical complexity. For example, bow and arrow technology did not arrive in the Mojave Desert until about 2,000 to 1,500 years ago, corresponding with a shift from large projectile points for use with atlatl darts to smaller points for use with arrows. While this event is at least 300 years prior to the inception of the MCA, the bow and arrow really began to flourish sometime during the Rose Spring Period (1,200 to 800 B.P.). The proliferation of this technology has potential implications for understanding climate shifts during this time; that is, a change in the subsistence regime possibly brought about by climatic conditions may have prompted the expansion of the bow and arrow.

In terms of sociopolitical complexity, the study sites should show evidence of changes in size, function, and demographics depending on their age. More specifically, during the height of the MCA, one would expect to see fewer sites with lower population levels as people adapted to life in a drought-stricken desert.

3. Does the model proposed by Sutton fit in with the core hypothesis?

As noted in Chapter 1, in an effort to better understand the prehistoric settlement and subsistence patterns in the western Mojave Desert, Sutton (1990, 1991a, 1991b)

developed a regional model that posits a relationship between culture change and environmental fluctuations in this region for the last 4,000 years. Briefly stated, based primarily on his research at the Koehn Lake site (CA-KER-875) in the Fremont Valley, Sutton postulated that during periods of mesic environmental conditions (the early part of the Rose Spring Period), prehistoric populations intensified their exploitation of the lacustrine resources at Koehn Lake and aggregated near the lake in permanent settlements. As the climate became increasingly arid (the latter part of the Rose Spring Period and continuing into the Late Prehistoric Period), the model posits that populations began to move further from the lake and closer to more distant water sources, such as streams and springs in the adjacent El Paso Mountains. This may have resulted in a population decrease and a change from permanent habitation to more seasonal sites.

In order to determine how, or even if, Sutton's model fits in with the core hypothesis, Rose Spring Period components in the study area would be expected to contain evidence of the use of lacustrine resources, human population aggregation near large sources of water, relatively large populations, and at least semipermanent residence. Conversely, in Late Prehistoric Period components, one would expect to see evidence of a decrease in the use of lacustrine resources, residence away from large water sources, a human population decline, and habitation in smaller seasonal sites. By analyzing and comparing the study sites detailed in Chapters 5 and 6, Sutton's model and its expectations are explored in an effort to discern whether the model is supported.

The Research Methods

To answer the research questions outlined above, data from various archaeological sites will be compared in an attempt to support the core hypothesis. Some relatively

recent examples of sites that are included in this comparison are Cantil (CA-KER-2211; Sutton 1991b), Rose Spring (Yohe 1992), the Rosamond site complex (Sutton 1993b), the Cross Mountain site (Gardner et al. 1996, 1997), the Coffee Break site (Gardner 2002), Freeman Spring (Williams 2004), the Terese Site (Rogers 2005; Rogers and Rogers 2004), and Red Mountain (Allen 2004). While Fort Irwin does not fall within the western Mojave Desert, its proximity to the study area and the voluminous amount of work that has been conducted there necessitated its inclusion in the comparison as well (e.g., Basgall and Hall 1992; Hall and Basgall 1994; McGuire and Hall 1988).

The analysis of these various data sets is intended to provide information regarding potential changes in resource distribution and availability as a result of the MCA and how those changes may have affected the settlement systems, subsistence patterns, technology, and other aspects of culture of the prehistoric peoples in the western Mojave Desert. In order to observe these changes, it is necessary to attempt to quantify resource differences through time. This involves analyses of archaeological assemblages that predate and postdate the MCA, as well as those that fall within the time frame of the MCA. For instance, during the Rose Spring Period, one of the most common characteristics in archaeological assemblages in this region is a variety of faunal remains, with hares usually being predominant. These Rose Spring Period faunal components can be compared to earlier and later assemblages in order to detect change through time in the Mojave Desert, and then to try to correlate those changes to the MCA, if possible.

Comments

By analyzing the results of investigations from a large number of archaeological sites and site complexes in the western Mojave Desert, the purpose of this study is to

determine the potential impact of the MCA on humans in this region beginning about 1,200 years ago. A number of research questions and data expectations have been generated regarding how people may have reacted to the MCA as a result of this roughly 550-year-long drought episode. Beyond that goal, the data sets can also be compared for the purpose of synthesizing the large amount of research that has been conducted in the western Mojave Desert in a way that long-term trends and changes may be illuminated, regardless of environmental influences.

CHAPTER 3

PREVIOUS RESEARCH ON THE MCA IN WESTERN NORTH AMERICA

> *Evidence has been accumulating in many fields of investigation pointing to a notably warm climate in many parts of the world, that lasted a few centuries around A.D. 1000-1200 . . . There has been some controversy as to whether this climatic variation was great enough to be significant in connection with the balance of Nature or the economy of Man.*
>
> (H. H. Lamb 1965:13)

Introduction

With the above statement, climatologist Hubert H. Lamb was one of the first researchers to attempt to quantify the potential impacts of what he referred to as the Early Medieval Warm Epoch, also known as the Medieval Climatic Anomaly (MCA). How widespread this climatic event was and how it may have impacted human populations on a global scale have been the subjects of inquiry and debate ever since.

But even as early as the mid-1960s, Lamb (1965:14) observed that, "multifarious evidence of a meteorological nature from historic records, as well as archaeological, botanical and glaciological evidence in various parts of the world from the Arctic to New Zealand" has provided support for such a warm epoch, or more likely a series of epochs. Although Lamb (1965:13) placed this epoch between about A.D. 1000 and 1200 (1,000 to 800 B.P.), most scholars now place it between about A.D. 800 and 1350 (1,200 to 650 B.P.) (see Ambler and Sutton 1989; Anderson 1990; Anderson and Smith 1991; Bettinger

1999; Bradley 1999; Coltrain and Leavitt 2002; Cordell 2000; Gardner 2004a; Gardner and Sutton 2002; Gavin and Brubaker 1999; Gill 2000; Graumlich 1993; Graumlich and Lloyd 1996; Hu et al. 2001; Hughes and Diaz 1994; Hughes and Graumlich 1996; Jones et al. 1999; Kennett and Kennett 2000; LaMarche 1974; Larson and Michaelsen 1990; Larson et al. 1996; Li et al. 2000; Millar and Woolfenden 1999; Raab and Larson 1997; Soon and Baliunas 2003; Spaulding 1994, 1995; Stine 1990, 1994, 1996; Yu et al. 2002).

Evidence for the MCA in western North America (Figure 2) has been derived from a variety of sources, including dendrochronological reconstructions, pollen studies, skeletal data, archaeological assemblages, and paleohydrologic data, among others. The proposed timing and intensity of the climatic changes during this time vary regionally, although the warmest phases appear to have transpired during the mid-twelfth century (Anderson and Smith 1991:40; Graumlich 1993:253). Nevertheless, extended droughts took place at various times between ca. A.D. 800 and 1350, interspersed with periods of more favorable climatic conditions (Graumlich 1993:254). During this time, there were widespread and long-term periods of decreased precipitation.

While there appears to be little doubt that the MCA was a significant climatic event in several regions of the world, evidence for how it may have influenced prehistoric human populations in the western Mojave Desert has remained largely inferential based primarily on observed changes in archaeological assemblages. Desert regions, such as the Mojave Desert, are of particular interest in examining issues of environmental stress, as they are frequently perceived to be somewhat marginal for human habitation even during more favorable climatic conditions. Therefore, during periods of environmental stress, such as a drought, the idea is that one would expect to see relatively dramatic

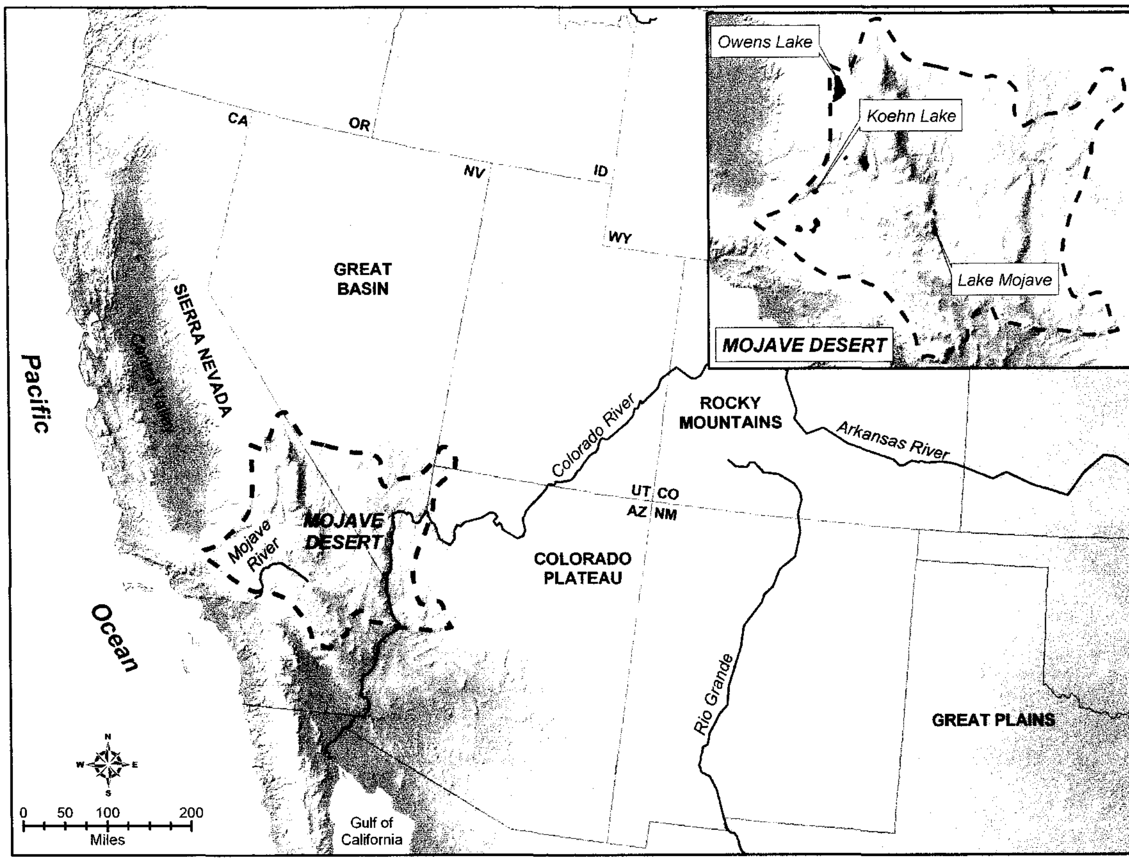

Figure 2. Map of western North America showing California, the Southwest, and the Great Basin, with the Mojave Desert boundary designated by the dashed line. (Map by H. Switalski.)

differences in adaptation, such as changes in settlement, subsistence, and subsistence-related technology (see Chapter 7).

In various parts of western North America, there are striking correlations between drought and changes in subsistence, population demographics, exchange, health, and violence during the MCA (e.g., Jones et al. 1999). Whether the MCA was the cause of these changes is difficult to determine, but the synchrony of the environmental and cultural changes suggests that it was a significant factor. What some of those impacts were and how they were likely to have affected western North American prehistoric cultures were eloquently outlined by Jones et al. (1999), who examined the issue of the MCA in the Great Basin, Mojave Desert, Colorado Plateau, and along the southern California coast.

Given the severity of this drought, the focus is not on *whether* climate played a role in cultural change in western North America, but on determining what the effects were and how they were manifested so that we can see them in the archaeological record. Because California, the Southwest, the Great Basin, and the Mojave Desert share not only boundaries, but also perceived similarities in human responses to environmental stress during the MCA, the following presents some of the evidence for the MCA in these three regions.

In order to address these issues, the purpose of this chapter is twofold: (1) to discuss the history of research into the MCA in western North America; and (2) to delineate the evidence for the MCA in the Mojave Desert and adjacent areas. As different researchers have utilized different names for this climatic episode, as well as somewhat different time frames, Table 1 provides a concordance of the various designations and times for the MCA for clarification purposes, and Figure 3 is a graphic illustration of the concordance. While there is some disagreement about the precise timing of the MCA, for the purpose of this study, the time frame of the MCA is regarded as taking place between A.D. 800 and 1350 (1,200 to 650 B.P.).

History of Research and Evidence for the MCA

In the mid-twentieth century, Ernst Antevs (1948, 1952, 1955) developed a now-famous climatic history of the western United States, dividing the Holocene into three periods; the Anathermal, the Altithermal, and the Medithermal. The Anathermal was a cool-moist period from about 9,000 B.P. to about 7,000 B.P.; the Altithermal was a subsequent warm-dry period that lasted until about 4,500 B.P.; and the ensuing Medithermal (post-4,500 B.P.) was generally cooler and moister than the preceding two

Table 1. Concordance of Designations and Times for the MCA in Western North America[a]

Designation	Time Range (A.D.)	Time Range (B.P.)	References
Medieval Climatic Anomaly	800-1300	1,200-700	Stine 1994, 1998, 2000
	800-1350	1,200-650	Jones et al. 1999
	800-1400	1,200-600	Raab and Larson 1997
	950-1220	1,050-780	Li et al. 2000
Early Medieval Warm Epoch	1000-1200	1,000-800	Lamb 1965
Medieval Warm Period	850-1150	1,150-850	Coltrain and Leavitt 2002
	900-1350	1,100-650	Millar and Woolfenden 1999
	1100-1375	900-625	Graumlich 1993
Medieval Warm Interval	800-1300	1,200-700	Spaulding 1994
Great Drought[b]	1276-1299	724-700	Antevs 1955; Douglass 1929; Plog 1997
Late Medithermal[c]	500-1400	1,500-600	Bettinger 1999

[a] Other terms that have been used mostly outside of western North America include Little Optimum (ca. A.D. 900-1300; e.g., Baliunas and Soon 2001) and Secondary Climatic Optimum (ca. A.D. 900-1300; e.g., McCartney 1977).
[b] The term "Great Drought" is typically used only in the Southwest, and is usually considered to be a single event rather than a series of episodes.
[c] The Late Medithermal is not a different name for the MCA; rather, is a larger time frame within which the MCA occurred.

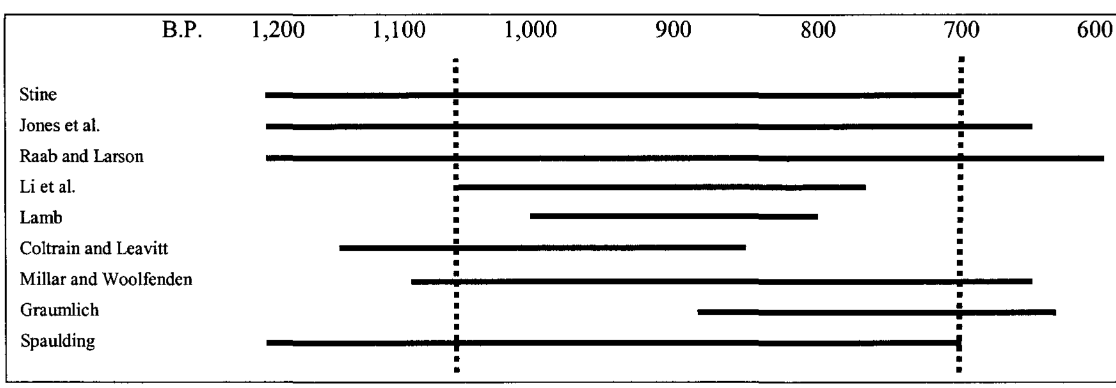

Figure 3. Time ranges for the MCA, as provided by various researchers in western North America (in years B.P.; refer to Table 1). Chart excludes the Great Drought, as it is a regionally specific event. The Late Medithermal is also excluded as it encompasses a span of time greater than that of the MCA. The dashed vertical lines indicate the area of greatest overlap between time ranges; however, it should be noted that four of the nine time lines in this figure extend to 1,200 B.P.

episodes and overlaps the MCA. Although Antevs's model was popularized by various scholars (e.g., Baumhoff and Heizer 1965; Morrison 1965), subsequent research has demonstrated that "the range of climatic conditions was much broader than the cool-wet versus warm-dry opposition seen by Antevs" (Thompson et al. 1993:495).

In the 1980s and 1990s, new approaches were developed in an attempt to elucidate the relationship between paleoenvironment and observed archaeological patterns. These include Binford's (1980) forager-collector continuum, wherein "different strategies of hunter-gatherer mobility and resource use relative to environmental heterogeneity" (Rhode 1999:40) were considered. Another approach employs modeling based on behavioral ecology (e.g., Bettinger 1991; O'Connell et al. 1982; also see Rhode 1999:40), the most popular of which is optimal foraging theory, which states that people make decisions that "maximize the net *rate* of energy gained" in terms of diet choice, foraging location and time, group size, and settlement location (Bettinger 1991:84; see Chapter 1 for more details on behavioral ecology and optimal foraging).

Evidence for climatic change during the Late Holocene has been documented primarily from proxy data, including dendrochronological sequences (e.g., Cordell 2000; Graumlich 1993; Nash 1999), lake and dune records (e.g., Hughes and Graumlich 1996; LaMarche 1974; Spaulding 1995), pollen assemblages (e.g., Anderson and Smith 1991; Coltrain and Leavitt 2002; D. Newman 1996), packrat middens (e.g., Cole and Webb 1985; Spaulding 1990), historical documentation, and other data. Especially for the last few thousand years, there are sufficient data to detect climate variation on as little as an annual basis (Lloyd and Graumlich 1997:1199). This high resolution has permitted the identification of "correlations between ecological change and climate variation at intermediate frequencies" (Lloyd and Graumlich 1997:1199). This view was supported by Anderson and Smith (1991:35), who maintained that the results of their pollen analyses made it possible to offer broad generalizations for the last few thousand years.

The proxy data from such drought reconstructions are "calibrated with the instrumental record to determine how well the natural record estimates the climate

record" (National Climatic Data Center 2005:1). A model can then be produced in order to determine how well the proxy data and climate record match. One such model is the Palmer Drought Severity Index (PDSI), which is a measurement of relative drought and wetness over large geographic areas (Cook et al. 2004:1016). In the PDSI model, it is possible to highlight multidecadal or longer changes in drought conditions; thus, the model "emphasizes some earlier increases in aridity that dwarf the comparatively short-duration current drought in the West" (Cook et al. 2004:1017).

In the PDSI model proposed by Cook et al. (2004), four episodes of significant aridity in the western United States were identified: A.D. 936, 1034, 1150, and 1253. These four epochs, which Cook et al. (2004:1017) referred to as "megadroughts," fall within the roughly 550-year period of time that encompasses the MCA. As further support for their model, Cook et al. (2004:1017) offered examples of other intriguing studies of indicators of past aridity in the western United States, such as drowned tree stumps (e.g., Stine 1994), fire frequencies (e.g., Swetnam 1993; Brunelle et al. 2005), charcoal in lake sediments (e.g., Millspaugh et al. 2000), and changes in lake sediment oxygen isotope ratios (e.g., Benson et al. 2002).

Jones et al. (1999:153) noted that many areas across western North America witnessed at least two periods of drought-related stress during the course of the MCA, one at about A.D. 900 to 1100 and one at about A.D. 1150 to 1350, with intervals of more favorable conditions (Graumlich 1993; Lloyd and Graumlich 1997; Stine 1994, 1996). It is likely that human responses to these drought episodes differed in a variety of ways, although the later episode appears to have precipitated more significant responses, perhaps because the latter event occurred at a time when populations were unusually high in western North America; thus, the potential for crisis was greater (Jones et al. 1999: 155).

With the foregoing as a background into the broad history of research on the MCA in western North America, the following is a discussion of some of the research that has taken place in specific geographic areas of western North America, including the California coast and Channel Islands, the Southwest, the Great Basin, and the Mojave Desert. The purpose for including this section is to discuss the various interpretations of the potential consequences of the MCA in geographic areas immediately adjacent to the Mojave Desert in order to attempt to detect similarities among these regions.

The MCA on the California Coast and the Channel Islands

Archaeologists along the California coast and the Channel Islands have long played a key role in research on climate changes during the Holocene, and how those changes may have impacted prehistoric human populations in these regions (e.g., Arnold 1987, 1991, 1997; Arnold et al. 1997; Colten 1993, 1994, 1995; Erlandson 1994, 1997; Glassow et al. 1994; Johnson 2000; Jones 2002; Jones et al. 1999; Kennett and Kennett 2000). It has only been in recent years, however, that high-resolution paleoclimatic data have made it possible to refine the climatological sequences in these regions, and thereby to make stronger arguments regarding the role of climate in culture change along the coast and the Channel Islands.

Commencing in the late 1980s, scholars working on the Channel Islands have argued that human problems evident in the archaeological record, such as settlement disruptions, disease, and violence, were attributable to maritime subsistence distress related to increased sea surface temperature (SST) between A.D. 1150 and 1300 (Raab and Larson 1997:319; also see Arnold 1992a, 1995). Citing paleoenvironmental, archaeological, and osteological evidence from this time frame, various researchers have argued that these stress indicators were related to the MCA (e.g., Arnold 1992a; Colten 1994; Glassow et

al. 1988; Lambert 1993; Lambert and Walker 1991). Raab and Larson (1997:319) observed that these cultural stressors were similar to those seen in the American Southwest at about the same time; thus, similar responses to drought conditions appear to have occurred during the late Holocene in these two regions (see below).

As a result of the accumulation of paleoenvironmental and archaeological data since the 1980s, diachronic modeling of the relationship between environment and sociopolitical complexity among prehistoric California cultures became popular. Basgall (1987) and Bouey (1987), for example, argued that the intensification of acorn exploitation was the key factor in the emergence of cultural complexity in California. Conversely, Arnold (1992a, 1992b, 1995) maintained that emerging complexity for prehistoric populations on Santa Cruz Island was due to elevated SST coupled with a drought episode between about A.D. 1150 and 1250. As a result, there was a decline in marine productivity that subsequently increased the manufacture of shell beads, which became the standard currency in exchange for subsistence items (Arnold 1992a:70). Along with environmental stress and other factors, this ultimately led to the disruption of settlement patterns, the development of an elite class that controlled the production of craft items, and deteriorating health conditions on the Channel Islands (Arnold 1992a:70-72). Raab and Larson (1997:322) argued, however, that elevated SST and drought are two different kinds of stress that would have required different human responses.

More recently, Kennett and Kennett (2000:379) maintained that between about A.D. 1150 and 1300, hunter-gatherer cultures along the southern California coast rapidly became more socially and politically complex. Using high-resolution oxygen isotopic and archaeological data for the last 3,000 years, Kennett and Kennett (2000:379) suggested that there was a strong relationship between unstable climatic conditions and

sociopolitical and economic responses, including the intensification of fishing as well as an increase in sedentism, violence, and trade. They further argued that the violence evident during this time intensified as the result of dramatic expansion of the bow and arrow between about A.D. 500 and 800 (Kennett and Kennett 2000:391; also see Lambert 1997; Lambert and Walker 1991; Walker 1989).

The MCA in the Southwest

In the arid Southwest, models of climatic stress have always been popular due to the perception of agriculturalists "living a precarious existence" (Raab and Larson 1997: 333). In their discussion of the MCA, Raab and Larson (1997:333) compared coastal California to events in the Southwest, wherein they suggested that both regions underwent similar environmental stress during the Late Holocene. Certainly there were also a number of significant differences, related not only to environment but also to factors such as demography, technology, and social organization (Raab and Larson 1997:333). Thus, although there were similarities between California and the Southwest in terms of culture change, populations did not necessarily respond in precisely the same way. Nevertheless, it seems clear that both agricultural and hunter-gatherer groups in both regions suffered, to some degree, from Late Holocene climatic variability and droughts (Raab and Larson 1997:333; also see Larson et al. 1996).

It has further been argued that from about A.D. 1270 to 1300, Pueblo communities in the Southwest were abandoned as a result of the "Great Drought" (e.g., Cordell 1984; Larson et al. 1996). Not all scholars agree with this explanation of apparent abandonment, although many do concede that this was a time of climatic instability and drought that may have had an influence on prehistoric populations of this region, along with other factors unrelated to climate (e.g., Raab and Larson 1997:333). For example,

Lipe (1995:143) argued that the northern Southwest during the late 1200s witnessed increasing violence, settlement disruptions, decreasing trade with outside groups, and new social hierarchies among Puebloan peoples. He suggested that these problems were at least partly the result of environmental stress (Lipe 1995:143). As Larson et al. (1996:217) observed, this episode "caused adaptations shaped by selection prior to the 1270s to fail; from a broader temporal-spatial perspective, however, the drought must be seen as part of the selective regime that shaped subsequent human adaptation to the northern Southwest."

Evidence from dendrochronological reconstructions for the Colorado Plateau demonstrates that by A.D. 1000, Southwest groups had expanded throughout this region (Cordell 2000:186). A mere 200 years later, the population on the plateau was so great that mobility was no longer an option due to local shortages (Cordell 2000:186). This population growth was the result of successful agricultural practices and abandonment of more marginal areas subsequent to a drought episode that occurred between about A.D. 1130 and 1150. Ultimately, the area was abandoned sometime between the late 1200s and 1450 due to dramatically changing rainfall patterns (Cordell 2000:186). Cordell (2000:190) cogently observed that the "chaotic, hence unpredictable, patterning in precipitation in the Southwest is an event of unimaginable magnitude."

In their study of the relationship between human behavior and paleoenvironment on the Colorado Plateaus, Dean et al. (1985:537) observed that while environmental variations and their effects on humans go beyond a simple dichotomy between favorable and unfavorable or wetter and drier, environmental factors explain at least some aspects of Anasazi life between A.D. 200 and 1300. Using palynological, hydrological, dendrochronological, and other data, they noted that during the Great Drought, the dense

populations residing on the Colorado Plateaus would have been severely affected by falling water tables and expanding arroyo systems (Dean et al. 1985:544). This would have included major population dislocations, adaptational changes, and possibly abandonment (Dean et al. 1985:546).

Noting that humans are not "mere pawns of the environment," Dean et al. (1985:547-549) proposed several mechanisms to explain documented culture changes on the Colorado Plateaus, including shifts in mobility, settlement location, subsistence mix, exchange, ceremonialism, agricultural intensification, and territoriality. In their attempt to identify the relationship between environmental and behavioral variability, they stressed that to do so employing "simple correspondence" was inadequate to explain such variability (Dean et al. 1985:549-550). Rather, it is necessary to understand the interaction between regional environmental and demographic factors before any generalizations can be made about how such factors affect human behavior (Dean et al. 1985:550).

In the Kayenta region on the Black Mesa of the Southwest, Powell (2002:80) noted that certain changes occurred in the environment between A.D. 750 and 900 that would have been challenging for the prehistoric Kayentans. Based on analyses of pollen, plant macrofossils, faunal specimens, geomorphology, and hydrology, Powell (2002) argued that during this period of time, erosion, water table decline, and arroyo-cutting took place. This would have created less than ideal conditions for agriculture as ground water would have been scarce (Powell 2002:80). Eventually, between A.D. 1100 and 1150, environmental degradation reached a point of apparent abandonment of the Kayenta region (Powell 2002:80). After subsequent recolonization, final abandonment of this region occurred at A.D. 1300 (Powell 2002:85; also see Dean 2002). While not invoking

environmental deterioration as the sole cause for these abandonments, Powell (2002:116) noted that such degradation in the Kayenta area "would have made already precarious adaptations impossible."

In his analysis of tree-ring and pollen records, Rohn (1989:167) argued that considerable climatic fluctuations and multiple periods of drought (including the Great Drought of 1276 to 1299) had little to do with abandonment of the Northern San Juan region. His argument is weakened, however, by his own suggestion that minor changes in mean annual temperature would have had serious consequences for the prehistoric farmers of this region in terms of the growing season (Rohn 1989:167). He further observed that while environmental diversity in Northern San Juan provided the opportunity for minor adjustments due to climatic fluctuations, the most significant problem for the residents of this region was "economic adaptation of a steadily growing population to their erratic natural context" (Rohn 1989:168). These statements seem to contradict his view that climate changes had little impact on Puebloan peoples in this region. Rather, Rohn (1989:168) argued that population movements between the tenth and thirteenth centuries were more likely due to social, political, or religious reasons.

As in other regions where scholars have stressed the significance of environmental factors in culture change, some Southwest researchers have instead emphasized sociopolitical issues, status differentiation, inequities in resource access, demographic processes, and other aspects of culture, rather than environment (e.g., Hill et al. 2004; Lightfoot and Feinman 1982; Lightfoot and Upham 1989; Plog 1990; Plog and Hantman 1990; also see Larson et al. 1996). As Larson et al. (1996:218) pointed out, however, while humans respond to various conditions in any number of ways, "it is a mistake to ignore or underestimate the effects of rainfall patterns among arid land agriculturalists."

The MCA in the Great Basin

One of the earliest Great Basin scholars to speculate on the effects of Late Holocene environmental stress was Luther Cressman, who postulated a time during which Great Basin lakes became desiccated to the point that cultural adjustments were necessary (Cressman 1942:140). Of course, it is the late prehistory of the Great Basin for which we have the most information, as we have more archaeological data after about 4,500 B.P. than from earlier eras, although this fact has done nothing to diminish debate about the details (Bettinger 1999:62).

The Great Basin has always had a great deal of climatic variability, even on short time scales (Kay 1982:76). As Rhode (1999:29) so aptly put it, "the Great Basin has endured substantial environmental shifts during more than 10 millennia of human occupation, shifts that profoundly affected how people made a living here." For the period of the MCA, there is now a considerable amount of evidence indicating that there were a number of significant dry intervals during this time. Some of this evidence has been derived from the dating of drowned tree stumps at Mono Lake and other locations, and further supported by the tree-ring sequence in the White Mountains of Nevada (Jones et al. 1999:142; also see LaMarche 1974).

While some interior regions were generally warm throughout the MCA, the entire period of the MCA was not consistently warm and dry throughout western North America. Two of the most significant arid periods occurred in the Great Basin between A.D. 892 and 1112 and between A.D. 1209 and 1350 (Graumlich 1993; Leavitt 1994; Lloyd and Graumlich 1997; Stine 1994). These drought episodes—determined in part through ring counting of relict stumps at Mono Lake, Tenaya Lake, West Walker River, and Osgood Swamp in the central Sierra Nevada—were interspersed with periods of high

rainfall in some places. One example is at Mono Lake, which rose to an elevation of 1,961 m. between these two drought events, the second highest elevation in the last 2,000 years (Stine 1994:549).

In addition, concomitant declines in tree abundance and treeline elevation in the Sierra Nevada between about 950 and 550 years ago appear to be associated with warm and dry climatic conditions, accompanied by severe drought conditions (Lloyd and Graumlich 1997:1205). The evidence for this has been derived from climatic reconstructions of foxtail pine, western juniper, giant sequoia, and bristle cone pine ring widths in the Sierra Nevada and White Mountains (e.g., Anderson and Smith 1991; Graumlich 1993; Jones et al. 1999; LaMarche 1974; Millar and Woolfenden 1999; Scuderi 1987, 1993), as well as lake level records from Mono Lake (Hughes and Graumlich 1996; Stine 1990, 1994; also see Lloyd and Graumlich 1997:1205). These climatic changes are associated with changes in subsistence behaviors, settlement patterns, and skeletal pathologies that are evident during this time (e.g., Bettinger 1999; Coltrain and Leavitt 2002; Elston 1982).

In the Great Salt Lake (GSL) Basin, Coltrain and Leavitt (2002:458) noted skeletal pathologies in almost half of 86 individuals recovered from various sites in the GSL wetlands sites. The burials dated between A.D. 423 and 1410. These pathologies included degenerative joint disease, extreme dental wear, mastoid infections, transverse lines, cribra orbitalia, and enamel hypoplasia. In total, 33% of their skeletal population displayed evidence of nutritional stress. Coltrain and Leavitt (2002:476) also observed that the MCA (what they called the Medieval Warm Period) coincided with the apex of Fremont expansion south of the Great Basin. They noted that sites became larger and more numerous, and that GSL populations were becoming increasingly complex

(Coltrain and Leavitt 2002:476). Farming was eventually abandoned in the GSL wetlands after about A.D. 1150, a situation that has been observed at Fremont sites in other regions.

Arguing that such an abandonment is attributable to climatic deterioration, Coltrain and Leavitt (2002:476) cited pollen and tree-ring data that indicate the onset of drought or a rainfall shift that may have prevented, or at least curtailed, farming in some locations. As further support for their argument, Coltrain and Leavitt (2002:476) also maintained that levels of $\delta^{13}C$ indicated a shift from maize to wild foods at about A.D. 1150. They added that these $\delta^{13}C$ values emerged around A.D. 1150, "signaling the most arid period in the chronology, following a brief period of below average moisture" (Coltrain and Leavitt 2002:476). This was in agreement with the isotope evidence from the GSL burials, whose diets consisted primarily of high levels of C_4 between A.D. 400 and 1150, and then changed to a diet of mostly wild C_3 foods after about A.D. 1150 (Coltrain and Stafford 1999).

This evidence suggested to Coltrain and Stafford (1999:82) that agriculture was abandoned and populations returned to a foraging lifestyle, probably in response to deteriorating climatic conditions (Coltrain and Stafford 1999:82). These data strongly suggest that farming in the GSL wetlands was abandoned as a result of a reduction in moisture during the growing season, which could be due to a change in the seasonality of precipitation and/or the onset of drought (Coltrain and Leavitt 2002:477).

Elston (1982:195) argued that during the mid-Archaic, favorable climatic conditions had major impacts on western Great Basin cultures, as witnessed by archaeological evidence that these conditions were coincident with significant increases in cultural complexity and elaboration. The archaeological record demonstrates this through various

lines of evidence, including a greater diversity of textiles, the size and complexity of structures, a variety of projectile points, evidence of long-distance trade, and craft specialization (Elston 1982:195). Then beginning about 2,000 years ago, climatic conditions gradually became warmer and drier. While this later episode may not have been as dramatic as earlier climatic changes, Elston (1982:197) argued that it was a time of significant culture change that could still be observed during the ethnographic period.

Technological changes evident in the archaeological record for this later episode include the development and expansion of bow and arrow technology, the addition of different ground stone tools for plant food processing, the appearance of pottery in some areas, and a change in the manufacturing techniques for flaked stone tools (Elston 1982: 198). Settlement and subsistence changes also appeared during this time, including an increased emphasis on plant foods, a decrease in big game hunting, a reduction in structure size, and more dispersed settlement patterns. One exception to this pattern occurred in Owens Valley, which witnessed larger residence groups and increasing social complexity (Elston 1982:198). The reasons for this disparity are not clear.

In the case of the bow and arrow, the use of this technology greatly expanded in the Great Basin after about A.D. 300. As the technology became more complex, arrow points became smaller, such as the Desert Side-notched and Cottonwood forms (Bettinger 1999:63). The bow made hunting more efficient, which presumably was necessary during the changing climatic conditions of the late Medithermal. At the same time, snares and deadfalls became more popular for the capture of small game (Bettinger 1999:63; Janetski 1979). Grinding and seed-gathering implements also increased during the latter part of the Medithermal, which is thought to reflect a greater reliance on plant foods (Bettinger 1999:64), presumably due to climate changes affecting resource

availability and distribution. The changes in subsistence are also evident in the intensification of wetland and alpine resources, as well as increased use of pinyon (Bettinger 1999:64-65; also see Baker and Janetski 1992; Delacorte 1994; Sutton 1991b).

In his discussion of the impact of the Medithermal (which overlaps the MCA), Bettinger (1999:63-65) noted that towards the latter part of this time, the ceramic traditions were initially developed with the Anasazi-Pueblo in the southern Great Basin (1,500 to 800 B.P.), the Fremont of the eastern Great Basin (1,500 to 600 B.P.), and the Numic of most of the Great Basin (post-1,000 B.P.) (also see Fowler and Madsen 1986; Griset 1986; Madsen 1977). The first two traditions are associated with the adoption and expansion of maize horticulture, while the Numic tradition is more likely related to efficiency in processing traditional foods (Bettinger 1999:63). Many of the changes that took place during the second half of the Medithermal overlap in time with the Numic expansion, a population migration that commenced about 1,000 B.P., originating in southeast California and moving out across the Great Basin, perhaps in response to changing climatic conditions (also see Chapter 7). While Bettinger (1999:62) cautioned against simplifying the complicated connections between various aspects of the culture-environment equation, he noted that it is clear that the Medithermal witnessed a significant change in the way people related to each other and to the environment.

The MCA in the Mojave Desert

While the Mojave Desert is technically considered a part of the Great Basin,[1] in this study it is treated separately. This is primarily due to the nature of its environment, as its water sources and subsistence resources were less predictable than those of the overall Great Basin, with large areas "characterized by broad swaths of largely unproductive habitat punctuated by resource patches of uncertain value" (Sutton et al. MS). There

has been much debate about the effects of climatic shifts on prehistoric populations in the Mojave Desert, largely because the region has been viewed as having minor environmental variation throughout most of the Holocene (e.g., Basgall and Hall 1992).

Jones et al. (1999:152) argued that extended episodic droughts in the Mojave Desert during the MCA would most likely have reduced the number of water sources significantly, so they would be less predictable and more widely dispersed. For hunter-gatherers in the Mojave Desert, this would have greatly increased the risk of foraging trips into the interior, where water may well have been absent. Instead, they would be more likely to tether themselves to better known and more predictable water sources, at the same time sacrificing foraging efficiency (Jones et al. 1999; Kelly 1995). In addition, diminishing one's foraging range would also have the effect of intensifying competition for reduced resources near the few reliable sources of water as well as exacerbating interpersonal violence, problems that are more apparent in California and the Southwest but which undoubtedly also occurred in the Great Basin and Mojave Desert (Jones et al. 1999:153).

The most convincing evidence of drought from the Mojave Desert has been derived from packrat middens and lake records that indicate increasing aridity beginning about 1,400 B.P. (e.g., Cole and Webb 1985; Jones et al. 1999; Spaulding 1990; Spaulding et al. 1994). During this time, xeric-adapted vegetation was common and mesic-adapted vegetation was rare. There also appears to have been little increased spring activity or elevated lake levels between A.D. 900 and 1350, and winter precipitation had also decreased (Jones et al. 1999:143).

Other evidence has come from radiocarbon dates at a number of archaeological sites in the Mojave Desert. During the MCA, it appears that there was a significant reduction

in the use of the desert and/or aggregation, which Jones et al. (1999:152) suggested was due to decreased availability of water. They noted that of 84 radiocarbon dated archaeological components spanning between A.D. 300 and 1800, 25 dated between A.D. 300 and 800, 12 to the MCA, with a significant increase of 47 from 1300 to 1800 (Jones et al. 1999:152).[2] Those components dating to the MCA are closely associated with a few perennial water sources along the Mojave River, suggesting that while hunter-gatherers of the Mojave Desert were less dependent on climate than agriculturalists, they nevertheless were affected by the severe aridity of the MCA (Jones et al. 1999:152-153).

Evidence for past variations in effective moisture in the Mojave Desert and adjacent areas can be seen in raised shorelines and the stratigraphy of dry lakes, as well as in spring and marsh deposits and in relict soils (Spaulding 1995:139-140). Even with moderate changes in effective moisture, there would likely be significant biotic responses (Spaulding 1995:140). There is now a considerable amount of information regarding those responses in biotic communities over time in the Mojave Desert, including data from packrat nests, tree ring records, archaeological assemblages, spring and lake studies, and other contexts (Sutton 1996:241). That does not mean, however, that we fully understand what all of this information means regarding climate and human responses to climate. As Sutton (1996:241) pointed out, "Arguments rage over the amount of rainfall in an area, whether the temperature was higher or lower, how such conditions affected spring flow and animal populations, etc."

Between 2,600 and 2,000 B.P., there is evidence of significantly increased aridity in the Mojave Desert, followed by a period of enhanced effective moisture from 2,000 to 1,400 B.P. (Spaulding 1994:10; Warren and Crabtree 1986). Arid conditions returned ca. 1,000 B.P. At about the same time, there is evidence that there was a shift in settlement

and subsistence patterns that may possibly be related to expansion of the bow and arrow (Yohe and Sutton 2000a), although at this time it is unclear why the changes occurred. Environment almost certainly played a role, but there undoubtedly were other factors.

Based on lake studies and tree ring records for several lakes in eastern California, as well as tree ring and tree line records for various water sources, Stine (2003:425) noted that at about 2,000 B.P., Mono and Walker lakes had experienced extremely low stands, indicating severe drought. Using that as proxy data for Owens Lake just north of the northern margin of the Mojave Desert, Stine (2003:425) suggested that due to these conditions, Owens Lake may have become desiccated during this time. Between about 1,100 and 600 years ago, these Great Basin lakes had become extremely desiccated, indicating perhaps the driest interval in the last 9,000 years (Stine 2003:425). Such drought conditions would have resulted in the loss of woodlands and wetlands in the Owens Lake Basin (Stine 2003:445; also see Anderson 2003:485).

This argument was supported by Mehringer and Sheppard (1978:165), who noted that at nearby Little Lake in the northern Mojave Desert, core samples indicated that beginning about 3,000 years ago, the lake became much shallower, perhaps due to declining water availability in the Owens River drainage (also see Anderson 2003:484). While they observed that this was likely at least partly due to climate change, Mehringer and Sheppard (1978:166) also noted that other geological factors might have been involved, such as faulting and rates of deposition.

In his study of the Little Granite Mountains (LGM) of Fort Irwin, Spaulding (1995:155-156) observed that blackbrush (*Coleogyne ramosissima*) specimens recovered from packrat middens at the LGM-2 site indicated more arid conditions at approximately 1,450 B.P. In addition, archaeological specimens from the eastern Mojave Desert

demonstrate "an upward advance in the upper limit of creosote bush, and therefore warmer winters" beginning about 1,400 years ago (Spaulding 1995:156). This is supported by evidence from the McCullough Range of southern Nevada, where Spaulding (1990:195) reported upward expansion of creosote between about 1,500 and 500 B.P.

Spaulding's (1995) study is interesting in that if warmer winters began in the Mojave Desert sometime between 1,450 and 1,400 years ago, the argument for a period of environmental amelioration during the subsequent Rose Spring Period (see Chapter 1) is weakened. Since this argument is based primarily on research at Koehn Lake (Sutton 1986a, 1990, 1991a) more than 80 miles west of LGM, however, perhaps the two environments were different enough to account for this discrepancy. The disparate environments that make up the Mojave Desert could account for a substantial degree of variability in the timing and effects of the MCA in the Mojave Desert. For instance, the watershed for the Little Granite Mountains requires rainfall within the western Mojave Desert itself, while the watershed for Koehn Lake is the Sierra Nevada and does not require rainfall from the desert to have water in it.

Discussion

This study represents an attempt to accumulate the data that are available in order to determine whether there may, in fact, be sufficient information at this point in our understanding to see whether better statements can now be made regarding the impact of the MCA on the prehistoric populations of the western Mojave Desert. How people will respond to climatic stresses depends on several factors, including the severity of such events, population size and density, and the predictability of game behavior, among

others (e.g., Jochim 1981:123; Larson and Michaelsen 1990:228). The ways in which these and other factors will affect a particular population will differ depending on the preferred subsistence system. For example, during times of climatic stress, farmers will likely face greater malnutrition and starvation than foragers, who have the flexibility to merely move to a more resource-abundant area (e.g., Jochim 1981:149).

As Larson and Michaelsen (1990:244) pointed out, it is really an issue of threshold, in that major changes will occur only if the stress induced by resource shortages "passes some significant threshold level that is predetermined by changes in demographic factors and climatic conditions." People also respond to cultural stressors, such as drought, in terms of their perception of the risks involved (Jochim 1981:123; Larson and Michaelsen 1990:228). Perception of risk will vary not just from culture to culture, but from individual to individual. For example, as Jochim (1981:123) observed, the poor individuals within a society that have less access to preferred resources will react to stress differently than the wealthy members of that same society. How those different perceptions will affect the responses of a particular culture as a whole is difficult to determine, at best. In any case, as Larson and Michaelsen (1990:228) noted, human responses to environmental imbalances will likely include strategies that minimize the risks involved, such as better planning, storage, and more intensive resource utilization (also see Glassow 1980:22). These are some of the issues that will be explored in this study in an attempt to determine the effects of the MCA in the western Mojave Desert.

Human populations around the world have developed cultural strategies and innovations that have permitted them to successfully colonize and densely populate virtually every environment on our planet. In most cases, regardless of the crisis—be it climate stress, overpopulation, food shortages, or other predicaments—humans have risen

to the challenge. Thus, it is not a question of *whether* human responses to the MCA took place; rather, it is the kind and degree of those responses that is the real question, and whether we can detect them in the archaeological record. In other words, although other factors certainly play a role in cultural adaptation, environmental fluctuations must be taken into consideration, especially in arid regions like the Mojave Desert.

Notes

1. This is only true in an anthropological/archaeological sense. Geologists restrict the term "Great Basin" to the internally drained basins, a hydrologic distinction that excludes the Mojave Desert from the Great Basin (Stephen M. Rowland, personal communication 2006). While Grayson (1993) placed the Mojave Desert within the Great Basin, he noted the floristic distinctions between the Mojave Desert and the rest of the Great Basin (e.g., the Joshua tree [*Yucca brevifolia*] and creosote bush [*Larrea tridentata*] appear only in the Mojave Desert). Zigmond (1986) included the Mojave Desert within the cultural Great Basin, and Warren and Crabtree (1986) considered the Mojave Desert to be within the environmental Great Basin.

2. It should be noted here that the radiocarbon dates compiled by Jones et al. (1999) differ somewhat from the compilation in this study. This is likely due to two reasons. First, Jones et al. (1999) used a partial list of radiocarbon dates for their study, necessarily leaving others out (and including some from outside the western Mojave Desert). The study here includes all radiocarbon dates that were available for the study sites. Second, Jones et al. (1999) did not have access to certain unpublished data that were available to me.

CHAPTER 4

REGIONAL BACKGROUND OF THE WESTERN MOJAVE DESERT

> *The Mojave Desert is among all things contradictory—inner visions and drab flats; rock needles and swamp muck; black basalt against a neon sky, above a translucent, perfect flower growing without visible stem on the gravel floor. Storms explode in a riot of wild yells and downpour. Evening is tranquility, a song singing to itself. And there are few other places where you get such tired, frozen feet.*
>
> (E. L. Davis 1978:3)

Introduction

The Mojave Desert, the smallest of the North American deserts, is located on the southwest margin of the Great Basin (see Figure 4). Its topography is similar to the Basin and Range Province of the overall Great Basin, although the isolated mountain ranges are of relatively low elevation (Spaulding 1995:140). At the higher elevations, such as in the Sheep and Spring ranges of Nevada as well as the Panamint Range and Inyo Mountains of California, the biotic communities consist primarily of a subalpine woodland (Spaulding 1995:140; also see Grayson 1993). At the lower elevations, the valley floors are situated less than 750 meters above sea level, supporting a more xeric-adapted biotic regime (Morrison 1965:265; Spaulding 1995).

Two of the most characteristic plants of the Mojave Desert are the creosote bush (*Larrea* spp.) and Joshua tree (*Yucca* spp.), both of which were important to the prehistoric inhabitants of the Mojave Desert. Other staple subsistence items included

Figure 4. One view of the western Mojave Desert near Freeman Junction, taken in 2002, with Robbers Roost in the background. (Photograph courtesy of A. Williams.)

mesquite (*Prosopis glandulosa*), screwbean (*P. pubescens*), and agave (*Agave deserti*) (e.g., Lyneis 1982). This chapter discusses the different aspects of the regional background of the western Mojave Desert. These include the paleoenvironment, current environment, ethnographic setting, cultural chronology, and archaeological background for this desert region.[1] Information on other parts of the Mojave Desert is also included where appropriate.

Paleoenvironment

The mountains of the Mojave Desert consist primarily of granites, rhyolite, and basalt (Van Devender et al. 1987:328). Many of the rocks across the Mojave Desert are at least Precambrian in age, with Paleozoic, Mesozoic, and Cenozoic rocks also being common (Glazner et al. 1994:3). In some parts of the Mojave Desert, such as Red Rock Canyon, the geology consists of plutonic rocks intruding into older metamorphic rocks, including quartzite conglomerate, hornfels, and basalt porphyry of presumed Jurassic age (Dibblee 1954; Whistler and Burbank 1992). On the western slopes of the El Paso Mountains northeast of Red Rock Canyon, the geology includes Mesozoic crystalline rocks,

Paleozoic metasedimentary rock, and Miocene volcanic rocks (Whistler and Burbank 1992:649).

Much of the geology of the Mojave Desert has been heavily influenced by tectonic forces during the last eight million years, particularly along the Garlock Fault (Loomis and Burbank 1988:12; also see Carter 1994; McGill 1994a, 1994b). McGill (1994a:363) reported a maximum recurrence interval of 1,700 years for the central Garlock fault, with the last significant earthquake occurring less than 530 years ago. Such tectonic events are related to "interactions between the North American, Pacific, and Farallon plates at the western margin of North America, and they provide some new age constraints for the uplift of the Sierra Nevada" (Loomis and Burbank 1988:27).

Although much of the western Mojave Desert is considered semiarid to arid by today's standards (e.g., Morrison 1965: 267), during the Miocene and Pliocene it was subhumid, with an estimated annual precipitation between 25 and 30 inches (Morrison 1965:267). During the Pleistocene, a different climate developed as the result of uplift by block faulting, fluctuating much more widely in temperature and precipitation (Morrison 1965:267). These climatic fluctuations "caused relatively large changes in erosional and surficial depositional processes [and] also caused the life zones to move hundreds of miles north- and southward and thousands of feet up and down the mountainsides" (Morrison 1965:267; also see Hall and Barker 1981).

During the late Pleistocene and continuing to some degree into the early Holocene, numerous deep lakes, marshes, streams, and rivers were a part of the Mojave Desert landscape, supporting biotic communities consisting largely of xeric woodland and cold steppe (Mehringer and Sheppard 1978:153), at least below about 300 meters (Van Devender et al. 1987:324-325). At higher elevations, juniper woodland and pinyon-

juniper woodland were common between about 900 and 1,200 meters (Van Devender et al. 1987:339; also see Force 1991; Grayson 1993; Thompson and Mead 1982; Van Devender 1977). Above ca. 1,900 meters, some parts of the Mojave Desert were host to bristlecone and limber pine, as well as white fir (Van Devender et al. 1987:340). At the end of the Pleistocene in the Mojave Desert, the last of the megafauna were virtually extinct (e.g., Mehringer and Sheppard 1978:15303).

Toward the end of the Pleistocene, the Mojave River flowed into Lake Mojave as it weaved its way toward Death Valley (Warren 1994:113-114). The Mojave and Amargosa rivers periodically flooded during times of heavy runoff, depositing large amounts of water into the desert playas; these and other rivers formed lakes at various times in the past (Warren 1984:340; also see Enzel et al. 1989, 1992). Along with associated streams and lakes, the Mojave Desert often contained a great deal of surface water that hosted a wide variety of resources (Warren 1994:114). As the Pleistocene came to a close, however, conditions began to become more arid, with the Early Holocene heralding the final desiccation of major lake systems in the Mojave Desert (Warren and Crabtree 1986). This transition was the most severe environmental episode in the California deserts during the post-Pleistocene era (Warren 1984:410).

In southeastern California, which encompasses much of the Mojave Desert, there are numerous ancient lakes from the recent geologic past (e.g., Blanc and Cleveland 1961a, 1961b; Fowler and Koch 1982). Some of these Pleistocene and early Holocene lakes were perhaps hundreds of miles long and hundreds of feet deep (Blanc and Cleveland 1961a:1-2). These lakes, including China, Mojave, Owens, Searles, Panamint, Manly, and Rogers lakes, formed an extensive drainage system that also included numerous rivers, such as the Owens, Mojave, and Amargosa rivers (Rowlands et al. 1982:106-107;

also see Warren and de Costa 1964). Most of these lakes and rivers are now dry unless there is heavy rainfall or flooding (Rowlands et al. 1982:107).

Probably the most significant Pleistocene feature of the western Mojave Desert was Lake Thompson (Sutton 1991a:7; also see Thompson 1929; Dibblee 1960). This lake was first documented by Thompson (1929:302-303), who noted several playas in the Antelope Valley, including Rosamond, Rogers, and Buckhorn dry lakes, that probably formed a single large playa at one time, although they are now separated by sand dunes. He also maintained that at some point during the Pleistocene, a perennial lake (later to be named Lake Thompson) likely encompassed these playas. Subsequently, Sutton (1991a:7) documented a high shoreline on the north shore of Rosamond Lake at about the 2,375 ft. contour, indicating that Lake Thompson must have reached at least that level, so it is reasonable to conclude that it overflowed into the Antelope Valley, as well as into the Fremont Basin to the north of Antelope Valley, during periods of great precipitation.

A point of interest for this study is the development of Koehn Lake (Figure 5), which is thought to have originated sometime during the Pleistocene and lasting well into the Holocene (Blanc and Cleveland 1961a). At least four fossil stands have tentatively been identified at Koehn Lake, one of which was at an elevation of 1,919 ft. and another at an elevation of 1,930 ft. (Sutton and Hansen 1986). The latter elevation is about 35 ft. above the current playa, suggesting that this lakestand was not ephemeral; rather, it attests to the presence of a significant body of water for a considerable period of time (Sutton 1991b:8). Based on evidence of neoglacial activity in the southern Sierra Nevada in the late Holocene, Sutton (1991b:9) maintained that it was reasonable to assume that a decrease in evapo-transpiration rates, along with an increase in precipitation, took place during the last several thousand years, which caused Koehn Lake to reach such a high elevation.

Figure 5. View of the area surrounding Koehn Lake (in background), taken ca. 1986. (Photograph courtesy of M. Q. Sutton.)

As the large lake systems began to desiccate at the end of the Pleistocene, the Mojave Desert became increasingly arid, as evidenced by the proliferation of creosote bush and desert spruce beginning about 7,000 years ago during the middle Holocene and continuing into the late Holocene (Spaulding 1991, 1994). By about 5,000 years ago, more mesic-adapted species began to appear, suggesting that climatic conditions had improved (Spaulding 1994:5). As the late Holocene was ushered in beginning ca. 4,000 B.P., there was a period of increased effective moisture, followed by an arid interval some 1,500 to 2,000 years later. There was a subsequent episode of increased effective moisture from ca. 2,000 to 1,400 B.P., followed yet again by another arid period between 1,200 and 700 B.P. (Spaulding 1994:7-8). This latter episode coincides with the time frame for the MCA (see Chapter 3 for more detail about the MCA).[2]

In more recent times, one of the most significant climatic events of the last four centuries was the Little Ice Age (LIA), a global event that took place between about 600 and 125 years ago (e.g., Fagan 1999, 2000; Grove 1988; Hereford 2002; Miller and Wigand 1994; Moore et al. 2002; Wigand and Rhode 2002; Williams et al. 1998; Wright et al.

1993). Based on historical documentation, tree ring data, geomorphological studies, proxy climatic data, and pollen analyses, evidence has been provided that during the LIA in the Great Basin, there was greater winter precipitation and cooler temperatures, signaling the end of the earlier drought episodes of the MCA and beginning a gradual reexpansion of juniper woodland (Wigand and Rhode 2002:331).

During the course of the LIA, temperatures were about 0.5°C below modern levels and the variance of temperature increased (Graumlich 1993:253). According to Fagan (1999), the severe cold conditions during the LIA caused major worldwide crises, such as crop failures, decimation of fish populations, increases in volcanic activity, social and political strife, disease, and perhaps even cannibalism. At the end of the LIA, arid conditions caused the juniper woodlands in the Great Basin to retreat once again, giving way to sagebrush steppe that characterizes much of this region today (Wigand and Rhode 2002:331). How the Little Ice Age affected the western Mojave Desert specifically is unclear at this time.

Current Environment

The current environment of the western Mojave Desert is very different than it was during the late Pleistocene and early Holocene. It is now a predominantly windy, dry, and hot desert with extremes in temperature, low humidity, and high evaporation rates (Rowlands et al. 1982:112). Due to the rainshadow effect of the Sierra Nevada, the mean annual precipitation of the western Mojave Desert ranges from less than four inches in the lower elevations to more than 30 inches at the highest elevations in the mountains (Jaeger 1957; Morrison 1965:267), and is extremely variable. Snow is relatively frequent, but again is highly variable depending on elevation (e.g., Rowlands et al. 1982:108).

Occasional flash floods are not uncommon in the western Mojave Desert, one of which took place in 1997, destroying the State Park ranger station at the Ricardo campground in Red Rock Canyon. High winds are also common features of this region. As with the rest of the Great Basin, drainage in the Mojave Desert is internal, "and the few perennial streams that rise in the high mountains . . . lose themselves in playas or salt lakes" (Wahrhaftig and Birman 1965:300). Daytime summer temperatures can sometimes exceed 100°F, while winter temperatures have been known to plummet to several degrees below freezing (e.g., Elford and McDonough 1964; Felton 1965).

The current botanical regime of the western Mojave Desert consists of a large variety of species, including shrubs, trees, and succulents, as well as perennial and annual forbs, grasses, and herbs (Rowlands et al. 1982:116). Some of the most common plants are creosote bush (*Larrea tridentata*), burro bush (*Ambrosia dumosa*), cheesebush (*Hymeroclea salsola*), bluegrass (*Poa scarabella*), needlegrass (*Stipa speciosa*), Joshua tree (*Yucca brevifolia*), Mormon tea (*Ephedra nevadensis*), fiddleneck (*Amsinckia* spp.), rabbit brush (*Chrysothamnus* spp.), cactus (e.g., *Opuntia* spp.), Russian thistle (*Salsola tragus*), Indian rice grass (*Achnatherum hymenoides*), locoweed (*Astragalus* spp.), a wide variety of flowers, and other plants characteristic of a creosote bush scrub community. In the mountains of the Mojave Desert, there are woodlands of juniper (*Juniperus* spp.) and pinyon (*Pinus* spp.). Rowlands et al. (1982:116) observed that "Spring displays of flowers are more frequent in the southwestern Mojave, while summer displays are more characteristic of the eastern Mojave, reflecting the differences in the seasonal rainfall patterns."

The abundant wildlife of the western Mojave Desert includes mammals, reptiles, amphibians, and birds (Jameson and Peeters 1988). Most of the mammal species consist

of small rodents (Jaeger 1965), the most prominent of which are kangaroo rats (*Dipodomys* spp.), wood rats (*Neotoma* spp.), pocket gophers (*Thomomys* sp.), antelope ground squirrels (*Ammospermophilus leucurus*), ground squirrels (*Spermophilus mojavensis*), and a number of mice species. Larger mammals include black-tailed hares (jackrabbits; *Lepus californicus*), cottontail rabbits (*Sylvilagus audubonii*), coyotes (*Canis latrans*), skunks (*Mephitis mephitis*, *Spilogale putorius*), kit foxes (*Vulpes macrotis*), bobcats (*Felis rufus*), and several bat species (cf. *Chiroptera* spp.). The mule deer (*Odocoileus hemionus*) is another major resident of the region, although it has witnessed a population decline in modern times. At one time, large numbers of pronghorn (*Antilocapra americana*) roamed the region, although their extent is uncertain (Sutton 1988:12). Bighorn sheep (*Ovis canadensis*) and black bear (*Ursus americanus*) were probably also present prior to contact, although they do not reside there now.

The western Mojave Desert is also home to a variety of reptiles and amphibians, such as toads (*Bufo* spp.), lizards (e.g., *Crotaphytus* spp., *Sceloporus* spp.), snakes (e.g., *Crotalus* spp., *Lampropeltis getulus*, *Phyllorrhynchus decurtatus*), and desert tortoise (*Gopherus agassizii*). Bird species include grebes (Podicipedidae), ducks (Anatidae), geese (*Branta* spp.), coots (*Fulica americana*), vultures (Cathartidae), hawks (Accipitridae, mostly *Buteo* spp.), owls (e.g., *Otus* spp., *Bubo virginianus*), roadrunners (*Geococcyx californianus*), quail (Phasianidae), and swallows (Hirundinidae), among others (Cogswell 1977; Robbins et al. 1983).

Ethnographic Setting of the Western Mojave Desert

Several ethnographic groups are known to have resided in various parts of the western Mojave Desert, while others are known or suspected to have traveled through it from time

to time, at least during ethnographic times (see Figure 6). Further, there are data to indicate that some of these groups have lived in the Mojave Desert for at least 2,000 years (see below). The main groups known to have occupied this region are the Kawaiisu, Kitanemuk, Koso Shoshoni, Serrano, and Tataviam. These groups were all mobile hunter-gatherers, each having broad, flexible territories (Sutton et al. MS).

The following provides general summaries of what is known (or presumed) about the lifeways of these groups. Much of the information below was taken from relevant articles in the California and Great Basin volumes of the *Handbook of North American Indians* (d'Azevedo 1986; Heizer 1978). The purpose of including this ethnographic data is to provide a general cultural context in which to place some of the inferences made in Chapter 7. The groups are discussed in alphabetical order.

Kawaiisu Ethnography

The Kawaiisu were the predominant native inhabitants of the western Mojave Desert during the ethnographic period. The Kitanemuk and Tataviam lived to the south and southwest of the Kawaiisu, the Owens Valley Paiute and Tübatulabal resided to the north, and the Southern Paiute lived to the east. While there is no single synthetic treatment available for the Kawaiisu, some ethnographic data are found in Gifford (1917) and Driver (1937), and general summaries have been presented in Kroeber (1925) and Zigmond (1986). In addition, information on specialized topics is offered in Sutton (1982), Sutton and Greene (1988), and Zigmond (1938, 1941, 1977, 1978, 1980, 1981). Most of the following was taken from these sources.

Territory, Language, and Population

The Kawaiisu inhabited the southern Sierra Nevada south of the Kern River and into the northern Tehachapi Mountains just south of Tehachapi Pass, as well as large portions

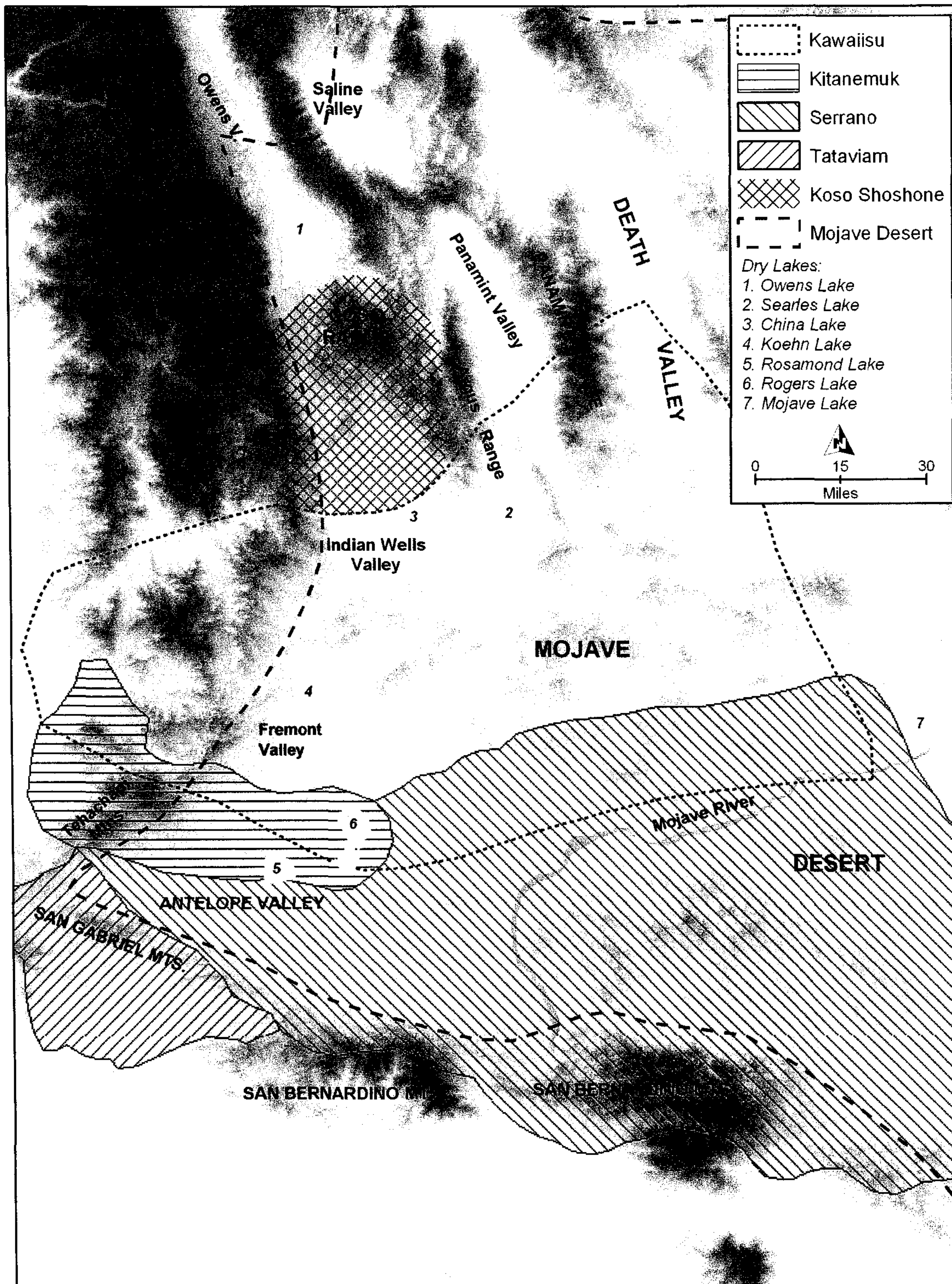

Figure 6. Generalized culture map, showing approximate territorial boundaries of the ethnographic groups discussed in the text. These boundaries were derived from d'Azevedo (1986:ix), Heizer (1978: ix), and Steward (1938:Figure 1). The overlap of Kawaiisu territory with that of the Kitanemuk and Serrano is most likely a reflection of the sometimes ambiguous nature of such boundaries. The boundary of the Mojave Desert indicated by the heavy dashed line encompasses the western Mojave Desert and parts of the central and eastern Mojave Desert, in order to show the far-ranging territorial boundaries of some of these groups. (Map by H. Switalski, in consultation with the author.)

of the western Mojave Desert (Zigmond 1986). Steward (1938:84) reported that the Kawaiisu also occupied the southern end of the Panamint Valley and part of Death Valley. The elevation of Kawaiisu territory runs between 1,000 feet in the valley to almost 8,500 feet in the mountains; thus, they could exploit a diversity of environmental zones, including forest, desert, and grassland regions (Zigmond 1981:3, 1986:398).

Several large ethnographic Kawaiisu villages have been documented in Sand Canyon, on the eastern side of the Tehachapi Valley. Two of these villages have been investigated archaeologically—*Ma'a'puts* (CA-KER-272/339; Pruett 1987) and the Nettle Spring site complex (CA-KER-230; Hinshaw and Rubin 1996; Sutton 1997, 2001). Although sites are known in the greater Tehachapi area, Sand Canyon appears to have been a central occupation area for the Kawaiisu. This hypothesis is supported by frequent references to Sand Canyon in Kawaiisu mythology (Zigmond 1980) and by the presence of Kawaiisu Creation Cave (CA-KER-508; Sutton 1982) in the canyon.

Zigmond (1986:398) noted that the Kawaiisu language belongs to the westernmost branch of the Southern Numic division of Northern Uto-Aztecan, which also includes the Southern Paiute and Ute (also see Sutton 1991a:11). The latter two languages are thought to have diverged from Kawaiisu about 1,000 years ago (D. Fowler 1972; Kroeber 1925; Lamb 1958). Other Numic languages, including the Owens Valley Paiute, Northern Paiute, Panamint, and Shoshoni, probably diverged about 3,000 years ago. While the origin, age, and spread of Southern Numic is not entirely clear, the Proto-Numic and Southern Numic appear to have dispersed near the southern Sierra Nevada in an area that was occupied ethnographically by the Kawaiisu (C. Fowler 1972:110). As this is thought to have occurred about 2,000 years ago, it suggests that the Kawaiisu have occupied their present territory for at least that long (Zigmond 1986:399).

The name Kawaiisu was given to them by neighboring groups having a number of dialectic variants (Kroeber 1925:602). According to Kroeber (1925:602), "Their own name for themselves is merely Nuwu or Nuwuwu, 'people'; it has also been written Newooah." Kroeber (1925:603) estimated that there were about 500 Kawaiisu just prior to European contact.

Subsistence and Settlement

The Sierra Nevada is considered the dividing line between the Great Basin and California prehistoric culture areas (Zigmond 1986:407). Thus, as the Sierras run through Kawaiisu territory, the Kawaiisu culture should exhibit aspects of both culture areas, and indeed it does (Zigmond 1986:407). For example, while it displays the Californian characteristic of acorn usage, it is distinctly Great Basin in its nonmoiety social organization (Zigmond 1986:408). The Kawaiisu culture also possesses traits that are not specific to either California or the Great Basin, such as tobacco use and salt taboos (Zigmond 1986:408).

The Kawaiisu economy was one of hunting and gathering, utilizing a diversity of resources. No agriculture was practiced, but tobacco plants were pruned to stimulate growth and wild seed fields were burned to improve subsequent plant yields (Zigmond 1941). Acorns were a major staple (Zigmond 1986), but many other plants were used as well. Zigmond (1981) identified over 250 taxa of plants used by the Kawaiisu. Of those, 120 were used as food products, 100 for medicine, 40 for ritual activities, and 90 for miscellaneous purposes. Most of these plants were collected in the mountains; few plants were obtained from the desert. Zigmond (1986:399; Zigmond 1981:56-57) listed 20 genera of plants as the most important resources, including acorns (*Quercus* spp.), pine nuts (from *Pinus monophylla*), yucca (*Yucca* spp.), and juniper (*Juniperus*). Zigmond

(1986:398) also noted that more typical desert plants, such as mesquite (*Prosopis glandulosa*) and screwbean (*P. pubescens*), played only a minor role in the Kawaiisu subsistence regime.

Although archaeological evidence suggests that the desert portion of ethnographic Kawaiisu territory witnessed somewhat ephemeral occupation, it is clear that several important resources were obtained there, including deer (*Odocoileus hemionus*), chuckwalla (*Sauromalus obesus*), pronghorn (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*), among others. One of the most abundant desert resources was the black-tailed hare (*Lepus californicus*), although deer appears to have been the favorite animal food (Zigmond 1986:400). Pronghorn and hares were hunted communally (Driver 1937:61), with pronghorn being hunted in the desert and in the San Joaquin Valley (Zigmond 1986:399). Rodents and insects were also consumed (Sutton 1988; Zigmond 1986), along with a variety of birds, including quail (e.g., Driver 1937:61).

The Kawaiisu also exploited resources outside their core territory, on occasion journeying into the southern San Joaquin Valley and other areas (Zigmond 1986:399). Koehn Lake in the Fremont Valley was identified as a regular destination for seasonal trips (Zigmond 1980), and along the Mojave River, Victorville has been noted in Kawaiisu oral tradition as an area where people would go to gather "bug-sugar" (e.g., Zigmond 1980:141). Further, one of Walker's (1971:8) native consultants, Refugia Williams, reported that the Kawaiisu engaged in spring migrations from the Piute Mountains across Indian Wells Valley (just north of the Fremont Valley), as well as to the Argus Range, where they hunted pronghorn and mountain sheep.

Despite the diversity and variety of foods available to the Kawaiisu, there were occasional periods of resource depletion, particularly during the winter (Zigmond

1986:399). During such lean times, conservation of food items was practiced to ensure sufficient provisions for all, although poor yields and rodent infestations might perilously reduce available resources (Zigmond 1986:399).

Social and Political Organization

The social organization of the Kawaiisu was centered around the family group (Zigmond 1986). Although there were no formal political groupings, at least during the ethnographic period, the position of chief (or headman) was conferred "simply through tacit acknowledgment of the people about him" (Zigmond 1986:405). The qualifications for chief depended upon wealth (Kroeber 1925:603), and the position might be passed from father to son, although such status was not automatically bequeathed as it depended on personal endowment (Zigmond 1986:406).

Families tended to live near each other and cooperate in some activities, and as such might be considered informal bands (Zigmond 1986:405). Moieties apparently were not part of the Kawaiisu social structure. As the property of an individual was burned at his or her funeral, such property could not be inherited; thus, status often appears to have been achieved, rather than ascribed (Gifford 1917). Shamanism was a well-developed concept among the Kawaiisu, including curing, bewitching, and weather specialists who acquired their powers by way of dreams and visions (Zigmond 1986:406).

External Relations

Many groups sporadically passed through and/or utilized the western Mojave Desert, often interacting with the Kawaiisu in a variety of ways. To one extent or another, these undoubtedly included the Owens Valley Paiute, Kitanemuk, Yokuts, Chumash, Mojave, Chemehuevi, Vanyume, Panamint Shoshone, and probably others. External relations between the Kawaiisu and other groups were generally friendly, although there were

intermittent episodes of conflict or warfare, particularly with the Yokuts and the Tübatulabal (e.g., Smith 1978:440). Exchange with other tribes was common; for example, acorns were traded for obsidian and salt from the Western Shoshone and the Panamint Shoshone (Zigmond 1986:399). Intertribal game drives, primarily for pronghorn, were occasionally conducted with the Chumash, the Yokuts, and the Tübatulabal (Zigmond 1986:399).

Kawaiisu relations with the Yokuts in the San Joaquin Valley were intriguing. Powers (1877:369-370) noted that the Yokuts were subjected to attacks from the "Paiuti," a generic term apparently used to refer to any Shoshonean (i.e., Northern Uto-Aztecan) group. These attacks took place during the late 1700s and early 1800s and were reported to be so severe that the Yokuts were forced out of much of the eastern foothill and southern valley portions of their territory by "Paiuti" tribes (Powers 1877: 369). Later, it seems that the attacking groups were so "enervated by the malaria [smallpox?]" (Powers 1877:370) that they retreated back into the mountains.

While Powers (1877) did not name the Kawaiisu specifically as the "Paiuti" intruders, Zigmond (1986:399) reported that hostilities between the Kawaiisu and the Yokuts did occur, although the frequency and intensity of such contacts was not clear. On the other hand, Kroeber (1925:601) reported that relations between the Kawaiisu and the Yokuts were basically peaceful. Powers' observations of a Shoshonean "invasion" of the valley were only cursorily mentioned by Kroeber (1925) and were not mentioned at all by Gayton (1948), Latta (1977), or Wallace (1978). Driver (1937:94) maintained that the Kawaiisu did not have tribal wars, although they did conduct surprise attacks.

The issues of Kawaiisu warfare and expansion are important to our understanding of the prehistory of the western Mojave Desert. Kroeber (1925:601) maintained that the

Kawaiisu were recent entrants into the southern Sierra Nevada, apparently moving west from the Mojave Desert, perhaps from the area of the Fremont Valley. This hypothesis was supported by Sutton (1987) in his study of the Numic expansion. If it were possible to determine whether the Kawaiisu were still moving west late in time, such data could provide support for the postulated invasion of the San Joaquin Valley.

Little data have been recorded regarding Kawaiisu relations with Euroamericans in the middle to late 1800s. However, it appears that Indian "troubles" were a constant problem in the El Paso Mountains, with fatalities occurring on both sides, as well as the destruction of mining property (Wynn 1963:passim).

Material Culture and Technology

While little is known of Kawaiisu material culture, ethnographic data indicate that it was varied and complex. This is especially true of their basketry, which Zigmond (1986:401) referred to as "an ever-present art." Few Kawaiisu sites have been excavated or published (but see Pruett 1987); thus, our knowledge of the material culture and technology of the Kawaiisu is limited.

However, it is known that upon the death of an individual, the deceased's house and possessions were burned. The body was wrapped in tule, placed in a rock crevice, covered with a basket, and piled over with rocks (Zigmond 1986:404). The Kawaiisu built several types of structures, depending on the time of year, the winter house (*tomokahni*) being the most common, and which

> . . . was built on a ground-level circular base with vertical forked poles, usually of willow, bound together at the top to form a smoke hole. Transverse poles were tied both inside and outside the vertical shafts, and the intervening space tightly filled with brush. Bark and tule mats are said to have made the structure waterproof, and a tule mat served as a door. The occupants slept with their feet toward the fire built at the center [Zigmond 1986:401].

During the summer, the Kawaiisu erected a flat-roofed shade house (or *havakahni*) (Zigmond 1980:123, 1986:401). Small, circular brush enclosures were used as windbreaks and larger ones were utilized for celebrations. Sweathouses (*tɨvikahni*) were earth-covered and located near water. Small above-ground granaries were constructed for the storage of acorns, nuts, and seeds (Zigmond 1986:401).

Religion and Ritual

One of the most common rituals of the Kawaiisu was related to the ingestion of datura by both girls and boys about a year or two subsequent to puberty. While under constant supervision, relatives and friends of those participating in the ritual gathered for a celebration that included feasting and dancing (Zigmond 1986:404). The following day, the drinker would swallow water to induce vomiting. The purpose of the ritual was to elicit visions that would require some kind of action by the drinker (Zigmond 1986:405).

Mourning ceremonies were held intermittently, during which the deaths of several individuals would be commemorated (Zigmond 1986:405). These were often intertribal events, with each tribe having its own space containing a circular brush enclosure. Effigies representing the deceased would be carried on poles and tossed into a fire. The mourning ceremony concluded with a feast, marking the end of the mourning period (Zigmond 1986:405).

Kitanemuk Ethnography

The Kitanemuk were a small group that inhabited the southern Tehachapi Mountains and claimed a major portion of the Antelope Valley (Blackburn and Bean 1978:564). Sutton (1980:220) suggested that the "late prehistoric period population of Antelope Valley was ancestral to the ethnographic Kitanemuk," although Blackburn (as cited in Sutton 1980:220) argued that they were probably proto-Tataviam. Summaries of

ethnographic data on the Kitanemuk are available in Kroeber (1925) and Blackburn and Bean (1978); additional data can be found in Bright (1975), Harrington (1917, 1942), and Sutton 1980).

Territory, Language, and Population

While little ethnographic or archaeological data are available on the Kitanemuk (see Sutton 1980), during the ethnographic period the area of major Kitanemuk occupation is thought to have been centered in the southern Tehachapi Mountains. The ethnographic record indicates that the desert area (i.e., the Antelope Valley) claimed by the Kitanemuk was utilized only seasonally. This may not be true during the Late Prehistoric Period, however, as it has been suggested that there was a significant population in the Antelope Valley at that time (Sutton 1980).

Kroeber (1925:611) observed that the Kitanemuk also lived on the upper Tejon and Paso creeks, and along the streams of the Tehachapi, Liebre, and Sawmill mountains at the westernmost end of the Mojave Desert (also see Sutton 1980). As such, they were primarily mountain dwellers, although they would travel to the southern lowlands during the cooler part of the year (Blackburn and Bean 1978:564), those lowlands being the Antelope Valley. Most of the Kitanemuk villages were located in the Tehachapi Mountains (Blackburn and Bean 1978; Kroeber 1925; Sutton 1980).

Sutton (1979) suggested that the Antelope Valley was virtually abandoned about 300 years ago, precipitating substantial changes in territory, settlement patterns, economics, and social organization of the valley inhabitants at that time. Subsequently, the population of the valley was represented by the ethnographic Kitanemuk (Sutton 1980: 214). However, there is some disagreement as to the extent of Kitanemuk claims to the Antelope Valley (see Blackburn and Bean 1978; Kroeber 1925). While Kroeber (1925)

assigned almost the entire Antelope Valley to the Kitanemuk, while Blackburn and Bean (1978) restricted them to the northern part of the valley, their territorial boundary remains ambiguous (Sutton 1980:215).

While the Kitanemuk language is extinct, Harrington (1917) noted that they spoke a Serran language of the Takic family (Blackburn and Bean 1978; Bright 1975; Shipley 1978). There are no historical population estimates for the Kitanemuk, but based on the size of their tribal territory, as well as comparisons with neighboring groups, their population was suggested to have been perhaps 500 to 1,000 people (Blackburn and Bean 1978:564).

Subsistence and Settlement

The Kitanemuk employed a hunting and gathering economy. As their major ethnographic occupation area was the southern Tehachapi foothills, it is assumed that acorns were a major staple (Schiffman and Garfinkel 1981). Since there are so few ethnographic or archaeological data available on the Kitanemuk, it is difficult to assess Kitanemuk subsistence. However, Blackburn and Bean (1978:564) maintained that the adaptation and subsistence technology of the Kitanemuk was not much different than that of their neighbors to the north and west. This adaptation emphasized the exploitation of fish, waterfowl, and a variety of roots and seeds, with little emphasis on mammals, although rabbits were occasionally captured communally (Wallace 1978:449-450).

The settlement patterns of the precontact Kitanemuk are also poorly understood (Sutton 1980:215), although most villages appear to have been located in the Tehachapi Mountains (Blackburn and Bean 1978; Kroeber 1925). Sutton (1980:216) suggested that the ethnographic Kitanemuk settlement pattern consisted of a number of semi-permanent villages in the Tehachapi Mountains, with smaller seasonal sites situated to take

advantage of season-specific resources. Smaller settlements may have existed at La Liebre and Tejon Ranch, at least historically (Sutton 1980:215). Similar to the Kawaiisu, the desert area of Kitanemuk territory was probably occupied on an ephemeral basis (Sutton 1980).

Social and Political Organization

Although little is known of Kitanemuk social and political systems, they were apparently well developed (Sutton 1980:217). Each village had a chief, ceremonial manager, messengers, shamans, diviners, and other ritual specialists (Blackburn and Bean 1978:567). Based on known similarities between Kitanemuk and Cahuilla kinship terminologies, their social system was probably patrilineal and lacked the totemic moiety systems found in other areas of southern California (Blackburn and Bean 1978:567; also see Harrington 1942:32).

External Relations

While the extent of Kitanemuk contact with other groups has not been well documented, Sutton (1980:221) suggested that they may have been heavily involved in the California trade system, and perhaps serving as middlemen. The middleman role "may have provided the economic base needed to support a complex social system in the desert" (Sutton 1980:221).

There was considerable interaction not only among Kitanemuk villages, but between the Kitanemuk and outside groups such as the Chumash and the Tübatulabal (Blackburn and Bean 1978:564). For example, Davis (1961:26) reported that the Kitanemuk received wooden vessels inlaid with *Haliotis* shell from the Chumash. Their relationship with the Yokuts and Tataviam was usually one of hostility, while an amiable relationship appears to have occurred with the Chumash and the Tübatulabal. In addition, there were frequent

visitations by the Mohave and the Quechan for trading purposes. Intermarriage with various outside groups was apparently common (Blackburn and Bean 1978:564).

Kitanemuk economic contacts may have been forcibly ended by the Spanish in 1811 (Sutton 1980, 1988). Mission records indicate that a large number of "Serrano" were taken to the San Fernando Mission in that year from a village at Willow Springs, as well as from several neighboring villages. It is possible that these "Serrano" were, in fact, Kitanemuk (Sutton 1980:221).

Material Culture and Technology

Very little has been documented about Kitanemuk material culture and technology, although Kroeber (1925:612) reported that their structures consisted of "a series of individual family rooms surrounding a court that had entrances on two sides only." These communal dwellings were constructed with wooden poles covered with mats made of rush. Within these rooms, each family had its own door and fireplace (Kroeber 1925:612). Blackburn and Bean (1978:565) suggested that these structures were also used for ceremonial purposes, such as the mourning ritual. Tobacco was processed for consumption with a mortar and pestle, with which lime and water were mixed to enhance sleep (Kroeber 1925:613). As noted above, wooden vessels inlaid with *Haliotis* were utilized for various purposes (Kroeber 1925:613).

Religion and Ritual

Much of Kitanemuk religion revolved around shamanism. A shaman's abilities were derived from his relationship with his dream-helpers (Blackburn and Bean 1978: 567). These abilities were acquired during adolescence by ingesting a hallucinogenic substance, typically datura or ants (e.g., Blackburn 1976). A male with more than three helpers was deemed to have exceptional powers to cure (Blackburn and Bean 1978:567). Shamans

were paid for their curing abilities, and the most powerful shamans "were able to bring rain, make an animal skin come alive, and cause miniature animals to appear on their arms while dancing" (Blackburn and Bean 1978:567). They also performed the mourning ceremonies.

Burial practices of the Kitanemuk involved the interment of the deceased in cemeteries. Individuals were interred in a tightly flexed position (Blackburn and Bean 1978:566; Kroeber 1925:613; Sutton 1980:216). Cemeteries were usually placed some distance from the village (Sutton 1980:217). Ceremonial cannibalism was apparently also practiced by the Kitanemuk, with each mourner receiving a portion of the brain for consumption (Blackburn and Bean 1978:566; Sutton 1980:217). There was a taboo on the use of the name of the dead "until regiven to a child" (Harrington 1942:2). Other rituals included the construction of shrines on hills, along trails, and in other areas that contained "a cleared space with five small piles of earth in the center in the form of a cross about six feet across, representing the earth" (Blackburn and Bean 1978:567). At these shrines, prayer offerings were deposited by passersby. Theft from a shrine was believed to cause the death of the thief (Blackburn and Bean 1978:568).

Koso Shoshoni Ethnography

The Koso Shoshoni, sometimes known as the Little Lake Shoshone (Steward 1938) inhabited the southern Owens Valley, the Rose Valley, and the Coso region (also see Yohe 2001). Kroeber (1925:589) provided a list of other names attributed to the Koso, including *Kosho*, *Shikaviyam*, *Sikaium*, *Shikaich*, *Kaich*, *Kwüts*, *Sosoni*, and *Shoshone*; however, none of Steward's informants acknowledged any of these names, except *Shoshone*. The Koso referred to themselves as *nuwu* or *ne wher*, meaning "Indian" or "the people" (Steward 1938).

Territory, Language, and Population

The Koso were part of a series of Shoshone districts in eastern California. These districts were associated with specific geographic areas consisting of related families (Steward 1938). The Koso district was known as the *Kuhwiji* district (Steward 1938:80). The heart of this district was in the Coso Mountains, covering an area of about 1,000 square miles (Steward 1938; Yohe 2001:9). The territory of the *Kuhwiji* district was bounded on the north by the southern end of Owens Lake, on the south by the northern end of Indian Wells Valley, on the western by the Sierra Nevada, and on the east by the Argus Range (Steward 1938).

The population of the Koso in late ethnographic times was likely sparse, with Kroeber (1925:590) referring to it as one of the most meager in California. The estimated population of the Koso prior to contact was approximately 500 or less, while the population reported at the time of Kroeber's (1925:590) treatise was between 100 and 150. The Koso are considered to be Panamint Shoshone speakers, which Miller (1986:99) distinguished from other Shoshone speaking peoples.

Subsistence and Settlement

The Coso Mountains, the Sierra Nevada, and the numerous valleys and open plains of the Koso territory provided a variety of resources, including pinyon in the higher elevations, desert grasses in the valleys, and acorns from the valleys and gorges of the eastern Sierra (Yohe 2001). Mountain sheep and deer were available in the Coso Range and the Sierra Nevada, while pronghorn and rabbits could be found in the lower elevations.

Plant resources provided most of the food for the Koso. Some of the most utilized resources were pine nuts from the pinyon pine (*Pinus monophylla*), acorns from the scrub

oak (*Quercus* spp.), Indian rice grass (*Oryzopsis hymenoides*), tansy-mustard (*Descurainia richardsonii*), chia (*Salvia columbariae*), bunch grass (*Sporobolus airoides*), desert plume (*Stanleya pinnata*), mariposa lily (*Calochortus kennedyi*), the Joshua tree (*Yucca brevifolia*), and mesquite pods (*Prosopis glandulosa*) (Irwin 1980; Yohe 2001). Animal foods included large and small mammals such as deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), jackrabbits (*Lepus californicus*), cottontails (*Sylvilagus audubonii*), desert tortoise (*Xerobates agassizii*), and chuckwalla (*Sauromalus obesus*) (Irwin 1980). A variety of waterfowl, rodents, fish, and insects were also components of the Koso diet.

Deer, sheep, and pronghorn were captured both individually and communally (Irwin 1980). Deer, sheep, and rabbits were snared with heavy ropes made of natural fibers (Steward 1938). Small rodents were often trapped with rock deadfalls (Irwin 1980). Meat is thought to have been relatively scarce, with hunting assuming more importance during times of seed shortages (Kroeber 1925; Steward 1938).

There were four main villages of the Koso in ethnographic times; *Pagunda*, *Müa'ta*, *Üyuwum'ba*, and *Pakwa'si* (Steward 1938:81). *Müa'ta* was the largest winter village, known today as Coso Hot Springs, contained boiling springs that were thought to possess magical and medicinal powers (Iroquois Research Institute 1978). *Pakwa'si* was located north of Rose Valley near the southwest end of Owens Lake (Yohe 2001).

External Relations

Although the Koso were adjacent to a number of other groups, Steward (1938:83) reported that conflict was rare. One of his informants told him of a fight that took place at Coso Hot Springs between the Koso and "some people" to the south, in which the intruders were all killed. During their seasonal round, in the summer, members of

different villages would sometimes join together for communal pronghorn drives, to hunt ducks, or to gather mesquite or pine nuts (Steward 1938:81-82). This pattern of seasonal transhumance was relatively consistent throughout the Great Basin (Arkush 1986).

Social and Political Organization

The basic social unit of the Koso was the nuclear family. Villages were typically comprised of related families who utilized the resources of the entire *Kuwhiji* district, although they "lacked sufficient intervillage cohesion to constitute a true band" (Steward 1938:81). Villages or families were generally autonomous, except during large resource gathering events (communal drives, pinyon harvests), at which times the "headmen" had influence over others (Irwin 1980).

During the fall season, gatherings would occur for the purpose of meeting prospective spouses from different villages and districts. Intermarriage between districts was permitted, which served to create alliances with people in other regions (Yohe 2001:14). Marriages were often arranged by parents, at which time the groom's parents would offer shell money to the bride's parents (Steward 1938:83). Postmarital residence was matrilocal until after the birth of the first child, after which it was considered to be the decision of the couple, although patrilocal residence was preferred (Steward 1938:84).

Material Culture and Technology

Little is known about material culture and technology specifically for the Koso, although discussions of certain tools, accessories, and structures for the Western Shoshone in general are found in Irwin (1980), Kroeber (1925), Steward (1941), and Thomas et al. (1986). The technology of the Koso was simple yet suited for their adaptation to the environment of the Coso region. Basketry was a very important part of their technology. Coiled basketry was of the "Yokuts" variety and consisted of pitch-

covered water jugs, shallow bowls, and carrying caps. Pine nut roasters, large conical seed/burden baskets, and seedbeaters are all examples of their twined basketry. Plant fibers were also used to produce nets, rope, and snares (see Yohe 2001:12).

Mortars for processing mesquite and acorns were usually made from cottonwood or mesquite trunks, although deep bedrock mortars were also used. Digging or walking sticks were used by all Koso, and women carried obsidian knives to assist in harvesting. Pottery consisted of crude vessels of untempered clays that were then baked and dried (Irwin 1980). Bow staves were manufactured from the trunks of juniper trees, which were heated and bent into the desired shape (Yohe 2001:13). Arrows were made from *Phragmites* cane that was straightened with a steatite shaft-straightener.

The dwellings of the Koso were of two varieties, pit houses and brush wickiups. Steward (1938) noted that the inhabitants of *Müa'ta* lived in "pit houses," but provided no details regarding their construction or size. On the other hand, the 1989 discovery of what is considered to have been a Late Prehistoric Period pit house at Rose Spring (CA-INY-372) was a relatively shallow structure (20 to 30 cm.) about three meters in diameter (Yohe 1992). Earth-covered sweat lodges were also used by some men and may have served as a village meeting house (Kroeber 1925:591; Steward 1938:83). Circular drive corrals for pronghorn were also constructed (Steward 1938).

Religion and Ritual

Little is known about Koso religion and ritual. For the Western Shoshone in general, Thomas et al. (1986:271) observed that religion "involved a simple direct relationship with the supernatural." As noted above, for the Koso specifically, the large winter village called *Müa'ta* had boiling springs believed to possess magical and medicinal powers (Iroquois Research Institute 1978). In addition, Steward (1938:83) noted that while

mourning ceremonies were held on an annual basis, they were usually somewhat private rituals with only family and close neighbors participating. These events were typically conducted at one time for several individuals who had died during the year, during which the property of the deceased was burned (Steward 1938:83).

Serrano Ethnography

The linguistic and geographic boundaries of the Serrano and the Vanyume of the San Bernardino and San Gabriel Mountains are unclear. In fact, Kroeber (1925:614) referred to the Vanyume as "the Serrano of the Mohave River." There are apparent differences between them, however, as the Vanyume were friendly with the Mohave and Chemehuevi, while the Serrano considered these groups enemies (Bean and Smith 1978:570). The boundary limits of Vanyume territory are difficult to determine as they had become extinct by early ethnographic times, although their territory likely extended from the terminus of the Mojave River to present-day Barstow, and perhaps as far south as Victorville (Kroeber 1925:614). As such, their territory does not fall within the western Mojave Desert, and they are not considered further here.

Bean and Smith (1978:570-574) presented a synthetic treatment of Serrano ethnography based on earlier work by Gifford (1918), Benedict (1924, 1926), Kroeber (1925), Strong (1929), and Drucker (1937). Additionally, considerable ethnographic data on the Serrano are available in the notes of J. P. Harrington (1986).

Territory, Language, and Population

Kroeber (1925) assigned the upper Mojave River, including the San Bernardino Mountains and the Summit Valley, to the Serrano. They also occupied part of the San Gabriel Mountains, as well as the northern part of the San Bernardino Valley (Kroeber 1925:615-616; also see Bean and Smith 1978). Although most of the Serrano territorial

boundaries fall outside the western Mojave Desert, the extreme western boundary may have extended into this region (see Heizer 1978:ix), prompting their inclusion in this ethnographic summary.

The Serrano are linguistically associated with the Takic language family, which also includes the Kitanemuk, Vanyume, and possibly the Tataviam (Bean and Smith 1978: 570). The term "Serran" has been used describe the Serrano and Kitanemuk more specifically as a way of distinguishing them from other Takic groups (Bean and Smith 1978:570). Despite their wide-ranging territory, their population was probably sparse, perhaps numbering 1,500 prior to contact (Kroeber 1925:617).

Subsistence and Settlement

The Serrano were a hunting and gathering culture who utilized a wide variety of resources from the mountains, the desert, and the Mojave River (Bean and Smith 1978:570). Their available resources included various plants, such as honey mesquite, oak, pinyon, cactus fruits, yucca, roots, and tubers, along with various berries, grasses, and seeds (Bean and Smith 1978:571). Chia was a particularly important plant resource, and was burned periodically to increase the yield (Bean and Smith 1978:571). Game animals consisted of a variety of large and small mammals. Deer, pronghorn, bighorn sheep, rabbits, and various birds were common resources, as were some reptiles and fish species.

While bows and arrows were used to capture large game, smaller animals (such as cottontail rabbits and jackrabbits) were caught with the use of drive nets, snares, traps, throwing sticks, and deadfalls (Bean and Smith 1978:571). Food resources were prepared in various ways. Meat might be cooked in earthen ovens or boiled in watertight baskets with hot stones. Seeds were often parched, while other vegetable foods were consumed

raw. Manos and metates were used to grind food, and mortars and pestles were used for pounding foods (Bean and Smith 1978:571).

The major criterion in the nature and distribution of Serrano villages was the presence of a perennial water source (Benedict 1924:368). Most Serrano villages were in the foothills, but a few were on the desert floor (Bean and Smith 1978:570). Small villages were more common, such as *Guapiabit* (Sutton and Schneider 1996), although there were larger villages in the Summit Valley and Cajon Pass. Small special purpose sites, such as temporary camps, food processing stations, and lithic procurement areas, were located as needed. Excursions were occasionally made to other areas, such as the desert region, perhaps to procure seasonal or exotic resources (Sutton and Schneider 1996:4).

Social and Political Organization

The Serrano were organized into exogamous totemic moieties that recognized patrilineal descent from a common male ancestor (Gifford 1918:178). The moieties were known as Coyote and Wildcat. The clan was the largest autonomous political unit, which held landowning responsibilities. The territory of these clans included the Mojave Desert as well as the San Bernardino Mountains (Gifford 1918:179-180).

Each clan was headed by a hereditary leader who received his position from his father (Gifford 1918:181). Typically, the leaders were male; however, if there was no male heir, a woman could succeed to the title. These leaders were responsible for ceremonial and religious activities, dealings with other clans, and scheduling the timing of various food collecting expeditions (Gifford 1918).

External Relations

The Serrano were enemies of the Mohave and Chemehuevi, unlike the Vanyume (Bean and Smith 1978:570). There was some intermarriage with the Cahuilla, indicating

good relationships with that group (Sutton and Schneider 1996:4). Trade was conducted with the Serrano and groups on the Pacific coast. Shell beads and ornaments, steatite, and sea otter pelts were common exchange items, with ceramics and obsidian also being likely trade items (Sutton and Schneider 1996:5).

Material Culture and Technology

Serrano tools were made of wood, bone, shell, stone, clay, and plant fibers (Bean and Smith 1978:571). Other aspects of Serrano technology included basketry, rabbit-skin blankets, stone pipes, bone awls, arrow shaft straighteners, bows and arrows, and fire drills. Additionally, rattles were made from deer hooves, tortoise shells, and turtle shells, and bone or reed whistles were popular. The Serrano also manufactured elaborate coiled basketry (Smith and Simpson 1964), as well as simple, undecorated ceramic vessels used for storage and transport. Domestic structures included simple brush dwellings, dome-shaped huts, and rectangular armadas (Bean and Smith 1978; Kroeber 1925:618).

Religion and Ritual

An important aspect of Serrano life was the ritual activities related to stages of the life cycle, such as birth, child naming, puberty, marriage, and death (Bean and Smith 1978). Part of the death ceremony involved the practice of cremation, at least prior to European contact. The cosmology of the Serrano resembled that of the neighboring Cahuilla, including a belief in twin creator gods (Bean and Smith 1978:573). Shamans used psychic powers and herbal remedies to cure and heal. Part of the psychic abilities of a shaman included the sucking cure for disease (Bean and Smith 1978:573).

Tataviam Ethnography

Of the three groups who resided within the boundaries of the western Mojave Desert, the least is known about the Tataviam. Most of the information that is available derives

from comparisons to neighboring groups and from the archaeological work conducted at Vasquez Rocks in Los Angeles County (King et al. 1974). A brief summary of Tataviam culture was provided by King and Blackburn (1978).

Territory, Language, and Population

The Tataviam occupied much of the upper reaches of the Santa Clarita River drainage, although their territory included part of the Sawmill Mountains to the north and the southwestern edge of the Antelope Valley in the western Mojave Desert (Johnson and Earle 1990; King and Blackburn 1978). Tataviam territory was bounded on the west by the Chumash and on the south by the Gabrielino (King and Blackburn 1978:535). Most of their traditional territory is situated between 1,500 and 3,000 feet above sea level, with the territorial core comprised of the slopes of the Liebre and Sawmill mountains. As the result of this slope and exposure, the Tataviam likely relied more heavily on yucca as a major resource than did neighboring groups. Other plant and animal resources were "otherwise generally similar to those exploited by neighboring Takic speakers" (King and Blackburn 1978:535-536).

In their discussion of a historical Tataviam village at Vasquez Rocks in Los Angeles County, King et al. (1974:40) reported that the Tataviam were known to their Chumash neighbors as Alliklik or "Grunters." The Kitanemuk referred to them as Tataviam, "or people of where the morning sun hits" (King et al. 1974:40). The Kawaiisu called the Kitanemuk, the Vanyume, the Tataviam, and other nearby groups "southerners" (King and Blackburn 1978:535; Zigmond 1938). The Tataviam probably spoke a Serrano dialect similar to that of the Kitanemuk (King et al. 1974:40). Bright (1975:230) concluded that the Tataviam language may be the remnant of a language family unknown in California, although King and Blackburn (1978:535) argued that it is probably Takic.

Early European explorers observed cultural similarities between the Tataviam and their southern Takic neighbors, which has since been supported by archaeological evidence (King and Blackburn 1978:535). However, archaeological data also suggest that the Tataviam began to differentiate from other Takic speakers around 3,000 years ago, and that by the historical era the Tataviam language "was so distinct that one of Harrington's Kitanemuk informants expressed the opinion that it was as foreign to him as English and certainly less easily understood than the San Fernando Valley dialect of Gabrielino" (King and Blackburn 1978:535). Population estimates for the Tataviam at contact have generally put them at less than 1,000 (King and Blackburn 1978:536).

Subsistence and Settlement

According to King and Blackburn (1978:536), several Tataviam villages are known, including those at San Francisquito, Piru Creek, one near Castaic reservoir, one near Newhall, and La Liebre Ranch. Johnson and Earle (1990:192) also identified other villages and campsites, such as one on upper Castaic Creek and several on Piru Creek. These villages varied in size from large settlements with hundreds of people to small settlements with 10 to 15 people (King and Blackburn 1978:536). The larger villages were dispersed, with smaller villages located adjacent to one of the major centers (King and Blackburn 1978:536). Most of the archaeological sites that have been documented for the Tataviam in the Angeles National Forest have included the remains of camps, yucca ovens, and small settlements (Northwest Economic Associates and King 2004:7).

Resources were likely acquired and prepared in much the same manner as neighboring groups (King and Blackburn 1978:536). The most important vegetal foods were yucca, acorns, sage seeds, juniper berries, and holly-leaf berries. Small mammals and deer were the primary animal foods (King and Blackburn 1978:536).

Tataviam settlement and subsistence practices changed dramatically with the establishment of San Fernando Mission in 1797 (Northwest Economic Associates and King 2004). The Tataviam were the first native peoples to be recruited into this mission, followed by the Serrano, Gabrielino, Chumash, and probably others (Northwest Economic Associates and King 2004:19). By the early 1800s, there were nearly 1,000 native people living at the mission, where they raised cattle and produced hides, other leather goods, tallow, and cloth (Malloy 2004:2).

Social and Political Organization

In their genealogical reconstructions for the Tataviam, Johnson and Earle (1990:209) "demonstrated remarkable convergence and consistency in ancestral village affiliation," and provided data for distinguishing the Tataviam as a separate ethnic entity from neighboring groups such as the Kitanemuk. In describing the Tataviam village of Agua Dulce, King et al. (1974:24) noted that evidence from this site suggested that the degree of village separation had implications regarding the frequency of social interaction, food sharing practices, resource acquisition efforts, and length of village occupation.

Moreover, King et al. (1974:24) maintained that the organization of Tataviam cemeteries reflects differential treatment of the deceased and wealth concentration. They also observed that Tataviam social organization was likely similar to the southern Serrano, in which lineages were organized into moieties (King et al. 1974:34). Chiefs and ceremonial leaders who resided at Agua Dulce probably represented different lineages that were independent units (King et al. 1974:35).

The distribution of houses at two of the Agua Dulce sites suggested to King et al. (1974:35) that small, extended families were the most important social units. The names of individuals were frequently titles and such naming practices "reveals information

concerning pre-conquest political organization" (Northwest Economic Associates and King 2004:6). Mission records show that there were many hereditary positions for the Tataviam (Northwest Economic Associates and King 2004:6).

External Relations

Little is known about external interactions between the Tataviam and other groups, although based on what is known of southern California populations during protohistoric and historical times, it seems likely that there were hostilities with people to the north and south, and friendly relations with those to the east and west (King and Blackburn 1978:536). Subsequent to the mission period, the remaining Tataviam often intermarried with the Kitanemuk. They also occasionally participated in Chumash ceremonies (King and Blackburn 1978:536). It was also common for the Tataviam to grant permission to visiting groups, such as the Kitanemuk and the Kawaiisu, to gather resources and to establish temporary camps in Tataviam territory (Johnson and Earle 1990:192).

Material Culture and Technology

While very little data are available on Tataviam material culture and technology, based on the cemetery goods recovered at Vasquez Rocks in Los Angeles County, it is apparent that their material inventory consisted of items such as shaped mortars, hopper mortars, metates, manos, shell and stone beads, stone knives and projectile points, cores, baked clay effigies, and stone pipes (King et al. 1974). In addition, yucca (and possibly other resources) was baked in earthen ovens.

Religion and Ritual

What is known of Tataviam religion and ritual suggests significant similarities among Tataviam, Chumash, and Gabrielino ritual organization. Some of the evidence for this comes from Bowers Cave between Newhall and Piru (Elsasser and Heizer 1963). This

site contained ritual paraphernalia identical to that utilized by the Chumash during ceremonies conducted by secret-society members (King and Blackburn 1978:536). Similar to neighboring groups, the Tataviam are thought to have held their annual mourning ceremony during the late summer or early fall (King and Blackburn 1978:536).

Cultural Chronology of the Western Mojave Desert

As a result of the large number of archaeological investigations in the western Mojave Desert, a cultural chronology for this region has been fairly well established, although some of the details differ among researchers. General summaries of the prehistory of this region have been presented in Warren (1984), Warren and Crabtree (1986), and Sutton (1988, 1996). While this chronology focuses on the western Mojave Desert, other areas of the Mojave Desert are included where appropriate.

The time periods discussed below are presented to provide a temporal framework for this study. As the nomenclature for these periods continues to be problematic for western Mojave Desert chronology, with different researchers using regionally specific terminology (Table 2), the designations for these time periods and their associated cultural complexes follows that of Sutton et al. (MS), who have introduced a revised chronology for the overall Mojave Desert (Table 3). This revised chronology makes a distinction between periods and complexes, in that periods represent a span of time that may contain multiple cultural adaptations while complexes represent specific cultural entities within each period (Sutton et al. MS).

Paleoindian Period (ca. 12,000 to 10,000 B.P.)

There has been a variety of terms used to classify known and postulated early human occupations in the Mojave Desert and other parts of the Arid West, including Clovis,

Table 2. Chronological Sequences for the Western Mojave Desert[a]

Bettinger and Taylor 1974		Gilreath and Hildebrandt 1997		Sutton et al. MS	
Period	*Time Frame*	*Period Name*	*Time Frame*	*Period Name*[b]	*Time Frame*
Mohave	>6,000	Early	>5,500	Lake Mojave	10,000-8,000
Little Lake	6,000-3,150	Little Lake	5,500-3,500	Pinto	9,000-5,000
Newberry	3,150-1,350	Early Newberry	3,500-2,800		
		Middle Newberry	2,800-2,300	Gypsum	4,000-1,800
		Late Newberry	2,300-1,275		
Haiwee	1,350-650	Haiwee	1,275-650	Rose Spring	1,800-900
Marana	650-contact	Marana	650-200	Late Prehistoric	900-contact

[a] The sequences provided by Bettinger and Taylor (1974) and Gilreath and Hildebrandt (1997) are specifically relevant to the Coso region in the western Mojave Desert. Time frames are B.P.
[b] It should be noted that Sutton et al. (MS) refer to these as complexes rather than periods, although that distinction is not made here.

Paleoindian, and the Early Systems Period (e.g., Chartkoff and Chartkoff 1984; McIntyre 1986; Moratto 1984). This is a period generally considered to have spanned between about 12,000 and 10,000 years ago, although the era known as Clovis is more specifically dated between about 12,000 and 11,000 years ago (Moratto 1984:111). The marker artifact for this time period is the fluted (or Clovis) projectile point, which is found most frequently in the northern and western Mojave Desert, particularly near Pleistocene lakes China and Thompson (e.g., Basgall 1993; Warren and Phagan 1988).

Presumed occupation sites from the Late Pleistocene are rare in western North America. While the nature of these early sites is poorly known, they were likely temporary in nature, although some Paleoindian sites have included evidence of activities such as toolmaking, food preparation, crafts, and garbage disposal. The absence of recognizable house remains or compacted surfaces lends credence to the suggestion that such sites were temporary and would have left little or no archaeological traces. In California and the Great Basin, sites of this time period are usually located near then-permanent water sources, such as China Lake (Davis 1978), Lake Mojave (Warren 1984), Borax Lake (Harrington 1948), and Tulare Lake (Fenenga 1993).

Table 3. Cultural Chronology for the Mojave Desert[a]

Designation	Time Frame	General Characteristics
Paleoindian Period	ca. 12,000-10,000 B.P.	Marker artifact is the fluted projectile point; hunting of large animals; temporary sites located near permanent water sources
Lake Mojave Period	ca. 10,000-8,000 B.P.	More generalized tools (Western Lithic Co-Tradition/ Western Pluvial Lakes Tradition); occupation and exploitation of Late Pleistocene lakeshores; Lake Mojave and Silver Lake projectile points
Pinto Period	ca. 9,000-5,000 B.P.	Follows desiccation of Pleistocene lakes; settlement centered around streams and springs; diverse artifact assemblages; exploitation of artiodactyls and lagomorphs; Pinto series projectile point
Gypsum (or Elko) Period	ca. 4,000-1,800 B.P.	Cooler and wetter interval during first half, more arid during second half; settlement/subsistence based near streams/springs; possible increases in population, trade, technology, exploitation emphasis on artiodactyls, but also lagomorphs, rodents, tortoise; Elko series, Gypsum Cave, Humboldt projectile points
Rose Spring Period	ca. 1,800-900 B.P.	High lakestands; settlement/subsistence likely focused on lacustrine resources; major increases in population; dramatic differences in artifact assemblages; evidence of architecture; high level of obsidian use; extreme emphasis on lagomorphs; Eastgate and Rose Spring series projectile points
Late Prehistoric Period	ca. 900 B.P.-Contact	Late prehistory of ethnographic groups; much more xeric; change in settlement/subsistence focus to streams, springs, wells; evidence of villages/large camps, as well as smaller sites; steep decline in obsidian use; focus on seed processing; decreased exploitation of lagomorphs; Marker artifacts are Desert series projectile points and brown ware

[a] See text for pertinent references.

In the Mojave Desert, evidence for occupation by people possessing a fluted point technology is limited to relatively few finds of Clovis or Clovis-like projectile points (but see Davis 1978; Warren 1984). These finds are widely distributed across the Mojave Desert and are rarely dated other than by typological means. While there are several isolated Clovis points known from the Mojave Desert and the surrounding area, only one major Clovis occupation site is known, that being at China Lake (Davis 1973).

Lake Mojave Period (ca. 10,000 to 8,000 B.P.)

Following the Paleoindian Period is the Lake Mojave Period, which is characterized by more generalized tools that often fall under the broad designation of the Western Lithic Co-tradition (Davis et al. 1969) or the Western Pluvial Lakes Tradition (Bedwell 1970). The Lake Mojave Period is associated with the Early Holocene occupation of lakeside environments.

The hallmark artifacts of this period are the Lake Mojave and Silver Lake projectile points found in association with Pleistocene lakeshores (Sutton 1996:229). Similar materials have been discovered in other parts of the Great Basin, suggesting cultural relationships in these areas (Sutton 1996:229; also see Bryan 1988; Moratto 1984; Warren and Ranere 1968; Willig and Aikens 1988). Hunting of artiodactyls and exploitation of lacustrine resources are thought to have formed the subsistence base (e.g., Davis and Panlaqui 1978; Douglas et al. 1988; Sutton 1996; Warren 1967).

Few Lake Mojave sites are known in the western Mojave Desert, although one was documented at Rosamond Lake (Basgall and Overly 2004) and a few have been identified from the area of Lake China (Basgall 2004a; Davis 1978; Hildebrandt and Gilreath 1988; Gilreath and Hildebrandt 1991; Hildebrandt and Gilreath 1988; Rosenthal et al. 2001). Elsewhere in the Mojave Desert, the Lake Mojave cultural complex has been documented at Pleistocene Lake Mojave (Davis 1973; Davis and Panlaqui 1978), Fort Irwin (Jenkins 1987; Warren 1991), and Twentynine Palms (Basgall and Giambastiani 2000b).

The flaked stone artifacts from Lake Mojave sites suggest that the tools were curated and transported. Trade and/or travel are indicated by exotic materials such as toolstone and shell beads. Milling equipment is rare at these sites, and those that are found show little evidence of extensive use (Sutton et al. MS). Settlement patterns consist of

relatively large residential sites, along with workshops and smaller camps (Basgall and Overly 2004). In general, the Lake Mojave complex has been regarded as reflecting "a forager-like strategy organized around relatively small social units," with intensive resource monitoring and high levels of residential mobility (Basgall 1993; Sutton et al. MS).

Pinto Period (ca. 9,000 to 5,000 B.P.)

The Pinto Period, a time following the desiccation of Pleistocene lakes in the Mojave Desert, was a very arid episode in the desert (Warren and Crabtree 1986). Pinto Period sites in the western and central Mojave Desert, such as Pinto Basin (Campbell and Campbell 1935), the Stahl site (Harrington 1957; Schroth 1994), the Awl site (Jenkins and Warren 1986), and Rogers Ridge (Basgall 1993), have contained diverse artifact assemblages. Additional Pinto sites have recently been documented in various parts of the western Mojave Desert (e.g., Gardner et al. MS; Basgall and Overly 2004; Giambastiani and Basgall 2000), as well as other areas of the Mojave Desert (e.g., Basgall and Giambastiani 2000; Basgall et al. 2003). That the Lake Mojave and Pinto periods overlap in time is demonstrated by the radiocarbon dates, obsidian hydration profiles, and co-occurring projectile point types documented in this region. This suggests some cultural continuity between the two periods, although there are distinct differences in site distribution and hydration ranges (Basgall 1995; Warren 2002).

Complexes of the Pinto Period have included tools such as Pinto projectile points, leaf-shaped points and knives, domed and elongated scrapers, flake scrapers, drills, and engraving tools, as well as milling equipment (Sutton 1996:232; Warren and Crabtree 1986:187). A lack of diversity in the toolstone during this time suggests a reduced foraging range, although shell beads found at some Pinto sites indicate a certain level of mobility and

exchange (Sutton et al. MS). The characteristic Pinto point was likely used as a tip for thrusting spears rather than for darts.

Pinto complex faunal remains consist primarily of lagomorphs and artiodactyls (deer, sheep, and pronghorn), with some reptiles and rodents, as well as *Anodonta* (e.g., Basgall 1993; Jenkins and Warren 1986). Botanical data have included pinyon, but other information on prehistoric utilization of plants during this time is scarce, although milling implements occur in sometimes great frequencies at Pinto complex sites, suggesting hard seed processing (Sutton et al. MS). The revised time span for the Pinto Period (ca. 9,000 B.P.) indicates that plant processing probably began earlier than previously assumed, a pattern also seen on the California coast (Sutton et al. MS; also see Fitzgerald 2000; Jones et al. 2002).

Pinto complex settlement has been documented at pluvial lake basins, fossil stream channels, spring locations, and upland areas (Sutton et al. MS). Sites were occupied for long periods of time by fairly large groups of people employing a collector strategy (see Binford 1980, 1982), in that they had centralized sites from which logistical trips were made to particular resource patches (Basgall 2000; Warren 2002). Due to the abundance of milling implements at Pinto complex sites, site placement may have been determined by access to plant resources (Sutton et al. MS). Within the Pinto Period, Sutton et al. (MS) suggested the presence of a second complex, referred to as the Deadman Lake complex (ca. 8,000 to 6,500 B.P.). As this complex appears to be restricted to the extreme southeast portion of the Mojave Desert, however, it is not discussed further here.

Gypsum Period (ca. 4,000 to 1,800 B.P.)

In some parts of the Great Basin, the Gypsum Period (sometimes referred to as the Elko Period) represents a cooler and wetter interval in the desert during the first half of the

period, becoming warmer and drier during the second half of this period (e.g., Currey and James 1982:45; Rhode 2000:159; Wigand and Rhode 2002:328). Gypsum Period components in the western and central Mojave Desert include Rose Spring (Lanning 1963; Yohe 1992), Newberry Cave (Davis and Smith 1981; Smith et al. 1957), Hinkley (Leonard 1980), Ord Shelter (Echlin et al. 1981), Owl Canyon (Eckhardt et al. 1982), CA-KER-2214 at Cantil (Sutton 1991b), and CA-KER-246 in Red Rock Canyon (Harvey and Gardner 2002). There are also a number of Gypsum Period components in the Red Mountain Archaeological District (Allen 2003, 2004), the Coso Volcanic Field (Gilreath and Hildebrandt (1997), and Fort Irwin (e.g., Basgall 2000; Basgall and Hall 1994; Hall and Basgall 1994). At Fort Irwin in the central Mojave Desert, Gypsum complex sites are somewhat more abundant, although they are ephemeral in nature (McGuire and Hall 1988:318).

Artifact assemblages from the Gypsum Period include medium to large stemmed and notched projectile points, such as Elko Eared, Elko Corner-notched, Gypsum Cave, and Humboldt Concave Base forms (Warren and Crabtree 1986:187). There is also evidence of ritual items, such as quartz crystals, paint, and rock art (e.g., Davis and Smith 1981; Warren and Crabtree 1986). In addition, there was a general increase in the number of bifaces and grinding implements during the Gypsum Period. Faunal assemblages have contained large amounts of artiodactyl remains (including mountain sheep), as well as lagomorphs, rodents, and tortoise (Sutton 1996:234-235).

Despite the number of components dating to the Gypsum Period, however, little is known about cultural adaptations during this time. Based on radiocarbon dates from the Koehn Lake site, which was interpreted as a Rose Spring village with a relatively large population, Sutton (1996:235) suggested that this population increase may have

commenced in the western Mojave Desert about 2,000 years ago, during the terminal Gypsum Period. This argument was supported by Gilreath and Hildebrandt (1991), who noted an increase in the number of Gypsum Period sites in the Coso region beginning about 2,300 years ago.

Rock art sites from the Gypsum Period (e.g., Davis and Smith 1981; Grant et al. 1968; Smith et al. 1957), particularly those with "Coso style" rock art that features bighorn sheep (e.g., McGuire and Hall 1988:319), suggest the importance of large game in the subsistence regime between about 3,300 and 1,350 years ago. Other aspects of Gypsum complex sites include lithic reduction and possible heat treatment of toolstone that was evident at CA-KER-246 (Harvey and Gardner 2002:56), as well as milling and hunting activities that were apparent at CA-KER-2214 (Sutton 1991b) and the Hinkley site (CA-SBR-189; Leonard 1980).

There seems to have been a 1,000-year hiatus between the Pinto and Gypsum periods (see Table 2). Sutton et al. (MS) suggested that this hiatus may have been of even longer duration, as the majority of Pinto components have been radiometrically dated prior to 6,500 B.P. The significance of this putative hiatus is unclear, although it strongly suggests that Mojave Desert population densities were very low during this time. In the absence of corroborating evidence, however, this suggestion remains speculative.

<u>Rose Spring Period (ca. 1,800 B.P. to 900 B.P.)</u>

The Rose Spring Period, which is roughly equivalent to the Amargosa Period (Wallace 1962) and the Saratoga Springs Period (Warren 1984; Warren and Crabtree 1986), falls between ca. 1,800 and 800 years ago, although some scholars have suggested that it began as early as 2,000 years ago (see Yohe and Sutton 2000b). It was a time when lakestands were high; therefore, settlement and subsistence were likely focused on

lacustrine resources (Sutton 1990). Rose Spring Period sites in the western and central Mojave Desert include those at Saratoga Springs (Wallace and Taylor 1959), Cottonwood Creek (Sutton 1988), Coso Junction Ranch (Whitley et al. 1988), Koehn Lake (Sutton 1990), Cantil (Sutton 1991b), Rose Spring (Yohe 1992), Rosamond (Sutton 1993b), Cross Mountain (CA-KER-4619; Gardner et al. 1996, 1997), Coffee Break (Gardner 2002), Freeman Spring (Williams 2004), and many others. While it is in the central Mojave Desert, Fort Irwin is included here as it stands as one of the largest scale studies in the region as a whole, with enormous surface collections and excavation volumes indicating occupations from the Lake Mojave to Late Prehistoric periods, including the Rose Spring Period (Basgall and Hall 1992, 1994).

Common artifacts recovered from Rose Spring sites include Eastgate and Rose Spring series projectile points, knives, drills, stone pipes, bone awls, a wide variety of milling equipment (including manos, metates, mortars, and pestles), marine shell artifacts, and large quantities of obsidian (Sutton 1996:237; Warren and Crabtree 1986:191). Architecture is also evident in the form of wickiups, pithouses, and other types of structures (Sutton 1988, 1990, 1991b). There is evidence strongly suggesting that the resource emphasis was on medium to small game, primarily lagomorphs and rodents, with less emphasis on larger game (Sutton 1996:237). A variety of botanical remains is also common at Rose Spring sites, such as pinyon, juniper, and perhaps mesquite.

The frequency of obsidian at many Rose Spring Period sites indicates that the procurement and processing of obsidian were crucial aspects of the settlement and subsistence patterns of the inhabitants of this region. The fact that all but a handful of obsidian specimens from Rose Spring components of the western Mojave Desert were derived from the Coso Volcanic Field demonstrates that people were involved in trading

activities with people living near the Coso Range and/or traveled to the area to obtain obsidian themselves.

It seems increasingly apparent that there are many sites in the western Mojave Desert that date to the Rose Spring Period, and fewer to the preceding and succeeding time periods (Gypsum and Late Prehistoric, respectively). This statement is made a bit hesitantly, however, as this situation may be a function of sample size in terms of the number of sites that have been excavated and/or published. During the Rose Spring Period, however, there appears to have been a major increase in population, as well as dramatic differences in artifact assemblages (Sutton 1996:235). A prime example is the development of bow and arrow technology by at least 1,500 years ago (Sutton 1996; Yohe 1992, 1998). The presence of large quantities of milling features and equipment at Rose Spring sites strongly suggests that milling of plants (and possibly small animals) was an integral component of the subsistence system during this time, although hunting remained important as well (Sutton 1996:237; also see Yohe et al. 1991).

A variety of environmental zones and geographic areas were utilized during the Rose Spring Period, including rockshelters (e.g., Coso Locality; Gilreath 2000; Hillebrand 1972; Panlaqui 1974), spring locations (e.g., CA-INY-372; Yohe 1992), colluvial fans (e.g., CA-INY-2284; Whitley et al. 1988), open-air sites along ephemeral drainages (e.g., CA-KER-250; McGuire et al. 1982), along lakeshores (e.g., CA-KER-875; Sutton 1990), adjacent to stream channels (e.g., CA-KER-733; Sutton and Everson 1992), at creek junctures (e.g., CA-KER-2211; Sutton 1991b), and in mountain ranges (e.g., CA-KER-6188; Rogers 2005; Rogers and Rogers 2004). This exploitation of various environments strongly suggests favorable climatic conditions and significant population size during the Rose Spring Period.

This argument is supported by investigations at Koehn Lake and other sites in the Fremont Valley, where Sutton (1996:235) argued that large villages had been established in this region by about 2,000 years ago, indicating an increase in population size in the western Mojave Desert (also see Whitley et al. 1988). It was also supported by investigations a little further north at the Rose Spring Site (CA-INY-372; Yohe 1992) and the Coso Junction Ranch Site (CA-INY-2284; Whitley et al. 1988), both of which were considered to be large Rose Spring village sites. As noted above, research in the Coso region by Gilreath and Hildebrandt (1991) also lends support to this proposed increase in population size beginning roughly 2,300 years ago. This proposed population expansion initiated during the terminal Gypsum Period and continuing into the Rose Spring Period strongly suggests an environmental amelioration at this time.

Late Prehistoric Period (ca. 900 B.P. to Historic Contact)

The Late Prehistoric Period is thought to reflect the late prehistory of ethnographic groups that resided in the desert (Sutton 1996:237). This was a time of increasingly xeric conditions that probably started during the late Rose Spring Period, with an apparent change in subsistence and settlement focus to streams, springs, and wells (Sutton 1990). Examples of Late Prehistoric Period occupation sites in the western and central Mojave Desert include Oro Grande (Rector et al. 1983), Afton Canyon (Schneider 1989), and Coso Hot Springs (Gilreath and Hildebrandt 1991), as well as the Late Prehistoric components at Cottonwood Creek (Sutton 1988), Coso Junction Ranch (Whitley et al. 1988), Cantil (Sutton 1991a), Rose Spring (Yohe 1992), Cross Mountain (Gardner et al. 1996, 1997), Fort Irwin (Basgall 2000), and within the Rogers/Rosamond lake system at Edwards Air Force Base (Byrd et al. 1994). Some of these sites represent major villages with associated cemeteries, as well as special purpose and seasonal sites (Warren and Crabtree 1986:192; also see Sutton 1996).

Late Prehistoric Period artifact assemblages consist of Desert series projectile points (including Desert side-notched and Cottonwood Triangular forms), brown ware ceramics, shell and steatite beads, slate pendants, incised stones, and a variety of millingstones (Sutton 1990; Warren and Crabtree 1986). There is a much reduced presence of obsidian from that of Rose Spring sites, with a concomitant shift to macrocrystalline stone, including locally available cherts (see Sutton 1990:6). Faunal remains include lagomorphs, deer, rodents, reptiles, and tortoise. Little botanical evidence has been recovered from archaeological contexts, but remains have included mesquite and juniper.

The Late Prehistoric Period appears to have witnessed a population recession in much of the western Mojave Desert. In other parts of the desert, however, this does not seem to be the case, such as at Red Mountain in the west-central Mojave Desert (Allen 2004:9) and at Fort Irwin in the central Mojave Desert, where a number of sites date to the Late Prehistoric Period (e.g., Basgall et al. 1988; McGuire and Hall 1988). Sites dated to this time reflect a substantial reduction in the frequency of obsidian, suggesting major sociopolitical and technological changes, and/or a subsistence focus shift to seed processing (Eerkens and Rosenthal 2004; also see Chapter 7).

It was also during the transition from the Rose Spring Period to the Late Prehistoric Period (ca. 1,000 B.P.) that the Numic expansion commenced, wherein Numic speakers moved north and east from southeastern California across the Great Basin (see Madsen and Rhode 1994; also see Chapter 7). It is possible that the MCA was at least partly responsible for this population movement. While settlement in the Mojave Desert during the Late Prehistoric Period remains unclear, there is evidence of large camps or villages indicating sustained occupation (e.g., Deep Creek [Altschul et al. 1989]; Oro Grande [Rector et al. 1983]; Afton Canyon [Schneider 1989]), as well as smaller seasonal or

special purpose sites (e.g., the small Late Prehistoric Period sites at Rosamond and Cantil [Sutton 1991b, 1993b]). Sutton (1996:240) suggested that depopulation of the western Mojave Desert during the Late Prehistoric Period was the result of European-introduced diseases and/or forceful removal by the Spanish.

Summary of Cultural Chronology

In summary, the late Pleistocene and Holocene chronology for the western Mojave Desert is a study of dynamic environments and numerous cultural adaptations. During the late Holocene in particular, the latter half of the Gypsum Period witnessed a time of arid conditions, followed by an environmental amelioration during the subsequent Rose Spring Period. During this period of more favorable conditions, populations increased significantly, the bow and arrow witnessed significant expansion in the Mojave Desert, there was an increasing emphasis on lagomorphs, and lacustrine resources were probably also important. This period was then followed by a renewed era of aridity during the Late Prehistoric Period, during which populations appear to have decreased in many areas of the Mojave Desert and a proposed subsistence focus shift occurred.

Archaeological Background of the Western Mojave Desert[3]

Archaeological investigations have been conducted in the western Mojave Desert since the 1930s, at which time they consisted primarily of the acquisition of artifacts for private collections by the University of Southern California, the Southwest Museum, and the Antelope Valley Indian Museum (Sutton 1988:23). Research activity was rare until 1947, when survey work and surface collections were conducted by the Archaeological Survey Association (ASA) of southern California. In the 1950s, the ASA worked at Hewitt Fault Springs Rockshelter and Willow Springs, recovering artifacts that appeared

to be of Late Prehistoric and Protohistoric period origin (Sutton 1988:23). Sutton (1988:24) argued that Willow Springs was a major protohistoric village.

In the early to middle 1960s, the late W. S. Glennan worked at several locations in the western Mojave Desert, including Fairmont Buttes, Hidden Valley, Little Buttes, Broad Canyon, Soledad Mountain, Willow Springs, and Sweetser (Glennan 1971). Little information was published about these localities, although the Sweetser site was dated between 4,000 and 6,000 B.P. based on the typology and obsidian hydration of a single projectile point (Glennan 1971:20-23). During the rest of the 1960s and early 1970s, work in the western Mojave Desert consisted mostly of surveys (such as those by Alex Apostolides), surface collecting, and site recordation, with very limited subsurface testing performed (Sutton 1988:24-25; but see Robinson 1973).

One major exception to this was the work of Emma Lou Davis who, beginning in the late 1960s and continuing into the 1970s, conducted research at China Lake, including excavations and intensive surveys (e.g., Davis 1978, 1982). This work resulted in the recognition of a Paleoindian occupation in the Mojave Desert. In the late 1960s, Hillebrand (1972) conducted excavations in the Coso Range near China Lake. These excavations revealed cremations, burials, cache pits, and other unusual features (see Chapter 5). Also in the late 1960s, Roger Robinson (1977) of Antelope Valley College (AVC) began a long-term program of archaeological research in the Antelope Valley, although published results have been minimal (Sutton 1988:25).

In the late 1970s and early 1980s, test excavations were performed at a number of western Mojave Desert sites, including CA-KER-250 and CA-KER-261 (McGuire et al. 1982), CA-KER-298 (Sutton 1982), and CA-KER-733 (Sutton 1984). In addition, an isolated human burial with an associated Elko Eared projectile point was recorded in

1979 at Dove Springs Wash (CA-KER-2584; Sutton 1992). Radiocarbon assays and the Elko projectile point placed the date of this burial within the Gypsum Period (Sutton 1992:27-28).

Since the late 1970s, archaeologists at Edwards Air Force Base in the western Mojave Desert have conducted numerous archaeological investigations, including surveys and test excavations (see Sutton [1988] for a partial list of references; also see Norwood 1990). Hundreds of sites have been investigated at Edwards, which have resulted in the recovery of a variety of projectile point types, including Pinto-like specimens, Elko corner-notched, Rose Spring series, and Desert series (Norwood 1990). Small-scale surveys have been conducted by state and federal government agencies since the 1970s. Salvage operations were performed in the middle to late 1970s in connection with specific projects, such as the proposed Palmdale International Airport (see Sutton 1988).

More intensive efforts have been undertaken in the western Mojave Desert since the mid-1980s. These efforts have included the survey, site recordation, systematic surface collecting, and excavations at CA-INY-2284 (Coso Junction Ranch; Whitley et al. 1988), CA-KER-875 (Koehn Lake; Sutton 1986a, 1990; Sutton and Hansen 1986), and CA-INY-372 (Rose Spring; Yohe 1992), as well as limited work at CA-KER-1998 (Sutton and Everson 1992). The excavations at the Koehn Lake site (CA-KER-875) revealed a large Rose Spring Period village containing a circular, semi-subterranean "pithouse" (Sutton 1990:3). The purpose of the work by Yohe (1992:x) at CA-INY-372 was to reexamine the earlier work by Lanning (1963) and Clewlow et al. (1970) in order to test the accuracy of the original chronology for this region and to reassess the utility of projectile points as temporally diagnostic artifacts for the southwestern Great Basin. The CA-KER-1998 site contained both Rose Spring and Late Prehistoric period components, and is considered to

be a large and important site, although function could not be determined as only two test units were excavated due to time constraints (Sutton and Everson 1992).

Comprehensive test excavations were conducted in the late 1980s and early 1990s at Cantil in the Fremont Valley (Sutton 1991b) and at Rosamond in the Antelope Valley (Sutton 1993b). At Cantil, eight prehistoric sites were excavated, spanning primarily between Gypsum and Late Prehistoric times. One possible exception was CA-KER-2212 which, based on obsidian hydration of two obsidian flakes, was suggested to be perhaps the oldest site known in the Fremont Valley, possibly predating the Gypsum Period (Sutton 1991b:53). Another of the Cantil sites (CA-KER-2211) was much larger than the others, and was interpreted as a multicomponent site (Rose Spring and Late Prehistoric periods) containing a possible wickiup foundation (Sutton 1991b).

In 1989 and 1990, archaeological research at Rosamond Lake revealed 23 small sites representing a variety of activities (Sutton 1993b). Of the sites that had datable material, the ages ranged between the Rose Spring and Late Prehistoric periods, based primarily on obsidian hydration and projectile point typology. Two exceptions were at CA-KER-2569 (Osborne and Sutton 1993) and CA-KER-2765 (Everson et al. 1993), which dated to the Pinto Period (7,000 to 4,000 B.P.) based on the presence of a single obsidian Pinto series projectile point at each site. One of the key aspects that Sutton (1993a:154) emphasized about the work at Rosamond Lake is the importance of small sites in our understanding of human use of this part of the Mojave Desert through time (also see Parr and Sutton 1991). At Rosamond, for instance, Sutton (1993a:154) pointed out that the fact that these were relatively small sites provided "the opportunity to examine individual behavior."

Considerable work has also been conducted at nearby Fort Irwin in the north-central Mojave Desert, primarily since the late 1980s (Basgall and Hall 1994; Hall and Basgall

1994). Although Fort Irwin is not in the western Mojave Desert, the sheer size and scope of this research, as well as its proximity to the study area, necessitated its inclusion. While the work is still ongoing, by 1994 investigations had "resulted in nearly 270 mi.^{2} of survey, identification of over 600 sites, surface collections in excess of 350,000 m.^{3}, and controlled excavation volumes surpassing 1,100 m.^{3}" (Basgall and Hall 1994:63). As a result of the work at Fort Irwin, sites dating to the Lake Mojave, Pinto, Gypsum, Rose Spring, and Late Prehistoric periods have been identified, indicating a relative degree of continuity over time in this region of the Mojave Desert (Basgall and Hall 1992:6).

In 1991, a small quarry site (CA-KER-140; Harry 1992) was investigated in the Fremont Valley, about ten miles south of Koehn Lake and just east of Cache Creek. According to Harry (1992:115), this quarry was not intensively exploited and was used for only a short period of time, a site type that has been termed a prospect by Wilke and Schroth (1989). Just south of CA-KER-140, expanding on work originally undertaken by Robinson in 1976, excavations were conducted in 1995 at a small cave in California City (CA-KER-517; Harvey et al. 2005). Based on the faunal analysis of this cave, the site was determined to have been used to process tortoises, as well as jackrabbits and artiodactyls (Harvey et al. 2005:130). Also in the late 1980s and early 1990s, Gilreath and Hildebrandt (1997) conducted investigations at 34 sites in the Coso Volcanic Field, in order to examine prehistoric production and exchange of Coso obsidian.

In 1994, during geologic trenching adjacent to the Garlock Fault in western Fremont Valley, three buried hearths dating to the Pinto Period were discovered (CA-KER-3939; Gardner et al. 2002a). The results of this work provided some of the oldest archaeological radiocarbon dates in the western Mojave Desert. More recently, salvage excavations of a number of burials were conducted at Cross Mountain (CA-KER-4619;

Gardner et al. 1996, 1997), a large prehistoric habitation and cemetery site in the southern Sierra Nevada. Included among the burials was that of an approximately seven-year-old child adorned with more than 500 *Olivella* beads, some of them still in their stringing position. Also included was the burial of three infants in a common grave, indicating that they were all buried on the same day. Radiocarbon assays from this burial event, along with one of the hearths, demonstrated occupation of this site sometime between A.D. 1400 and 1655. DNA analysis of one deciduous tooth from each of the infants indicated the presence of at least two lineages (Gardner et al. 1998, 2002b).

In Red Rock Canyon State Park, park personnel have been conducting periodic site surveys since 1986, and continue to encourage archaeological research in the park. As a result, in order to test a model of settlement and subsistence in the western Mojave Desert (Sutton 1990, 1991a, 1991b), Gardner (2002) conducted investigations in the late 1990s at the Coffee Break site (CA-KER-5043) in Red Rock Canyon. Coffee Break was interpreted as a multicomponent seasonal site, with sporadic occupation during the Gypsum Period. Part of the research design for the Coffee Break Site was to compare the results of a project conducted by McGuire et al. (1982) at the Bickel and Last Chance sites less than a mile from Coffee Break, both of which were interpreted as rabbit drive sites. Shortly thereafter, Harvey and Gardner (2002) conducted further investigations in Red Rock Canyon at CA-KER-246, which was interpreted as a lithic reduction site dating primarily to the Gypsum Period (also see Flenniken 2000).

More recent research has continued to augment the archaeological data base in the western Mojave Desert. Although the analyses are incomplete, ongoing investigations at Red Mountain (Allen 2003, 2004), the Terese Site (Rogers 2005; Rogers and Rogers 2004; Rogers et al. 2002), and Freeman Spring (Williams 2004) have the potential to add data to

our understanding of settlement and subsistence in the western Mojave Desert (see Chapters 5 and 6).

Notes

1. The cultural chronology and the succeeding archaeological background of the western Mojave Desert are drawn extensively from Gardner (2002, 2004b). I thank Gary Breschini at Coyote Press for his permission to use sections of Gardner (2002) here.

2. It should be noted that this assessment of the late Quaternary environment of the Mojave Desert, and particularly the middle Holocene, has been challenged by some scholars who have disputed the concept of widespread, severe aridity during the middle Holocene (e.g., Van Devender et al. 1987).

3. This section provides a general summary of archaeological investigations in the western Mojave Desert in the twentieth and twenty-first centuries. For more in-depth information, detailed descriptions of most of these sites are provided in Chapter 5.

CHAPTER 5

THE ARCHAEOLOGICAL DATA SETS

As part of this study about the effects of the Medieval Climatic Anomaly (MCA) in this desert region, it was necessary to assemble a data base that would provide the information required for such a treatment. By examining the details of the sites discussed in this chapter, the goal is to attempt to relate those data to the MCA (see Figure 7). While the focus of this study is on the western Mojave Desert, the following summary of the results of archaeological investigations includes other parts of the Mojave Desert that fall close to the western boundary. Thus, sites from the central Mojave Desert that are situated near the western margin are also discussed, including the complex of sites from Fort Irwin. Since the late 1980s, a large number of sites in the western Mojave Desert have been investigated by Mark Q. Sutton and his field classes at California State University, Bakersfield.

In an attempt to standardize the following data for comparative purposes, for each site discussed below, the information includes (where provided) a summary of the site description, field methods, features, material culture, faunal and botanical remains, dating techniques and results, and interpretations as expressed by the original investigators (also see Appendix A). While some of these sites also contained historical materials, such materials are not addressed in this study. The sites are in order first by county (Inyo,

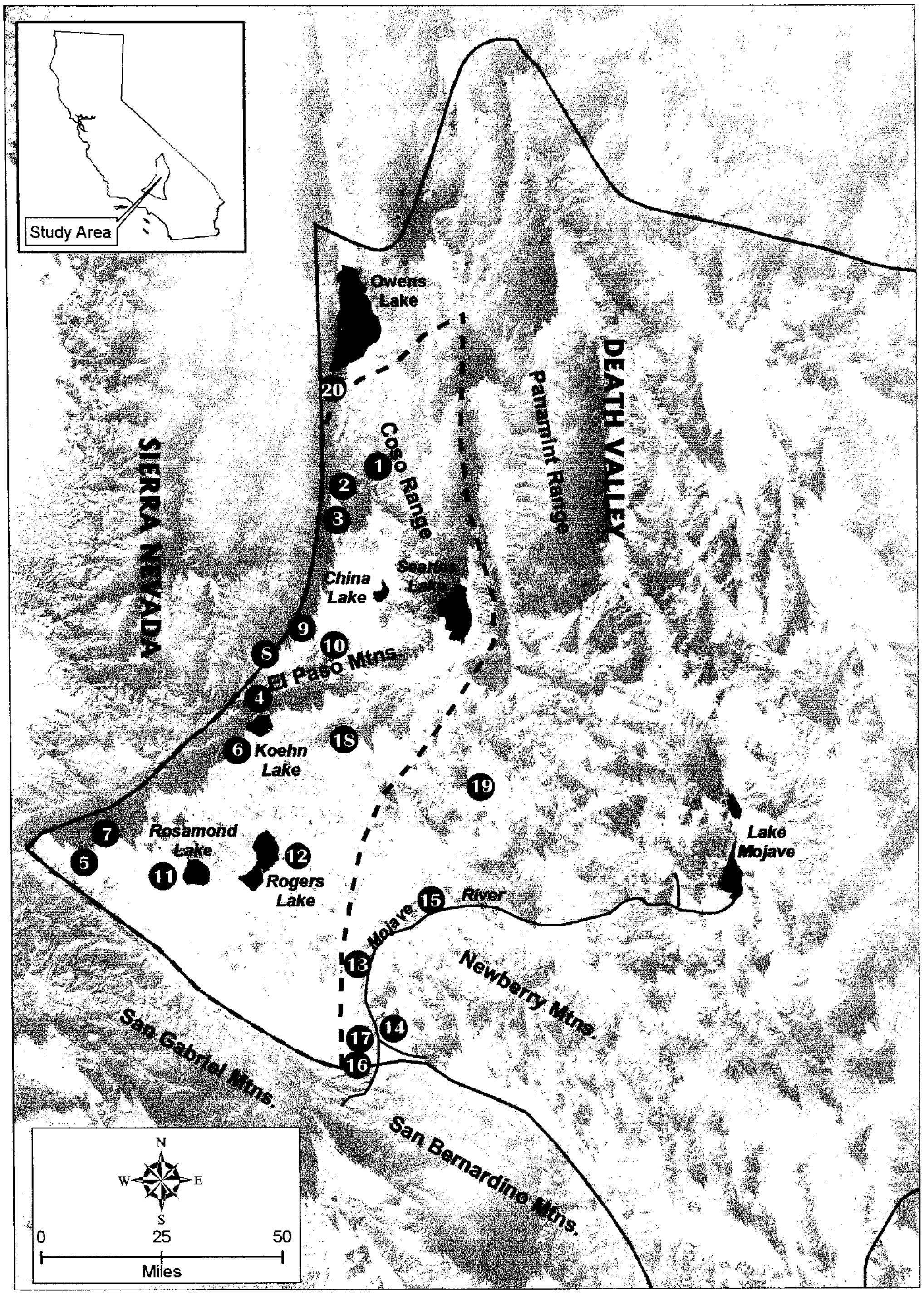

Figure 7. The Mojave Desert of California, with approximate locations of archaeological sites discussed in the text: (1) the Coso Range; includes the Coso Locality sites (CA-INY-444, -1534A, -1534B, -1535) and Coso Volcanic Field sites; (2) Rose Spring (CA-INY-372); (3) Coso Junction Ranch (CA-INY-2284); (4) Red Rock Canyon sites; includes CA-KER-246, Bickel and Last Chance (CA-KER-250 and -261), and Coffee Break (CA-KER-5043); (5) CA-KER-733; (6) Koehn Lake (CA-KER-875) and Cantil; (7) Oak Creek Canyon (CA-KER-1998); (8) Cross Mountain (CA-KER-4619); (9) Freeman Spring (CA-KER-6106); (10) Terese (CA-KER-6188); (11) Rosamond sites; (12) Rogers Lake sites; (13) Oro Grande (CA-SBR-72); (14) Deep Creek (CA-SBR-176); (15) Hinkley (CA-SBR-189); (16) *Guapiabit* (CA-SBR-1913); (17) Siphon (CA-SBR-6580); (18) Red Mountain Archaeological District; (19) Fort Irwin; (20) Owens Valley.

Kern, San Bernardino) and then by trinomial, with the exception of the Cantil, Rosamond, and Rogers Lake sites, as their trinomials are not consecutive. In addition, the Coso Volcanic Field, Fort Irwin, and Owens Valley investigations are not detailed by site; rather, they are discussed broadly as site complexes. The section on the Coso Volcanic Field sites is a summary of the report by Gilreath and Hildebrandt (1997), which is itself a summary of the large-scale investigations conducted there since 1979. While Fort Irwin and Owens Valley are not in the western Mojave Desert, it was felt that their immediate proximity to the study area, as well as the extensive investigations that have taken place at these two locations, was sufficient reason to include broad discussions of how these complexes may relate to the study area.

This data set only includes sites that were excavated; if a site was merely surveyed and/or surface collected, it was excluded. These criteria should not be interpreted as suggesting that the following data sets represent a statistical sample. Rather, any site (or complex of sites) that was deemed to provide comparable and relevant data for this analysis was included.

Another consideration in this chapter was deciding which terminology to employ for chronological purposes. For the Coso Locality sites, for example, Hillebrand (1972) used the terms Ray Phase and Chapman Phase, which roughly correspond to what are often referred to as the Gypsum (or Elko) Period (Ray Phase) and the early and late Rose Spring Period (Chapman Phase). Others scholars prefer the designations Newberry, Haiwee, and Marana, which roughly correspond to the Gypsum, Rose Spring, and Late Prehistoric periods, respectively (e.g., Bettinger and Taylor 1974; Gilreath and Hildebrandt 1997; see Table 2). For the purposes of this study, I chose to use the terminology outlined in Chapter 4; i.e., the Gypsum, Rose Spring, and Late Prehistoric

periods,[1] as researchers at most of the sites included in this chapter employed these designations, which facilitated the comparisons made herein.

The purpose of this chapter is to furnish detailed information about archaeological sites that have been investigated in the study area. Following these site descriptions, the data are summarized in Chapter 6. It should be noted that there is no intent in this chapter to augment the analyses of these sites as provided by the original researchers. That task is accomplished in Chapter 7, in which comparisons and interpretations of the data sets, as well as other pertinent information from outside the study area, are provided.

CA-INY-372 (Rose Spring Site)

Site Description

The Rose Spring site is a large, open-air site situated at the north end of Rose Valley on the extreme northwest border of the Mojave Desert (Yohe 1992; see Figure 8). It contains numerous loci and a variety of features, covering approximately 75,000 $m.^2$ (Yohe 1992:89). It is considered to be "one of the most significant archaeological sites in the western Great Basin" (Yohe 1992:1) due to its great depth (just under four meters) coupled with its remarkable stratification, a rare phenomenon in this region. While there had been previous studies of the Rose Spring site (Clewlow et al. 1970; Lanning 1963), the work conducted by Yohe (1992) was much more extensive, although only one locus (Locus 1) has been reported in any detail. Therefore, the description herein deals almost exclusively with Yohe's (1992) study (also see Yohe 2000).

Locus 1 of the Rose Spring site contained dark soil and was approximately 40 m. east-west by 15 m. north-south (Yohe 1992:91). Three small caves are located nearby, although construction of the Los Angeles Aqueduct in this area, as well as looting over

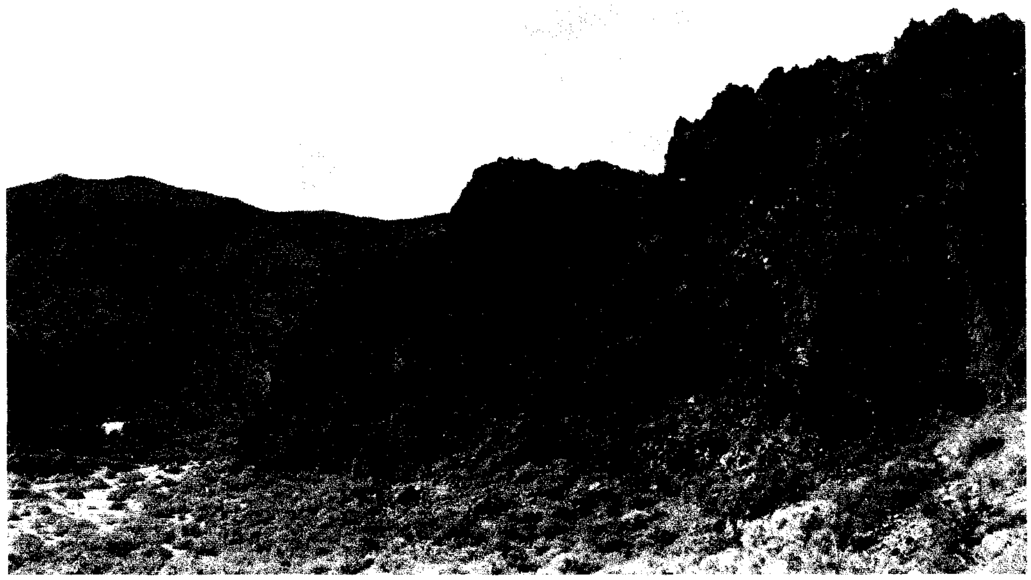

Figure 8. The Rose Spring site (CA-INY-372). (Photograph courtesy of Robert M. Yohe.)

many years, has likely destroyed the cultural deposits of these caves. Locus 2 was the largest habitation area at Rose Spring, with dimensions of approximately 110 by 70 m. and consisting of numerous features (Yohe 1992:92). Locus 3, first discovered in the spring of 1988, was located southwest of Locus 2 (Yohe 1992:93). It had a small (60 by 30 m.) but rich cultural deposit adjacent to one of two main drainages that bisect the site. Locus 4, situated between Loci 1 and 2, contained a concentration of milling and roasting features, and was ca. 90 by 50 m. (Yohe 1992:94). Locus 5 consisted of a single large bedrock milling station with mortar holes, grinding slicks, ground stone tool fragments, and a roasting feature (Yohe 1992:94). Locus 6 is also a bedrock milling feature situated between Loci 2 and 3. It contained dark soil and a light lithic scatter (Yohe 1992:95).

Field Methods

As part of Yohe's (1992) investigations at the Rose Spring site, two backhoe trenches and 11 1.5 $m.^2$ excavation units were placed at Locus 1. All other units outside of Locus

1 were either 1 by 1 m. or 1 by 2 m. No trenches were placed anywhere else on the site. The units were excavated in 10-cm. levels, and all soil was screened through 1/8-in. mesh. However, because the surface and near-surface were so badly disturbed, the top 70 to 100 cm. were removed with heavy equipment (Yohe 1992:99).

Features

There were 16 features at Locus 1 (Yohe 1992:114-134). All but one of the features were characterized as some type of cooking feature; i.e., hearths, roasting features, concentrations of fire-affected rock, and/or ashy soil. Three of these features occurred at shallow depths (10 to 50 cm.), and 12 at deeper levels (65 to 300 cm.), with four of the latter occurring at 200 cm. or deeper. Feature 3, the only one not defined as a cooking feature, consisted of a cluster of rocks in front of an alcove (Yohe 1992:119). Artifacts associated with these features included a metate fragment and a hammerstone from Feature 2; a basin metate fragment, core, and biface fragment from Feature 3; and a Humboldt basal-notched biface, a biface fragment, a mano, an incised slate fragment, and a fragment of unidentified ground stone from Feature 5 (Yohe 1992:119-123).

About 20 m. southwest of Locus 1, another feature associated with what Yohe (1992:134) referred to as the Spring Locus contained a depression interpreted as a house with a large hearth. The depression was discovered at a depth between 30 and 50 cm., and the structure was estimated to have been three meters in diameter. The depression contained a midden that revealed numerous *Olivella* disk beads ($n \geq 100$). Two radiocarbon assays placed the date of this feature at less than 150 B.P. (Yohe 1992:134).

Material Culture

Because the primary focus of Yohe's (1992) study was flaked stone artifacts, he did not quantify other artifacts in that publication. However, a review of the catalog revealed

to this author that the vast majority of the items recovered from the Rose Spring site during Yohe's (1992) excavations were flaked stone tools and debitage. Among the flaked stone artifacts were numerous projectile points (n $\geq$ 200), including Desert Side-notched, Cottonwood Triangular, Rose Spring, Elko, and Gypsum Cave types,[2] indicating long-term use of the site. Other flaked stone artifacts included hundreds of bifaces (n $\geq$ 480) and edge-modified flakes, as well as a few cores, unifaces, scrapers, drills, spokeshaves, and knives. Not surprisingly, the vast majority of the flaked stone consisted of debitage, numbering in the tens of thousands. While the toolstone material was overwhelmingly obsidian, other materials represented included basalt, chalcedony, chert, jasper, quartz, rhyolite, and others in small quantities.

There were also numerous ground stone implements, including manos (n $\geq$ 111, metates (n $\geq$ 65), pestles (n $\geq$ 6), abraders, and hammerstones. Other ground stone items included pumice balls and spheres, pumice pendant and pipe fragments, a "donut" stone fragment, and inscribed green slate fragments. Dozens of pottery sherds (mostly brown ware), a variety of *Olivella* and steatite beads, modified bone artifacts, ochre and white pigment specimens, avian eggshell fragments, and fire-affected rocks were also listed in the catalog.

Faunal and Botanical Remains

While the faunal analysis remains incomplete, a preliminary analysis of Locus 2 demonstrated that of nearly 1,900 specimens that have been analyzed, the greatest majority (77%) were identified as small mammal, followed by large mammal (31%), rodent (3%), black-tailed jackrabbit (*Lepus californicus*; 2%), and small quantities of other animals (Lauber 1995:10). It is likely that many of the fragments identified as small mammal are *Lepus* (Robert M. Yohe, personal communication 2004).

Although a formal analysis of the macrobotanical remains of the Rose Spring site has not yet been conducted, 15 pollen samples from two excavation units were submitted to Paleo Research Laboratories in Golden, Colorado (Yohe and Scott Cummings 2000; also see Scott Cummings 2000). That analysis indicated that the pollen record of the site was dominated by high-spine Asteraceae, which represents plants such as rabbit brush (*Chrysothamnus* spp.), pin-cushion (*Chaenactis santolinoides*), and desert aster (*Aster*) (Yohe and Scott Cummings 2000:5). Cheno-am pollen is also abundant in the pollen samples, likely representing saltbush (*Atriplex* spp.) and hop-sage (*Grayia spinosa*). Sagebrush (*Artemisia*) and low-spine Asteraceae (e.g., ragweed, cocklebur) are also represented in the pollen specimens. The presence of pine (*Pinus* spp.) and juniper (*Juniperus* spp.) specimens is likely due to long-distance wind transport from higher elevations. Most of these species were derived from the bottom of the record, which dates to the Gypsum Period component of the site (see below for dating).

In small quantities, other specimens from the upper portion of the pollen record included alder (*Alnus*), mesquite (*Prosopis*), oak (*Quercus*), creosote (*Larrea*), Mormon tea (*Ephedra*), cactus (*Opuntia*), and various grasses (*Poaceae*), among others. Whether any of these pollens represent cultural activity is not clear, although the natives who inhabited this region were known to have made use of pine, mesquite, and a variety of grasses (Scott Cummings 2000; Yohe and Scott Cummings 2000:6).

Dating

Locus 1 produced 17 radiocarbon samples, including five from the study by Clewlow et al. (1970), ranging in depth from 40 to 300 cm. (Yohe 1992:138). Four additional dates came from the Spring Locus (two from the hearth), Locus 2, and Locus 3. The results of these radiocarbon assays ranged in age between ca. 5,500 B.P. and the modern

era. The uncorrected radiocarbon dates from Locus 1 are as follows: 110 ± 50, 280 ± 50, 330 ± 50, 330 ± 60, 590 ± 60, 1,360 ± 70, 1,400 ± 50, 2,070 ± 90, 2,240 ± 145, 2,900 ± 80, 3,240 ± 60, 3,520 ± 80, 3,580 ± 80, 3,900 ± 180, 4,030 ± 100, 4,460 ± 110, and 5,460 ± 80 RCYBP (Yohe 1992:140). The two radiocarbon assessments from the Spring Locus were modern in age, while the one from Locus 2 returned a result of 900 ± 60 RCYBP and the one from Locus 3 produced an age of 2,240 ± 100 RCYBP (Yohe 1992:145).

A sample of 94 obsidian flakes was submitted for obsidian analysis. Of these, 64 specimens were chosen from each 10-cm. level of Unit X-1 at Locus 1, to a depth of 210 cm. (Yohe 1992:148). The remaining 30 samples came from Unit XX-7 of Locus 1, which were derived from a depth of 160 to 260 cm. All of these samples were chemically characterized to the Coso Volcanic Field (Yohe 1992:149). Most of the samples had hydration values between 6.0 and 9.3 microns (70.4%), with 34.4% of these ranging between 7.0 and 8.7 microns. The stratigraphic mixing of these results led Yohe (1992:154) to conclude that further analysis of the hydration technique was required "if the method is even to be considered an effective relative means of dating."

The projectile points from the Rose Spring site also provided temporal data (Yohe 1992, 2000). The typeable projectile points from Locus 1 alone included two Desert Side-notched, 12 Cottonwood Triangular, 30 Rose Spring, eight Humboldt Basal-notched, eight Elko Series/Gypsum Cave, and one Pinto (Yohe 1992:209). This clearly demonstrated the predominant Rose Spring occupation of the site, although the Gypsum and Late Prehistoric periods are represented as well.

While the Rose Spring site is considered to be overwhelmingly Rose Spring in age (Robert M. Yohe, personal communication 2005), it also appears to exhibit a rather substantial Gypsum Period component and a lesser Late Prehistoric Period component. It

should be noted, however, that the radiocarbon dates for the Gypsum component were from the excavations conducted by Clewlow et al. (1970), who took samples of loose charcoal that was derived from the deepest levels of the site. As a result, their association with cultural activity is suspect. The two dates that are clearly Rose Spring in age (1,360 ± 70 and 1,400 ± 50 RCYBP) are from the subsequent work conducted by Yohe (1992). Both of these dates were derived from hearth features, at depths of 90 and 140 cm., respectively.

In addition, in terms of projectile point typology, in Locus 1 alone, there were 27 Elko points and 131 Rose Spring points. Along with the results of the obsidian hydration studies at Rose Spring, this led Yohe (1992) to conclude that the site was likely used during the Gypsum Period for biface production and dart points, with subsequent generations of occupants reusing the obsidian specimens that had been produced some 2,000 or so years earlier. This suggested that the florescence of the Rose Spring site was during the Rose Spring Period (Robert M. Yohe, personal communication 2005). Therefore, while a Gypsum Period occupation is evident at the Rose Spring site, the greatest level of occupation and activity at the site was during the Rose Spring Period.

Interpretations

Yohe (1992:95) argued that the Rose Spring site experienced occupation primarily from 2,000 B.P. to historic times, with the zenith of population and activity taking place between about 2,000 and 500 years ago. The site has frequently been referred to as a village (e.g., Bettinger 1989), although this does not appear to have been the case during the latest phase of occupation. Yohe (1992:1) preferred to refer to it as a large open-air site, rather than as village, as that term is open to interpretation.

According to Yohe (1992:96), this increase in population and site activity may have been the result of the development of the bow and arrow early in the Rose Spring Period. He further argued that the radiocarbon dates from the stratified contexts at Rose Spring suggested that the bow and arrow made its appearance at this site about 1,500 years ago (Yohe 1998:31). The flaked stone analysis revealed that lithic procurement and processing activities at local quarries remained relatively stable through time (Yohe 1998:49).

Evidence for seasonality of the site was based on the position of Locus 1 and the presence of deep mortar holes (Yohe 1992:96). Locus 1 is on a south-facing cliff, suggesting that it was not occupied during the summer, as the intense heat reflecting off the rock face of the cliff during the summer would preclude its use at that time. The presence of deep mortar holes indicated that the inhabitants may have been processing acorns, especially since Locus 1 is close to both water and acorn sources, implying fall usage of the site (Yohe 1992:96). The faunal analysis of Locus 1 is incomplete, but the preliminary results also indicated a fall occupation of the site, based on the presence of jackrabbit remains (Lauber 1995), a species that was usually hunted in the fall (see Steward 1938).

The pollen analysis of the stratigraphic samples at Rose Spring suggested to Yohe and Scott Cummings (2000:8) that the major vegetation communities in the region today have been present for at least the past 3,600 years. The abundance and distribution of the plants in these communities likely fluctuated through time, "perhaps in response to increasing and decreasing alkalinity and available moisture" (Yohe and Scott Cummings 2000:8). In addition, the decrease in abundance of the high-spine Asteraceae during the last few hundred years, coupled with the increase in Cheno-ams at the same time,

demonstrated that at one time the environment of Rose Spring experienced more xeric conditions (Yohe and Scott Cummings 2000:8).

CA-INY-444, -1534A, -1534B, -1535 (Coso Locality)

Site Descriptions

In the late 1960s, Hillebrand (1972) conducted investigations in and around the Coso Range near China Lake. This investigation was the first of its kind in the Coso Locality, as Hillebrand (1972) referred to it. Of the nine sites studied, three were excavated by Hillebrand, and one (Ray Cave) had been excavated previously by personnel from the Maturango Museum (Panlaqui 1974). The four sites analyzed by Hillebrand (1972) were Ray Cave (CA-INY-444; also identified as UCLA Site No. INY-349), Chapman Rockshelter 1 (CA-INY-1534A), Chapman Rockshelter 2 (CA-INY-1534B), and the Junction Ranch Site (CA-INY-1535).[3] Since then, the materials from these sites have been reanalyzed by Panlaqui (1974) and Gilreath (2000).

Ray Cave is a small rockshelter overlooking China Lake. It rests on the edge of a steep mesa at an elevation of 5,000 feet (Hillebrand 1972:34). Measurements were taken in feet rather than meters, so the maximum size of this rockshelter was reported to be about 12 by 17 feet, with a ceiling height of about four feet. Chapman Rockshelters 1 and 2 are both located at the bottom of a basalt cliff and both are relatively close in size to Ray Cave (20 by 15 feet and 20 by 8 feet, respectively). Both of these rockshelters developed "as the result of a collapsed lava tube or blister" (Hillebrand 1972:30). The Junction Ranch Site is a cluster of house rings associated with petroglyphs. It is situated on a basalt flow with a good view of the valley and mountains (Hillebrand 1972:32). All four sites are located near streams and/or springs.

Field Methods

Most of the test units excavated by Hillebrand (1972) were five feet square and were excavated in half-foot arbitrary levels. Materials were screened through 1/4-in. mesh. Eight units were placed at Chapman 1 and three at Chapman 2. Two trenches (2.5 by 10 feet) were placed at Junction Ranch. No new excavations were conducted at Ray Cave by Hillebrand (1972), although Fitzwater (1967) reported that volunteers from the Maturango Museum had excavated three cubic yards there as of 1967.

Features

At Chapman 1, features included five burials, four cache pits, four hearths, a flagstone wall, and one petroglyph (Hillebrand 1972:43). Chapman 2 contained a single burial with two individuals, an adult and an infant. At Junction Ranch, there were eight house rings, five hunting blinds, five mortars, and more than 100 petroglyphs (Hillebrand 1972:43). Five of the house rings were excavated. At Ray Cave, there was a burial, two hearths, and "several" petroglyphs (Hillebrand 1972:43).

Two burials from Chapman 1 were partially cremated, which Hillebrand (1972:43) pointed out was not a common practice for this part of the Mojave Desert. One of the burials, a mature male, had a partial ring of rocks beneath it and several basketry fragments directly above it, as well as what appeared to be the remains of a cairn (Hillebrand 1972:44). The second cremation from Chapman 1, identified as an adolescent, was tenuously associated with a probable arrow fragment, basketry fragments, and a potsherd. Another individual was partially mummified, and was thought to be an adult male. This individual had fiber cording wrapped about the pelvis, which "probably was once a rabbit skin cloak or girdle, characteristically used by the Shoshoneans" (Hillebrand 1972:44).

The burial from Chapman 2 contained what had initially appeared to be a single inhumation of an adult male; however, subsequent laboratory work revealed the presence of an infant along with the adult (Hillebrand 1972:45). The left tibia of the adult exhibited a notch that was determined to be a cut mark. A large obsidian knife blade that may have been the cause of death was associated with this burial (Hillebrand 1972:45). The burial at Ray Cave was that of an elderly female found with two metates, a flake scraper, an *Olivella* bead, two modified obsidian flakes, a bone awl tip, two projectile point fragments, and a modified large mammal long bone (Hillebrand 1972:46).

The cache pit features at Chapman 1 were likely intended as storage for seeds or other items (Hillebrand 1972:46). These pits were lined and capped with rocks. The lining consisted of bunch grass, Joshua fiber, tule matting, and twined basketry. Combined, these four cache pits contained debitage of various materials, obsidian blade fragments, two obsidian projectile points, a modified jasper fragment, bone beads, coiled and twined basketry fragments, tule matting, pinyon hulls, an arrow shaft fragment, cordage, buttons, slate pendant fragments, a mano, asphaltum, hematite, paint, moccasins, and human remains (Hillebrand 1972:47-50). The flagstone wall at Chapman 1 was made of basalt slabs that may have been intended as a windbreak (Hillebrand 1972:50).

Material Culture

Along with the artifacts associated with the features discussed above, 201 projectile points were recovered at Chapman 1, Chapman 2, and Junction Ranch, 118 of which were complete enough to be classified.[4] These included Desert Side-notched (n = 13), Cottonwood Triangular and Leaf-shaped (n = 16), Rose Spring series (n = 65), Elko series (n = 18; 14 of which came from Ray Cave), and Humboldt (n = 6). Most of the projectile points were obsidian (n = 167; 83%), followed by chert/other (19; 9.5%) and

jasper (n = 15; 7.5%) (Hillebrand 1972:52). Flaked stone materials from all three sites also included 374 "utilized" flakes and 210 "worked" flakes Hillebrand 1972:58-59). Almost all of these specimens were made of obsidian. Blades and knife blades from the three sites totaled 62, all but one of which was made of obsidian (Hillebrand 1972:62). Although the debitage was not quantified, it was clearly dominated by obsidian, followed by jasper, chert, quartzite, and basalt. An obsidian needle, two drills (quartz, jasper), and a chert "flesher" made up the balance of the flaked stone artifacts, all of which were recovered at Chapman 1 (Hillebrand 1972:63).

Ground stone items from the three sites excavated by Hillebrand (1972:64-65) consisted of 22 basalt manos, 113 basalt metates, a granite pestle, nine slate pendant fragments, and a slate pencil. Pottery was represented by what Hillebrand (1972:65) referred to as Owens Valley Brown Ware, and consisted of 34 sherds from Chapman 1 and Junction Ranch. In a "hoard of objects" from Chapman 1 (Hillebrand 1972:67), there were eight ground squirrel skulls, two small clay bowls, a clay animal effigy, a quartz crystal, and hematite. In an area close to this hoard was a phallic-shaped clay figure, although it "sported a set of protruding female human breasts" (Hillebrand 1972:67).

Several specimens of basketry, cordage, and matting were also discovered at Chapman 1. The basketry fragments were of both the twined and coiled varieties (Hillebrand 1972:70). The remaining prehistoric materials from Chapman 1, Chapman 2, and Junction Ranch included ten bone beads, 15 shell beads (10 *Olivella biplicata*, five *Haliotis*), and a pair of leather moccasins (Hillebrand 1972:72-74).

<u>Faunal and Botanical Remains</u>

Faunal remains from the three excavated sites included large mammals, small mammals, and birds (Hillebrand 1972:79). Most of the large mammal bones were too

fragmented for taxonomic identification, but small mammals represented were ground squirrel (*Citellus leucurus*, *Citellus* sp.), kangaroo rat (*Dipodomys ordii*), desert wood rat (*Neotoma lepida*), pocket mouse (*Perognathus* spp.), pocket gopher (*Thomomys bottae*), and other rodents, as well as black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus audubonii*), spotted skunk (*Spilogale putorius*), and marmot (*Marmota flaviventris*). Most of the remains were *Neotoma* and *Citellus*, which may have been natural elements of the sites.

Based on a formula provided by Hillebrand (1972:84), he estimated the population frequencies for *Lepus* and *Sylvilagus* at Chapman 1 and Chapman 2 at 86 and 146, respectively. The botanical remains consisted of *Chenopodium californicum*, pinyon hulls (some parched and broken), Joshua seeds, and unidentified grass seed, (Hillebrand 1972:78-79). *Chenopodium californicum* is commonly referred to as soap plant, as it was used by native peoples as a soap substitute (Twisselmann 1995:228).

Dating

At Ray Cave, Hillebrand (1972) reported a single radiocarbon assay, which returned a result of calibrated result of A.D. 460 ± 50. However, obsidian hydration analysis was performed on 162 artifacts from various sites in the general Coso Locality, including the four discussed here (Hillebrand 1972:93). The micron values for these specimens ranged between 1.2 and 15.6. At Ray Cave, Hillebrand (1972:96) reported that two flakes from the same level as the radiocarbon sample had micron values of 3.1 and 3.3, which he proposed dated to about A.D. 1650. However, a review of the handwritten catalog of the 1969 hydration data sheets from the now-defunct U.C. Davis hydration lab indicated that these rim values were reported incorrectly.[5] The actual values are 4.0 and 4.2 microns, and these are the values used in the discussion and graphs in Chapter 6.

Additional radiocarbon dates and obsidian hydration assessments were obtained during Panlaqui's (1974) and Gilreath's (2000) study of the burials. Panlaqui (1974:8) reported two radiocarbon dates, one from an ash lens in the center of the shelter and one on a large piece of charcoal under a boulder. These two dates were 1,500 ± 95 and 3,390 ± 50 RCYBP, respectively. At Chapman 1, Gilreath (2000:26) reported three radiocarbon dates, 320 ± 60, 580 ± 70, and 760 ± 60 RCYBP. Chapman 2 produced two radiocarbon dates, 230 ± 60 and 470 ± 80 RCYBP (Gilreath 2000:45).

The additional obsidian rim readings from Ray Cave, as reported by Gilreath (2000:70-71), were 3.03, 3.1, 3.3, 3.53, 4.54, 5.05 microns, although these readings were regarded as unreliable. At Chapman 1, Hillebrand (1972) reported 38 rim measurements, and Gilreath (2000:27) reported nine; in total, these 47 rim readings range between 1.5 and 14.1 microns. Again, little credence was placed on the reliability of the greatest rim measurements (9.8 and 14.1 microns) (Gilreath 2000:27). A total of 47 rim values were reported for Chapman 2 (Hillebrand 1972:102; Gilreath 2000:46), ranging between 1.1 and 6.9 microns, with an additional outlier at 12.9 microns. Junction Ranch produced 64 rim measurements, ranging between 1.6 and 10.7 microns (Hillebrand 1972:102).

Although Hillebrand (1972) used different terminology for his phases, the dating techniques employed at these sites, including the projectile point typology (see above) suggested that the main occupation phases spanned between the Rose Spring and the Late Prehistoric periods, with a more ephemeral occupation during the Gypsum Period.

Interpretations

Due to the occurrence of pinyon hulls in the Coso Locality sites, Hillebrand (1972:79) postulated that the season of occupation of the site was primarily during the fall. This interpretation was based on the fact that pinyon is ready to harvest in the fall, with

harvesting taking place from September through October. However, Hillebrand (1972: 79) suggested that the presence of summer grass seeds indicated that the occupants may have resided at the site during the summer as well.

According to Hillebrand (1972:145), during his Ray Phase (roughly Gypsum age), the large Pleistocene lakes had dried up and the Coso environment became desiccated. This was a time when people were hunting rats, rabbits, deer, and bighorn sheep. Hillebrand (1972:145) further argued that the early part of the subsequent Chapman Phase (roughly early Rose Spring) witnessed the appearance of the bow and arrow, signaling a new and drastically different hunting technique. Spear points used in conjunction with atlatls ceased to be manufactured in favor of arrow points, simplifying the acquisition of bighorn sheep. During the later part of the Chapman Phase (roughly late Rose Spring), pottery and cache pits began to appear (Hillebrand 1972:146).

Hillebrand (1972:v-vi) noted that the data from these and other Coso sites indicated that occupation of the Coso area commenced at the onset of the Altithermal. This time may also have witnessed the genesis of the well-known Coso rock art tradition. While little data were recovered for climatic interpretations, Hillebrand (1972:130) noted that geological conditions at these sites indicated a warm and dry climate similar to modern conditions. Further, Hillebrand (1972:130) observed that the presence of pinyon provided evidence for moister conditions during the earliest phases of occupation (perhaps ca. 3,000 B.C.).

In her analysis of three of the Coso Locality sites (Ray Cave, Chapman 1, and Chapman 2), as well as two other sites not reported here, Gilreath (2000:37) suggested that Chapman 1 was occupied between about 1,500 B.P. and the A.D. 1800s. Based on the mortuary items recovered from the cremated remains at Chapman 1, she suggested an

affiliation with the Panamint Shoshone (Gilreath 2000:37). Chapman 2 was thought to date within the last 750 years and that the human remains were buried during the Marana (Late Prehistoric) Period, although there is also evidence of a Rose Spring occupation as well (Gilreath 2000:48). The occupation of Ray Cave was thought to be primarily Gypsum in age, although later usage was also apparent (Gilreath 2000:72).

CA-INY-2284 (Coso Junction Ranch)

Site Description

As part of his study on optimal foraging theory, Gumerman (1985) included the only publication known to this author that has any details about the cultural constituents of the Coso Junction Ranch site (but see Allen 1986; Whitley et al. 1988). The site is located on a colluvial fan in the Rose Valley of eastern California, at an elevation of 1,215 m. (Gumerman 1985:1). It rests on a landform known as Portuguese Bench (Whitley et al. 1988:3). No site dimensions were provided, other than to describe it as a large site with multiple occupations (Gumerman 1985:13).

Field Methods

Excavations at the Coso Junction Ranch site included 11 2 by 2 m. test units chosen from a stratified random sample, 22 non-random 2 by 2 m. test units, and a 40-m. long backhoe trench. The units were excavated in 10-cm. levels, except where natural levels were evident. All soils were screened through 1/8-in. mesh, and soil samples were taken from every unit and feature (Gumerman 1985:13).

Features

A total of 25 features were identified at the site, including hearths, ash lenses, "living surfaces," concentrations of obsidian, and storage pits (Gumerman 1985:13). No other

descriptions about the features were provided by Gumerman (1985) or by Whitley et al. (1988).

Material Culture

Gumerman (1985) did not provide any details about the artifact assemblage. However, his descriptions of the occupation phases appear to have been based on projectile point typology, including Pinto, Elko, Rosegate, and Desert Side-notched forms (Gumerman 1985:13). There was a large number of obsidian artifacts, presumably debitage for the most part, although the artifact categories and materials were not given. No other artifact descriptions or tabulations were furnished by Gumerman (1985), although Allen (1986:24) reported that he analyzed more than 150,000 debitage specimens. In addition, Whitley et al. (1988:7) noted that nearly 200 shell beads and ornaments were recovered from the site.

Faunal and Botanical Remains

As the focus of his study was on optimal foraging, more detail was provided about the faunal and botanical remains. Data for the faunal remains was derived from two test units and 16 features (Gumerman 1985). While the faunal remains were quantified only as present or absent, the species list included bighorn sheep (*Ovis canadensis*), mule deer (*Dama hemionus*), bobcat (*Lynx* sp.), coyote (*Canis latrans*), porcupine (*Erethizon dorsatum*), black-tailed jackrabbit (*Lepus californicus*), cottontail (*Sylvilagus audubonii*), ground squirrel (*Citellus beecheyi*), kangaroo rat (*Dipodomys* sp.), wood rat (*Neotoma* sp.), pocket mouse (*Perognathus* sp.), vole (*Microtis* sp.), raven (*Corvus* sp.), hawk (*Falco* sp.), rattlesnake (*Crotalus* sp.), king snake (*Lampropeltis* sp.), and lizard (*Uta* sp.).

Botanical remains were better quantified, and consisted of carbonized seed species of various quantities, ranging between ca. 140 specimens of wild buckwheat (*Eriogonum*

sp.) and one specimen of fiddleneck (*Amsinckia* sp.) (Gumerman 1985:Tables 6-8). Besides buckwheat and fiddleneck, other species represented in the two test units and 16 features included Asteraceae (sunflower family), Brassicaceae (mustard family), Chenopodiaceae (goosefoot family), Laminaceae (mint family), Poaceae (grass family), Solanaceae (nightshade family), wire grass (*Juncus* sp.), mallow (*Malva* sp.), and beard tongue (*Penstemon* sp.).

Dating

Dating for the Coso Junction Ranch site was based on point typology and obsidian hydration from the two test units and the features in Gumerman's (1985) study. The micron values for all of the 127 obsidian specimens submitted for hydration fell between 2.9 and 7.9 microns, although the majority (n = 106) fell between 4.0 and 6.9 microns (Gumerman 1985:Table 14). Using a range of values between 4.0 and 6.5 microns, Gumerman (1985:43) provided a mean calendar age between A.D. 132 and 832 (roughly 1,800 to 1,200 B.P.). Most of the micron values and associated calendar ages, as well as the Rosegate projectile points, generally coincide with the Rose Spring Period, with possible smaller Pinto, Gypsum, and Late Prehistoric period occupations.

Interpretations

As Gumerman's (1985) study was not a site analysis per se, the following interpretations were gleaned from the subsequent publication by Whitley et al. (1988). Based on the faunal and soils analyses, the Coso Junction Ranch site was interpreted as a large village occupied primarily during the late summer/early fall or late spring/early summer (Whitley et al. 1988:3). Whitley et al. (1988:3) maintained that the site witnessed its initial significant occupation during the late Archaic, with a peak in occupation (and population) during the Rose Spring Period. There was no evidence of a

Shoshonean Period (i.e., Late Prehistoric Period) habitation at the site (Whitley et al. 1988:3). Its large size, intensity of occupation, and presumed seasonality (other villages in the region typically being occupied during the winter) were considered unique aspects of the site (Whitley et al. 1988:4-5).

The faunal analysis also provided evidence that small game was the subsistence focus, primarily jackrabbits, although large mammals were also represented in the faunal remains (Whitley et al. 1988:6). The seed remains were derived from mostly local sources, suggesting a limited catchment zone. Together, these data demonstrated "a fairly generalized subsistence strategy" that included hunting and seed gathering (Whitley et al. 1988:6; also see Gumerman 1985). The shell beads indicated at least some level of trade, most likely with people in the southern San Joaquin Valley (Whitley et al. 1988:7).

CA-KER-246 (Red Rock Canyon)

Site Description

The CA-KER-246 site, a prehistoric lithic reduction locale with an extensive lithic scatter, is located at the northern end of Red Rock Canyon State Park (Harvey and Gardner 2002; see Figure 9). The site is less than five miles east of State Highway 14 and less than a mile northwest of Last Chance Canyon. Resting at an elevation of 3,200 ft. on a dune of Holocene-aged material originating from the Sierra Nevada to the west, CA-KER-246 is ca. 360 m. east-west by 300 m. north-south (Harvey and Gardner 2002:39). The nearest water source is Lee's Spring, which is approximately one mile southeast of CA-KER-246. Part of the site lies on Department of Parks and Recreation (DPR) land and part on land administered by the Bureau of Land Management (BLM) land, although excavations were restricted to DPR land.

Figure 9. Overview of CA-KER-246, taken in 2002. (Photograph in possession of the authors.)

When the site was initially recorded in 1964, Alex Apostolides (1964:1) noted core tools, ground stone fragments, and an adjacent hearth. Thirty years later, Fenenga and Alcock (1994) noted great quantities of lithic materials as part of their study there, which did not involve excavations. In 1999, Flenniken (2000) conducted an analysis of several "lithic debitage dominated sites," including CA-KER-246. Harvey and Gardner (2002) subsequently identified a dense scatter of predominantly tertiary flakes of heat-treated chert and chalcedony, as well as obsidian flakes.

Field Methods

The investigations at CA-KER-246 included mapping, placement of a 1 by 1 m. surface scrape, and excavations of two 1 by 1 m. test units (TU-1 and TU-2) as well as the hearth feature mentioned above. With one exception, all units were excavated in 10-cm. levels, and all soil was screened through 1/8-in. mesh (Harvey and Gardner 2002:42).

The one exception was the initial level of the hearth, which was excavated to 20 cm. due to slope. The 1 by 1 m. surface scrape was placed in an area that appeared to be a pocket drop (Harvey and Gardner 2002:43; also see below). The scrape involved the removal of the top two cm. of soil from the surface and screening it through 1/8-in. mesh. Column and soil samples were taken from the hearth and the test units.

Feature

The hearth feature that was excavated at CA-KER-246 was located at the southern boundary of the site (Harvey and Gardner 2002:41-42). A flood in the summer of 2001 caused severe washout of the area around the hearth. In addition, there were at least two "pocket drops" on site; that is, areas where one or more individuals had recently sorted through the debitage and then dropped the ones deemed worthless. Although the soil in the hearth was a very dark gray color, little charcoal was recovered. Five small flakes and six fragments of fire-affected rock were encountered in the unit that contained the hearth feature (Harvey and Gardner 2002:49, 52).

Material Culture

In 1996, when DPR personnel collected obsidian specimens from the site for sourcing and hydration analyses, they also recovered a partial Elko series projectile point made of obsidian (not submitted for obsidian studies). As a result of their study, Harvey and Gardner (2002) recovered other flaked stone tools, including two chalcedony biface fragments and an expended jasper core.

A total of 682 pieces of debitage was recovered from the test units, the hearth, and the surface scrape (Harvey and Gardner 2002). The materials from which the debitage was derived included multicolored chert (65%), chalcedony (24%), reddish-brown jasper (9%), and a small amount of obsidian (2%). The waxiness of many of the flakes

suggested that they were heat treated (Harvey and Gardner 2002:49). A handful of ground stone fragments was observed during the study conducted by Harvey and Gardner (2002), all of them on the BLM portion of the site, so they were not quantified. A small quantity of fire-affected rocks (n = 45) was found in the test units and the hearth.

Faunal and Botanical Remains

A total of 14 unburned fragments of unidentified small mammal was found in the test units, but no faunal remains were recovered from the hearth. A column sample from TU-2 contained an unburned small mammal phalanx. Due to the loose compaction of the soil and extensive evidence of bioturbation from mammals, insects, reptiles, and roots, it was presumed that these faunal remains were noncultural in nature (Harvey and Gardner 2002:53-54).

The only botanical remains that could be identified were apparently modern in age. Identified materials include cheese brush (*Hymenoclea salsola*), Joshua tree (*Yucca brevifolia*), fiddleneck (*Amsinckia* spp.), rabbit brush (*Chrysothamnus* spp.), cactus (e.g., *Opuntia* spp.), Indian rice grass (*Achnatherum hymenoides*), buckwheat (*Eriogonum* spp.), and saltbush (*Atriplex* sp.) (Harvey and Gardner 2002:53-54). While they appeared to be modern (i.e., not burned), all of these species were exploited by prehistoric populations in this region; thus, it is possible that they represent unprocessed resources. However, as the site does not appear to have had a habitation function (see below), this suggestion is unlikely.

Dating

A radiocarbon sample from the lower portion of the stained soil in the hearth was submitted for accelerator mass spectrometry (AMS) assay. The sample returned a result of 3,140 ± 40 RCYBP (cal B.P. 3,390 to 3,340 at one sigma). This placed the occupation

of the site during the Gypsum Period. This age was supported by the Elko series projectile point discovered by DPR personnel in 1996 (Harvey and Gardner 2002:54).

In 1996, DPR personnel collected obsidian specimens from the surface of the site for geochemical sourcing and hydration analysis (Harvey and Gardner 2002:11). All six were chemically characterized to the Coso Volcanic Field, all but one from the West Sugarloaf subsource. Five of the six samples had mean hydration readings ranging between 7.5 and 7.7 microns, one of which had two hydration rims with mean readings of 7.6 and 10.6 microns. The sixth sample had a mean hydration rim measurement of 16.4 microns, which was presumed to be a geologic age.

The seven obsidian flakes recovered from the test units were also submitted for sourcing and hydration (Harvey and Gardner 2002:54-55). Once again, all were chemically characterized to the Coso Volcanic Field, with two samples further identified as originating from the West Sugarloaf subsource. The specimen from TU-1 had a mean hydration rim reading of 7.5 microns. The other six specimens were from TU-2 and had mean rim readings of 5.9, 7.1, 7.3, 7.3, 7.5, and 8.6 microns. Using the chronological conversion factors for obsidian from various researchers (e.g., Basgall 1990; Hartzell 1992; Parr 1998), the majority of the rim measurements (11 of 13, ranging between 7.1 and 8.6 microns) from CA-KER-246 fell within the early to middle part of the Gypsum Period, while one (5.9 microns) fell within the very early Rose Spring Period and may actually represent a late Gypsum Period date (Harvey and Gardner 2002:57).

Interpretations

Site CA-KER-246 was interpreted as a lithic reduction site dating to the Gypsum Period (Harvey and Gardner 2002:56). Further evidence for the chronology of CA-KER-246 was provided by Flenniken (2000). Based on the large quantity of apparently

discarded bifacial flakes at CA-KER-246 that would have been ideal for arrow point production, Flenniken (2000:50) suggested that the site was inhabited prior to the Rose Spring Period and the onset of bow and arrow technology. His conclusion supports the radiocarbon and obsidian data provided by Harvey and Gardner (2002).

The lithic materials at CA-KER-246 consisted primarily of a white/gray chert. Although there are 15 known prehistoric quarries within a two-mile radius of the site, the source of this chert has not yet been identified (Harvey and Gardner 2002:40). Silicates of brown and mottled orange-colored chert on the site may have been acquired from quarries to the east. The fact that the obsidian all came from the Coso Volcanic Field, which is about 50 miles northeast of the site, suggested that the site inhabitants were involved in trading activities with people from the Coso region and/or that they traveled significant distances to obtain obsidian directly (Harvey and Gardner (2002:60-61).

CA-KER-250 (Bickel Site)

Site Description

The Bickel and Last Chance sites were investigated jointly by McGuire et al. (1982; see discussion of Last Chance site below). The two sites are within about a mile and a half of each other in the El Paso Mountains. The sites have been bisected by a dirt road that cuts through both of the site deposits, which has led to continuing erosion (McGuire et al. 1982:5). Both are "large, open-air sites situated on sand hummocks that flank an ephemeral drainage" (McGuire et al. 1982:2). While they displayed similar artifact assemblages, the Bickel Site had a greater density and diversity of materials than the Last Chance Site. The dimensions for the Bickel Site are ca. 270 by 130 m. (McGuire et al. 1982:21).

Field Methods

Along with a surface collection, 15 1 by 2 m. test units were excavated in 10-cm. levels. The test units were augered an additional 50 to 100 cm. in order to ascertain the presence of underlying cultural deposits. All materials were screened through 1/8-in. mesh. Soil samples were taken from the units and features (McGuire et al. 1982).

Features

Two features were documented in two separate test units. The first was a small concentration of charcoal and fire-affected rock. Although the shape of the feature was described as amorphous, McGuire et al. (1982:45) referred to it as a hearth. No artifacts or ecofacts were recovered from this feature, suggesting that it may not have been utilized for food preparation. The other feature was identified as a "slightly compacted lens of cultural deposit" (McGuire et al. 1982:45). A number of artifacts (mostly debitage) and ecofacts was found in or near this feature. Although the purpose of this feature was not clear, the test unit in which it was found contained the highest density and diversity of cultural materials recovered from the site.

Material Culture

A variety of cultural materials was recovered from the Bickel Site, including flaked and ground stone items, *Olivella* shell beads, and fire-affected rock. The flaked stone artifacts consisted of 14 classifiable obsidian projectile points (11 Rosegate, and one each of Desert Side-notched, Cottonwood, and Elko Corner-notched) and three point fragments; debitage of chalcedony (n = 2,830), chert/jasper/quartzite (n = 215), and obsidian (n = 462); edge-modified flakes (n = 38); cores and core fragments (n = 28), 22 of which were made of chalcedony; biface fragments (n = 19), 10 of which were made of chalcedony, eight of obsidian, and one of chert/jasper/quartzite; and three unifacial tools

(all chalcedony). Ground stone tools numbered 19 items, including manos or manos/ pestles (n = 10), metates (n = 8), and a hammerstone. The *Olivella* beads were identified as disks (n = 2) and saucers (n = 3).

Faunal and Botanical Remains

A total of 6,211 faunal elements were recovered from the Bickel Site (McGuire et al. 1982). Disregarding the 5,239 that were unidentified beyond small mammal (n = 4,993) or large mammal (n = 246), the greatest number of remains by far (by element count) were identified as *Lepus* (n = 708), the next highest being that of *Neotoma* (n = 130). *Sylvilagus* was the next largest category (n = 81), followed by artiodactyl (n = 35). The remaining identified specimens (n = 18) were those of rodents (*Dipodomys*, *Thomomys*, *Citellus*). In addition, most of the nearly 5,000 unidentified specimens were thought to have been jackrabbit remains (McGuire et al. 1982:76). The few botanical remains consisted of 12 seeds or seed fragments from digger pine (*Pinus sabiniana*) (McGuire et al. 1982:74).

Dating

Chronological data from the Bickel Site included radiocarbon assessments, obsidian hydration, and temporally sensitive artifacts. Because the radiocarbon samples were derived from a composite of charcoal fragments recovered from concentrations in the test units, the results of the radiocarbon analyses must be viewed with caution, especially since the results are somewhat anomalous (McGuire et al. 1982:35). The four radiocarbon results are as follows (calendar date in parentheses): 650 ± 65 RCYBP (A.D. 1310), 950 ± 75 RCYBP (A.D. 1040), 1,050 ± 90 RCYBP (A.D. 960), and 1,255 ± 110 RCYBP (A.D. 735 to 765). It is interesting to note that the dates are in reverse order of their stratigraphy (i.e., the A.D. 1310 date corresponds to a depth of 120 to 130 cm., the

A.D. 1040 date to a depth of 90 to 100 cm., etc.), which indicated the likelihood of stratigraphic mixing of the deposits (McGuire et al. 1982:35).

Almost all of the 34 obsidian hydration measurements fell within the generally accepted time range for the Rose Spring Period, and all but one (an unknown) were chemically characterized to the Coso Volcanic Field. A point of interest about the obsidian results is that there is a distinct bimodality in the samples, in that 26 of the readings fell between 3.2 and 4.8 microns, no readings fell between 4.8 and 5.0 microns, and six clustered between 5.0 and 5.8 microns. These results led McGuire et al. (1982:42) to propose that there may have been discrete episodes of occupation intensity, one from ca. A.D. 900 to 1050 and another from ca. A.D. 1100 to 1400.

Most of the projectile points (n = 11) were Rosegate series, with one each of Desert Side-notched, Cottonwood, and Elko Corner-notched forms. Thomas (1981) proposed that "Rosegate" points have a time span between about A.D. 700 and 1300. Because the Desert Side-notched point had an obsidian hydration value that is inconsistent with the presumed timing of this type of point (the Late Prehistoric Period), McGuire et al. (1982:37) suggested that it may have been misclassified and may in actuality represent a somewhat earlier (and undefined) class of projectile point, perhaps as early as the immediately preceding Rose Spring Period.

There was a similar problem with the Elko projectile point, which also had an obsidian hydration value inconsistent with the generally accepted timing of this tool type (McGuire et al. 1982:38). If the classification is incorrect and the obsidian hydration value is valid, then this projectile point form may also date to the Rose Spring Period. The five shell beads have little temporal significance, but due to their provenience were presumed to bracket the period between A.D. 700 and 1300 (McGuire et al. 1982:43).

Interpretations

In their interpretation of the Bickel Site, McGuire et al. (1982:75) argued that the data suggested a nearly single-component occupation spanning between A.D. 700 and 1300. They also observed a pattern in the dating and stratigraphy that indicated "that the early or initial occupation of the Bickel Site may have been relatively more intense than subsequent occupations" (McGuire et al. 1982:75), with the earlier occupation occurring between about A.D. 800 and 1050 and the later occupation between about A.D. 1100 and 1400.

The overwhelming frequency of jackrabbit remains led McGuire et al. (1982:76) to describe the site as one with a "highly efficient procurement strategy" focused on communal rabbit drives. The position of the site at the north end of a steep and narrow drainage attests to the proposed efficacy of such a strategy (McGuire et al. 1982:76). The site is also in an ideal location for the procurement of locally available microcrystalline toolstone. Some processing activities undoubtedly took place at the site as well, as evidenced by the presence of ground stone implements.

McGuire et al. (1982:78-79) described the Bickel Site as a short-term occupation locale that was seasonally occupied, most likely between late summer and winter, although the fall season likely witnessed the peak of occupation. This interpretation was supported by the presence of digger pine at the site, as the nuts of this tree ripen in the fall, a time of intense harvesting by ethnographic groups in this area (e.g., Voegelin 1938). It is also supported by the presence of the jackrabbit remains, as communal drives were typically conducted in the fall and winter (Steward 1938).

The human population of the Bickel Site was estimated based on the technique employed for capturing jackrabbits, which involved the use of netting on open terrain,

requiring the assistance of at least five to eight families (McGuire et al. 1982:80). On that basis, McGuire et al. (1982:80) estimated the population to be somewhere between 25 and 40 individuals.

CA-KER-261 (Last Chance Site)

Site Description

As noted above, the Last Chance Site (CA-KER-261) is about a mile and a half south of the Bickel Site, in the same ephemeral drainage (McGuire et al. 1982). It is an open-air site on a small terrace at a bend in the drainage, which forms the east and southeast boundaries of the site. As with the Bickel Site, the Last Chance Site has been bisected by a dirt road that cuts through the deposit (McGuire et al. 1982:5). The site dimensions for CA-KER-261 are ca. 35 m. by 70 m., considerably smaller than the Bickel Site (McGuire et al. 1982:81).

Field Methods

A 100% surface collection was conducted at the Last Chance site, in 10 $m.^2$ collection grids. In addition, six 1 by 1 m. test units were excavated in 10-cm. arbitrary levels. All materials were screened through 1/8-in. mesh.

Feature

A single feature was identified at the site, described as a roughly circular hearth containing 25 fist-sized cobbles of fire-affected rock within a concentration of charcoal (McGuire et al. 1982:83). It was discovered at a depth of 28 to 40 cm. The quantity of rabbit and other small mammal bone recovered from this hearth suggested that the function of the hearth was for cooking (McGuire et al. 1982:83). Charcoal from the feature was collected for a radiocarbon assay.

Material Culture

Cultural materials were derived from both the surface and subsurface of the site, and included flaked and ground stone tools. The flaked stone specimens (n = 211) consisted of edge-modified flakes (n = 2), cores and core fragments (n = 6), biface fragments (n = 3), and debitage (n = 200). The majority of the flaked stone was made of chalcedony (n = 191), although there were 15 specimens of obsidian debitage, with the rest made up of chert/jasper/quartzite. The number of ground stone implements was small, consisting of five metates and one pestle, all but one made of basalt (McGuire et al. 1982:84-92).

Faunal and Botanical Remains

Only 176 pieces of bone were recovered from the Last Chance site. Of those, 22 were identified as *Lepus*, two as *Neotoma*, one each of *Sylvilagus* and Artiodactyla, 147 as small mammal, and three as large mammal (McGuire et al. 1982:92-93). In addition, a portion of the radiocarbon sample from the site was identified as a burned fragment of creosote bush (*Larrea diviricata*) (McGuire et al. 1982:84).

Dating

There were no diagnostic artifacts recovered from the Last Chance site, and only a small amount of obsidian that was not submitted for obsidian studies (McGuire et al. 1982:84). The radiocarbon sample from the hearth returned a result of 640 ± 75 RCYBP (A.D. 1300, corrected for secular variation) (McGuire et al. 1982:84). This places the approximate age of the site during the early part of the Late Prehistoric Period.

Interpretations

As with the Bickel Site, jackrabbit remains are predominant at the Last Chance Site, although in much smaller numbers. Given its proximity to the Bickel Site, however, McGuire et al. (1982:92) maintained that it may have served a similar purpose. The

radiocarbon date demonstrated "an occupation equivalent to the most recent period of use at the Bickel site" (McGuire et al. 1982:94). The near absence of pressure flakes, which are indicative of tool finishing and maintenance activities, argued for sporadic occupation of the site. The modest cultural assemblage also suggested that the site was used only for specific activities, most likely including the acquisition of locally available toolstone and/or preferred food sources (McGuire et al. 1982:95).

CA-KER-733

Site Description

CA-KER-733 is in the westernmost portion of the Mojave Desert. It was initially recorded in 1972 by R. W. Robinson at Antelope Valley College (AVC) and later excavated by Sutton (1984). The site is located in Antelope Valley in the foothills of the Tehachapi Mountains, at an elevation of 945 m. It rests on a terrace east of a small intermittent stream that eventually eroded the western portion of the deposit, exposing a clear profile of the site (Sutton 1984:35). The profile revealed a very dark midden approximately one meter deep, as well as several hearths and artifacts. CA-KER-733 is just west of CA-KER-303, a large village excavated by AVC in the 1970s (see Sutton 1988; no site report available). The site dimensions for CA-KER-733 are 18 by 12 m.

Field Methods

Three test units were placed at CA-KER-733, excavated in 10-cm. levels and screened through 1/8-in. mesh. Charcoal samples were collected for radiocarbon analysis, one of which (from a hearth) was subsequently dated. Soil samples were removed from the hearths for additional recovery of ecofacts. A profile was also drawn of the stream cut that bisects the site (Sutton 1984:36-37).

Features

The site contained numerous ash concentrations, charcoal, and rock that "were so frequent that their individuality was obscured . . . and hence their reconstruction is difficult" (Sutton 1984:49). As such, they were not described separately or in any detail. However, Sutton (1984:49) did note that Robinson had discovered a rock-lined earthen oven at the site in 1972, although it had already been so badly vandalized that little information could be gleaned from this feature. Material and radiocarbon samples were taken from some of these features.

Material Culture

Artifacts from the CA-KER-733 site included those of flaked and ground stone, modified bone, and shell and stone ornaments (Sutton 1984). Of the flaked stone assemblage, five items were projectile points, only one of which was complete (Sutton 1984:40-42). Two of the points were made of obsidian, two of rhyolite, and one of silicate. Two were identified as Cottonwood points, and one as a possible Cottonwood. The other two could not be typed. In addition, one rhyolite core was discovered in the same unit and level as two of the point fragments, neither one of which was rhyolite. Debitage consisted of 443 flakes from all test units, and included rhyolite (39.5%), silicates (32.5%), quartz (16%), obsidian (10%), and basalt (2%).

Ground stone tools and miscellaneous items included three manos (one each of granite, basalt, and schist), a mortar, a black stone bead (serpentine?), a schist pendant fragment, and an incised steatite tablet fragment (Sutton 1984:37, 40). One modified bone was also recovered, consisting of the midsection of an awl. Additionally, 64 shell beads were derived from all test units (Sutton 1984:42), although most came from TU-2 (50%), and mostly from the upper 40 cm. in all test units (92%). Of the 64 beads, 58

were *Olivella* (mostly *biplicata*), four were *Mytilus* cf. *californianus*, and two were *Haliotis rufescens* disks. Other materials from the site included a small amount of hematite and a single piece of burned clay. The clay specimen may represent the remains of a structure (Sutton 1984:49).

Faunal and Botanical Remains

The faunal assemblage from CA-KER-733 contained 8,649 bone specimens, many of which were burned (Yohe 1984:57). Due to extreme fragmentation of most of the specimens, only 1,309 (15%) could be identified to species level. By far the most frequent taxon represented in the sample was jackrabbit (*Lepus californicus*; n = 1,279), with many other specimens identified only as Leporidae (n = 332) that may represent *L. californicus*. Other elements included those of woodrat (*Neotoma*; n = 28), cottontail rabbit (*Sylvilagus*; n = 14), ground squirrel (*Citellus beecheyi*, *C. tereticaudus*; n = 11), pronghorn (*Antilocapra americana*; n = 10), kangaroo rat (*Dipodomys merriami*; n = 3), badger (*Taxidea taxus*; n = 2), and one each of pocket mouse (*Perognathus*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), rattlesnake (*Crotalus*), Cooper's hawk (*Accipiter cooperii*), and western whiptail lizard (*Cnemidophorus tigris*).

Of the remaining faunal elements that were identified to family or class level, there were artiodactyls (Artiodactyla; n = 34), large mammals (Mammalia; n = 200), rodents (Rodentia; n = 15), and squirrels (Sciuridae; n = 3). There were also fish remains consisting of four vertebrae fragments, representing members of the minnow family (*Mylopharodon conocephalus* and Cyprinidae) (Follett 1984). Butchering was evident in the form of cut marks on a rabbit bone and two pronghorn bones (Yohe 1984:68).

The midden contained burned juniper berries (*Juniperus* cf. *occidentalis*), and soil samples from a charcoal/ash concentration adjacent to a small hearth revealed a single

juniper seed (*Juniperus* cf. *occidentalis*) (Sutton 1984:44, 49). As these juniper berries were mostly complete specimens, it is likely that they were attached to the juniper plant that was used for firewood, rather than being a food source (Sutton 1984:44).

Dating

Dating for CA-KER-733 was derived from a single radiocarbon assay, obsidian hydration, and projectile point and shell bead typologies (Sutton 1984:51). The radiocarbon assay returned a date of 460 ± 75 RCYBP (A.D. 1490). Four obsidian specimens (one flake, three projectile points), all from the Coso Volcanic Field, provided rim measurements of 2.8/3.3, 3.0, 3.9, and 4.3 microns. These results indicated an age for the site between ca. A.D. 1280 and 1680 (Sutton 1984:51). The beads date between ca. A.D. 1500 and 1810, and the projectile points date from A.D. 1000 to historic times. Together, these data demonstrated site occupation between about A.D. 1000 and 1810 (Sutton 1984:51), commencing roughly at the beginning of the Late Prehistoric Period. This corresponds with the evidence from CA-KER-303 (see above), prompting Sutton (1984:51) to argue that the two sites were occupied concurrently, as CA-KER-303 is less than 100 meters away from CA-KER-733. Based on this chronological evidence, CA-KER-733 is considered here to date to the Late Prehistoric Period.

Interpretations

Based on the results of his investigations, Sutton (1984:51) interpreted CA-KER-733 as a "special activity site occupied contemporaneously, and in conjunction with, the large village at Ker-303." Sutton (1984:53) further suggested that the function of CA-KER-733 may have been as an ancillary locus to CA-KER-303, perhaps for food preparation following communal drives, particularly of rabbits (also see Yohe 1984:67). According to Sutton (1984:53), this suggestion was supported by the presence of projectile points

and the virtual absence of milling equipment at CA-KER-733. Yohe (1984:67) also suggested that the presence of large amounts of charcoal indicated that large fires were maintained in order to cook as many rabbits as possible during the course of a single communal hunt.

CA-KER-875 (Koehn Lake)

Site Description

The Koehn Lake site (CA-KER-875), a large site on the southwest shore of Koehn Lake in the Fremont Valley, was first identified by Stuart Peck in 1950 and formally recorded by Herrick Hanks in 1971 (Figure 10). Beginning in the fall of 1985, archaeological field classes from Cerro Coso College and later from CSUB, under the direction of Mark Q. Sutton, conducted excavations at Koehn Lake. While the site report has not yet been completed, the raw data from the site were provided to this author to include in this study.

The Koehn Lake site is situated within sand dunes on a small bench above a fossil shoreline of Koehn Lake, at an elevation of 1,930 ft. Extensive midden deposits and surface materials were evident on the surface of the site at the time of the excavations. The size of the site is at least 720 by 420 m.; it is probably much larger than that, but parts of the site could not be accessed because they were on federal land, for which no permit had been issued at the time of the excavations (Mark Q. Sutton, personal communication 2005). Due to its large size, the site was divided into multiple loci based on surface indicators (Sutton and Hansen 1986:2). As a result, 14 loci were identified, eight of which were chosen for testing, while the remaining loci were mapped but not tested.

Figure 10. View of Koehn Lake (near the top of the photo), taken ca. 1986. (Photograph courtesy of Mark Q. Sutton.)

Field Methods

A review of the catalogs for the Koehn Lake Site indicated that a total of 26 test units was excavated in eight loci; seven in Locus 1, three in Locus 2, one in Locus 6, two in Locus 7, one in Locus 8, 15 in Locus 10, two in Locus 11, and one in Locus 12. Most of the units were 1 by 2 m., although a few were 1 by 1 m. All units were excavated in 10-cm. levels, with all soil screened through 1/8-in. mesh. Surface scrapes were also placed in a few of the loci.

Features

Of the eight loci that were tested, features were discovered in Loci 1, 2, 6, 8, 10, and 12, while there were none in Loci 7 and 11. Along with other types of features, hearths were revealed in all of the loci that contained features. The catalog review demonstrated that Locus 10 produced the most intriguing features, including multiple hearths, a ground stone concentration, a possible ash dump, a concentration of fox skulls, and a structure.

The structure was a circular, semisubterranean "pithouse" located at the base of the deposit (Sutton 1990:3; Sutton and Hansen 1986:2).

Material Culture

The material culture from Koehn Lake consisted of artifacts from the units and from surface collections. These include projectile points, bifaces, cores, drills, a possible knife, hammerstones, modified flakes, debitage, ground stone items, a stone ball, shell and stone beads, green slate ornaments, bone awls, and pottery sherds. Because Locus 10 had far more units than the other loci, the catalogs were split between Locus 10 and all other loci, which is how they are treated here. The inventory listed below was derived from a relatively cursory examination of the handwritten catalogs of the site, and is not intended to be the definitive artifact tabulation.

From all but Locus 10, the flaked stone artifact assemblage includes 16 Rose Spring projectile points, 13 of which are obsidian, two are chalcedony, and one is jasper. One point was identified in the catalog as Eastgate, and is made of jasper. Cottonwood points include five obsidian, two chalcedony, and one rhyolite specimens. Desert Side-notched points are represented by a single obsidian specimen. Unclassified points consist of nine specimens of obsidian, two of chalcedony, and one of jasper. There is a total of 16 bifaces, 11 of obsidian, four of chalcedony, and one of jasper. Other flaked stone items include 21 cores, two drills, a possible obsidian knife, six hammerstones, and 12 modified flakes (eight of which were manufactured from obsidian). Debitage consists of various materials, including obsidian ($n \geq 3,600$), chalcedony ($n \geq 1,600$), jasper ($n \geq 400$), and others (quartz, quartzite, rhyolite, chert; $n \geq 450$).

Ground stone items include manos and mano fragments of various materials ($n \geq 200$), metates and metate fragments of various materials ($n \geq 100$), unidentified ground

stone fragments (n ≥ 35), and stone bowl fragments (at least three). In addition, these loci produced 29 *Olivella* beads, including one saucer, 14 wall/disk, three spire ground/lopped, and 11 untyped (per Bennyhoff and Hughes 1987). There were also *Haliotis* and clamshell ornaments, green and black slate ornament fragments, two pottery sherds, and a bone awl.

In Locus 10 alone, there are four obsidian Rose Spring projectile points and one chalcedony Rose Spring point. Cottonwood points are represented by one rhyolite and three obsidian specimens. Untyped points include 15 made of obsidian, one of chert, and one of jasper. Other flaked stone items consist of five bifaces (three obsidian, two chalcedony), six modified flakes (five obsidian, one jasper), seven cores, two hammerstones, and two obsidian drills. The debitage count for Locus 10 is roughly 9,700, the vast majority of which is made of obsidian (n ≥ 6,400), with the remaining specimens made of chalcedony (n ≥ 2,000), jasper (n ≥ 550), chert (n ≥ 70), and other materials (primarily quartz or quartzite; n ≥ 700).

Manos and mano fragments (n ≥ 95), metates and metate fragments (n ≥ 45), a pestle, a ground stone ball, and unidentified specimens (n ≥ 20) make up the ground stone tools from Locus 10, many of which are burned. The shell beads are all made of *Olivella* (nine wall, one spire-lopped, 10 untyped). The remaining artifacts from this locus consist of a clamshell ornament, a bone awl, a ceramic sherd, and four green slate ornaments.

Faunal and Botanical Remains

Although the faunal and botanical analyses are incomplete, this author has begun the process of analyzing the faunal remains. The total faunal assemblage has not been calculated, but it is estimated to be somewhere around 100,000 specimens (Mark Q. Sutton, personal communication 2003). Thus, it was deemed prudent to take a sample of

these faunal remains for study. That sample has also not been tabulated, but is estimated to be about 20,000. While the analysis is still in progress, of the thousands of remains that have been identified thus far, the vast majority have been either *Lepus californicus*, *Lepus* spp., or lagomorph. There are also numerous specimens that have been identified as small mammal that are probably lagomorphs, the majority of which is burned. This initial analysis coincides with what was observed during the field work and subsequent cursory examinations of the faunal assemblage.

The incomplete results of the faunal analysis from Koehn Lake so far appear to correspond well to that of nearby CA-KER-2211 (see below), in that the vast majority of faunal remains at the latter site were identified as jackrabbit or rabbit-sized. At Koehn Lake, the analysis thus far indicates a variety of jackrabbit skeletal elements. This provides evidence that hare exploitation was a major activity at Koehn Lake, and may indicate mass collection via rabbit drives, as suggested by Yohe and Goodman (1991:218) at CA-KER-2211. In fact, Yohe and Goodman (1991:219) maintained that the Fremont Valley "was most likely one of the fall rabbit drive areas for the Kawaiisu and their predecessors."

Of the remaining faunal remains from the Koehn Lake site that have not been identified as lagomorphs, a large number are small rodents (e.g., *Dipodomys* spp., *Perognathus* spp., *Ammospermophilus* spp., *Neotoma* spp.). There are also remains of cottontail rabbit (*Sylvilagus audubonii*), fox (*Urocyon cinereoargenteus*), badger (*Taxidea taxus*), desert tortoise (*Gopherus agassizii*), and horned lizard (*Phrynosoma* cf. *platyrhinos*), among others. As of this writing, little analysis has been conducted on the botanical remains from Koehn Lake, but juniper (*Juniperus* spp.) berries were recovered from several of the hearths and the structure at Locus 10. It is likely that when the

botanical analysis is complete, specimens of pinyon (*Pinus monophylla*) will also be identified, as pinyon is often associated with juniper (Sutton 1990:4).

Dating

Dating for the Koehn Lake site was derived from projectile point and shell bead typologies, radiocarbon assay, and obsidian hydration analysis (Sutton 1990:3; Sutton and Hansen 1986:3). The identified projectile points are predominantly Rose Spring series, while the remaining points are Desert series (primarily Cottonwood Triangular and Desert Side-notched).

Two radiocarbon samples were submitted from Locus 1, one from Locus 6, and five from Locus 10. The samples from Locus 1 were taken from TU-2, one at 78 to 85 cm., and the other from 120 to 130 cm. These resulted in dates of 970 ± 70 and 1,180 ± 40 RCYBP, respectively (Sutton 1990). The single sample from Locus 6 came from TU-1 at 60 to 70 cm., and produced a date of 1,140 ± 50 RCYBP. The five samples from Locus 10 came from TUs 3, 4, 5, 7, and 9, and ranged in depth between 30 and 70 cm. The dates from these five samples were 1,110 ± 70, 1,430 ± 60, 1,240 ± 90, 1,300 ± 60, and 1,420 ± 50 RCYBP, respectively.

The obsidian hydration specimens consisted of projectile points and bifaces from Locus 1 (n = 10) and Locus 10 (n = 13). The hydration measurements from these specimens ranged between 4.0 and 5.5 microns, with the exception of one with two readings (6.4 and 13.0 microns). All of these obsidian artifacts were derived from the Coso Volcanic Field, with 19 of those specifically identified to the Sugarloaf subsource (Mark Q. Sutton, personal communication 2004).

The radiocarbon and obsidian hydration results, as well as the preponderance of Rose Spring projectile points, clearly demonstrate a virtually single-component Rose Spring

Period occupation. In fact, while it contains a few items of Gypsum and Late Prehistoric age, it is overwhelmingly Rose Spring in its character and composition and is "absolutely a single-component site," with the earlier and later items constituting mere "noise" (Mark Q. Sutton, personal communication 2005). To further support this age assignment, Sutton and Hansen (1986) argued that the archaeological materials at Koehn Lake were almost entirely restricted to the top of the bench on which the site rests; thus, if the site was younger than the lake stand, the deposit would likely have overlapped the shoreline feature rather than resting solely on top of it (Sutton and Hansen 1986).

Interpretations

The Koehn Lake site has been interpreted as a large Rose Spring Period village dating between ca. 970 and 1,430 RCYBP (Sutton 1990, 1991a, 1991b). The enormous quantity of lagomorph remains attests to a significant fall occupation of the site (Steward 1938). It is also one of the few sites in the western Mojave Desert where a substantial structure has been identified, implying a winter occupation as well, as such significant shelter would not be necessary during warmer seasons (Sutton 1990). This proposed multiple occupational sequence suggests permanent settlement at the site, with other sites in the area used on an occasional or seasonal basis, such as perhaps the Coffee Break site (Gardner 2002; see below).

The study at Koehn Lake demonstrated the presence of four fossil stands of the lake, the most significant being a nonephemeral stand at an elevation of 586 m. (Sutton 1991a:2; also see Gardner 2002:9). While there are currently no geological studies of Koehn Lake, Sutton and Hansen (1986:6) argued that the occurrence of such a substantial shoreline would have required an increase in the precipitation rate, a decrease in the evaporation rate, or a combination of both, suggesting that "the environment of the

southern Sierra Nevada and its eastern slopes was somewhat different during the time 2,000 B.P. to 1,000 B.P." Then at around 1,000 B.P., the lake appears to have desiccated to the point that the site was abandoned, "although water is still present on an ephemeral basis" (Sutton and Hansen 1986:6). This event roughly coincides with the MCA (see Jones et al. 1999; also see Chapter 1).

Sutton (1990:3) observed that occupation of the site was concurrent with the above-mentioned 586-m. lake stand. Thus, Sutton (1990) proposed that the site inhabitants exploited the lacustrine resources provided by the lake. The sheer quantity of the ground stone artifacts provided evidence that grinding was a major activity at the site. Many of these artifacts were burned and broken, suggesting that they were used to heat water for cooking in watertight baskets (Sutton 1990:4).

CA-KER-1998 (Oak Creek Canyon)

Site Description

The Oak Creek Canyon Site (CA-KER-1998) is located in the foothills of the Tehachapi Mountains, "within the ecotone between the Mojave Desert and the Tehachapi Mountains" (Sutton and Everson 1992:43). It is about 10 mi. west of the community of Mojave, at an elevation of 1,200 m. The site is situated at the intersection of two small stream channels that flow into Oak Creek 200 m. to the south. It contains a substantial midden that is at least one meter deep. The midden is buried by a large sand dune, exposing only the southeast portion of it. The eastern margin of the site has been cut by one of the stream channels, revealing a large section of the midden in profile (Sutton and Everson 1992:43). During a subsequent site visit by this author and Sutton in 2003, it was noted that the midden was still visible in portions of the site, and a few artifacts

Figure 11. View of the Oak Creek Canyon site (CA-KER-1998). This photograph, taken ca. 1989, shows a portion of the midden that was exposed by one of the adjacent stream channels. (Photograph courtesy of Mark Q. Sutton.)

(mostly ground stone fragments) wexre observed on the surface. As a large portion of the site is covered by the dune, the dimensions could not be fully and accurately determined during the investigations by Sutton and Everson (1992), but the site encompasses at least 100 by 150 m., and undoubtedly it is significantly larger than that.

Field Methods

During Sutton and Everson's (1992) investigations, two 1 by 2 m. test units were excavated in 10-cm. levels, with all soil screened through 1/8-in. mesh. In addition, a 60-m. profile of the midden was illustrated. TU-1 was placed in the midden exposure along the southeast portion of the site and TU-2 was placed just outside the midden in order to determine a minimum date for the dune (Sutton and Everson 1992:46).

Features

One feature was recorded at the Oak Creek Canyon Site in TU-1, a hearth beginning at a depth of 30 cm. and ending at 50 cm. (Sutton and Everson 1992:48). This hearth

contained very dark soil, along with burned and unburned stones. There was also a small amount of faunal and botanical remains from this hearth (see below). Unfortunately, there were insufficient materials that were suitable for radiocarbon dating.

Material Culture

The material cultural from the Oak Creek Canyon Site consisted of flaked stone tools, ground stone implements, and an *Olivella* shell bead (Sutton and Everson 1992:50-57). The flaked stone items included one obsidian Rose Spring series and two obsidian Desert series (Desert side-notched and Cottonwood triangular) projectile points, seven bifaces, three cores, and more than 400 pieces of debitage. The flaked stone artifacts were made from a variety of materials, including (in order of frequency) cryptocrystallines (chalcedony, chert, jasper; 64.5%), obsidian (16.8%), rhyolite (16.1%), quartzite (1.3%), basalt (1.0%), and fused tuff (0.3%), with cryptocrystallines representing by far the largest percentage of toolstone.

Four complete manos, seven mano fragments, and two metate fragments made up the identified ground stone implements from the site. All but one of these were made of granite, and two were burned (Sutton and Everson 1992:50-53). There were also 11 unidentified ground stone fragments of quartzite, granite, basalt, and sandstone. In addition, an *Olivella biplicata* bead identified as K1 (per Bennyhoff and Hughes 1987:137) was recovered from TU-2 between 117 and 127 cm. Finally, fire-affected rock was found throughout the deposit, suggesting the presence of other hearth or roasting pit features (Sutton and Everson 1992:58).

Faunal and Botanical Remains

Faunal remains from Oak Creek Canyon consisted of 1,627 fragments, of which 1,515 were identified to at least the class level (Sutton and Everson 1992). Most of these

remains were identified as rabbit-sized (n = 1,155), although an additional 177 specimens were identified further as *Lepus californicus,* 18 as *Sylvilagus audubonii,* and five as unidentified lagomorphs. The next most abundant elements were deer-sized mammals (n = 66), woodrat (*Neotoma*; n = 7), unidentified lizard (n = 7), *Canis* or coyote-sized (n = 5), kangaroo rat (*Dipodomys*; n = 3), artiodactyl (n = 3), reptile (n = 2), rodent (n = 60), and one each of California mole (*Scapanas latimanus*), squirrel (Sciuridae), ground squirrel (*Ammospermophilus*), pocket gopher (*Thomomys bottae*), pocket mouse (*Perognathus*), mouse (*Peromyscus*), and snake.

Botanical remains recovered from the site included 30 small, unburned seeds from the hearth in TU-1. These were identified as red-stem filaree (*Erodium cicutarium*), horehound (*Marrubium vulgare*), and buckwheat (*Eriogonum* sp.) (Sutton and Everson 1992:48, 58). Other botanical specimens included burned juniper (*Juniperus* cf. *californica*) scattered throughout the midden. Because filaree and horehound were introduced very late in time and buckwheat is native, their presence in the hearth suggested to Sutton and Everson (1992:48) that this was either the result of bioturbation (evident in the soil profiles) or that site dated late enough that the inhabitants would have had access to these plants.

Dating

As noted above, there were no suitable materials for radiocarbon dating from Oak Creek Canyon (Sutton and Everson 1992:62). Thus, the site was dated by way of the diagnostic projectile points (Rose Spring and Desert series), the *Olivella* shell bead, and obsidian hydration analysis.

Seven obsidian measurements ranged between 2.2 and 5.2 microns, although five of the measurements clustered between 3.3 and 3.7 microns. All of the obsidian came from

the Coso Volcanic Field. Sutton and Everson (1992:62) argued that the totality of these dating techniques indicated that the site was a multicomponent Rose Spring and Late Prehistoric period site.

Interpretations

Sutton and Everson (1992:61:62) maintained that the frequency of lagomorph remains strongly suggested a primary subsistence focus of hare exploitation, which would require several families to have a successful rabbit drive (e.g., see Kroeber 1935; Steward 1938). Despite the sparse artifact assemblage, they further argued that the size of the site and the focus on hares implied the presence of a relatively large group of people, larger than what would typically be expected from a small, temporary camp (Sutton and Everson 1992:62). The paucity of artifacts probably reflects the fact that only two test units were excavated; the sheer size of the site strongly suggests that further excavations would likely support this interpretation. No season of occupation was offered by Sutton and Everson (1992), but based on the presumed hare focus, it may have been late summer or fall.

Sutton and Everson (1992:43) observed that the dune event associated with the Oak Creek Canyon site is roughly concurrent with the desiccation of Koehn Lake beginning about 1,000 years ago (at about the time of the MCA). This is supported by research in the Fremont Valley and Rosamond area not far from Oak Creek Canyon (Sutton 1990, 1991b, 1993b; Sutton and Hansen 1986). Sutton and Everson (1992:43) proposed that due to these conditions, "the Kawaiisu may gradually have shifted their core occupational territory to the southern Sierra Nevada, while still retaining claims to the western Mojave Desert." This situation may also have resulted in different adaptational systems in this region, one during the Rose Spring Period and one during the Late Prehistoric Period, the

former adapted toward lake resources and hares and the latter toward streams and/or springs and a different (and as yet unknown) resource focus (Sutton and Everson 1992:63).

CA-KER-2211 (Cantil)

As the result of an archaeological testing program in the late 1980s in advance of large-scale construction in the Fremont Valley of the western Mojave Desert, 3,840 acres of land were inventoried and/or excavated (Sutton 1991b). In all, 12 prehistoric sites, one historical site, and 119 isolated artifacts were documented. Of the 12 prehistoric sites, eight were mapped, surface collected, and excavated (Sutton 1991b:1). The other four sites had been heavily impacted by agriculture and were not thought to contain intact deposits (Sutton 1991:1). The largest of these sites, CA-KER-2211, is detailed below. The other, much smaller, sites are described together at the conclusion of the discussion of CA-KER-2211. All of the sites have generally been referred to collectively as the Cantil sites due to their location within the Cantil Test Track, an automobile testing facility, the construction of which was the impetus for this study.

Site Description

Site CA-KER-2211 is located at the crest of a small ridge near the junction of Cottonwood and Cache creeks in the Fremont Valley of the western Mojave Desert, a few miles southwest of Koehn Lake (CA-KER-875; Sutton 1991b:22). At the time of this investigation, the site contained areas of dark soil indicative of a substantial midden (Sutton 1991b:83). In addition, there is a dirt road that bisects the site on the east-west axis. A large number of surface artifacts and fire-affected rock, along with the concentrations of dark soil, were documented on both sides of this road. Agricultural

activities that have taken place since the early 1940s were evident in obvious disturbance to the site. Due to distinct differences between the east and west portions of the site, each portion was designated as a separate locus (Locus 1 and Locus 2). The dimensions of the site are approximately 825 by 225 m. (Sutton 1991b:83).

Field Methods

Along with a surface collection of formed artifacts and obsidian debitage, excavation units and surface scrapes were placed in three phases (Sutton 1991b:85). In all, six 5 by 5 m. surface scrapes, seven 1 by 1 m. test units, and six 1 by 2 m. test units were placed in Locus 1, and three 5 by 5 m. surface scrapes and two 1 by 1 m. test units were placed in Locus 2. In addition, a small backhoe trench was placed at Locus 2 in the center of one of the surface scrapes.

The surface scrapes were excavated to a depth of three to five cm. The test units were excavated in 10-cm. levels, with the exception of some of the units in Locus 1. As it had been determined that a plow zone was present at Locus 1, during the second phase of investigations the first level of six of the units in this locus was excavated to 45 cm. All soil was screened through 1/8-in. mesh. Soil and column samples were taken from features and test units (Sutton 1991b:88).

Features

Locus 1. Sixteen features were documented at Locus 1, although five were later determined to be noncultural and were ultimately eliminated from analysis (Sutton 1991b:93). Of the remaining 11 features, there were four hearths, four possible hearths, an obsidian cache, a rock pile, and a structure (Sutton 1991b:90-98). Three of the confirmed hearths contained fire-affected rock, and two were radiocarbon dated. The obsidian cache consisted of five large flakes and a core. An obsidian biface was found

nearby and may have been associated with the cache (Sutton 1991b:93). The biface and one of the flakes from this cache were submitted for sourcing and hydration (see below). The rock pile consisted of a number of fire-affected rocks in what appeared to be an intentional configuration, although its function was not clear and no radiocarbon samples were recovered. Within the pile of rocks were a burned metate fragment and a burned mano fragment (Sutton 1991b:94).

The structure contained a 10-cm. thick compacted lens of charcoal and burned soil (Sutton 1991b:94). Its configuration was oblong and dish-shaped. Two burned metate fragments were directly associated with this feature, and an obsidian Rose Spring projectile point was recovered below it and may also have been associated. There were also numerous faunal and botanical remains found in the soil samples taken from within the structure, and radiocarbon samples were removed (see below). Sutton (1991b:98) suggested that this structure represented a wickiup, "a simple structure that was built on the surface to shelter a family."

Locus 2. No features were identified at Locus 2, despite the excavation of three surface scrapes, two test units, and the backhoe trench (Sutton 1991b:144).

<u>Material Culture</u>

Locus 1. The cultural inventory from Locus 1 of CA-KER-2211 consisted of 4,944 artifacts, including flaked and ground stone tools, shell and stone beads, ceramics, ochre, and bone awls (Sutton 1991b:98-139).

The flaked stone category of artifacts from Locus 1 included Cottonwood Triangular projectile points (n = 6), Desert Side-notched points (n = 6), Rose Spring points (n = 14), a Humboldt point, and seven unclassified point fragments (Sutton 1991b:Table 26). Of the 34 projectile point specimens, 25 were made of obsidian, five were made of

chalcedony, two were made of rhyolite, one was made of basalt, and one was made of chert (Sutton 1991b:Table 32). In addition, there were 18 bifaces (eight obsidian, five chalcedony, three chert, two jasper), nine unifaces (four chalcedony, three rhyolite, two jasper), a rhyolite chopping tool, two obsidian drill bases, 52 cores (33 chalcedony, nine jasper, seven rhyolite, one each of chert, quartzite, and obsidian), 28 modified flakes (17 obsidian, six chalcedony, four jasper, one rhyolite), 10 hammerstones (five chalcedony, two each of rhyolite and quartzite, one chert), and 4,449 pieces of predominantly obsidian debitage (Sutton 1991b:127).

The ground stone items at Locus 1 included metates (n = 53), manos (n = 113), pestles (n = 2), stone balls (n = 3), green and grey slate fragments (n = 11), a shaft straightener, and unidentified ground stone fragments (n = 111) (Sutton 1991b:Table 26). There were various material types represented by these ground stone artifacts, including basalt, sandstone, quartzite, granite, and schist. The slate fragments had incised surfaces and ground edges (Sutton 1991b:108).

The excavations at Locus 1 also produced 25 *Olivella biplicata* beads, one *Haliotis* ornament, seven steatite beads, seven ceramic fragments, one ochre fragment, three large mammal bone awls, and two unidentified fragments of modified large mammal bone (Sutton 1991b:Table 26). The *Olivella* shell bead types included small spire-lopped, lipped, saddles, saucers, ground disks, cupped, oval punched, and split drilled (Sutton 1991:134). The ceramic fragments were all undecorated brown ware (Sutton 1991b: 138). The ochre was probably used as pigment.

Locus 2. Locus 2 produced 695 artifacts, considerably fewer than at Locus 1. These items included flaked and ground stone tools, as well as shell and stone ornaments (Sutton 1991b:144-175).

The flaked stone category of tools consisted of projectile points and point fragments (n = 7), bifaces (n = 12), unifaces (n = 9), a drill, cores (n = 55), hammerstones (n = 6), modified flakes (n = 27), and debitage (n = 351) (Sutton 1991b:160-171). The projectile points included two obsidian Cottonwood types, one chalcedony Desert Side-notched type, one basalt Rose Spring type, and three unclassified specimens (two obsidian, one chalcedony). The materials for the bifaces and unifaces included chalcedony, obsidian, jasper, chert, and rhyolite, while the drill was obsidian. The cores, hammerstones, and modified flakes were also made of a variety of materials, although the predominant material was chalcedony. There was also a variety of debitage material, again with chalcedony occurring most frequently (Sutton 1991b:160-173).

The ground stone implements discovered at Locus 2 consisted of metates and metate fragments (n = 16), manos and mano fragments (n = 106), a mortar, pestles (n = 3), stone spheres (n = 2), unidentified fragments (n = 78), and incised green slate fragments (n = 3) (Sutton 1991b:144-160). The metates were made primarily of sandstone and breccia, but there were also specimens of basalt, granite, schist, and rhyolite. The materials for the manos were similar, but also included dacite, pumice, and quartzite. The mortar and stone spheres were made of breccia, the pestles of granite and rhyolite, and the unidentified fragments of a variety of materials.

Nine *Olivella biplicata* shell beads, one *Haliotis* shell ornament, and five stone beads were also recovered from Locus 2 (Sutton 1991b:171-175). The *Olivella* beads were classified as Types E1a, E2, K1, E2a, and K3 (per Bennyhoff and Hughes 1987). The *Haliotis* specimen was the upper portion of a small pendant. Four of the stone beads were a grey-green steatite, while one was described as a reddish-colored stone (Sutton 1991b:175).

Faunal and Botanical Remains

Locus 1. A large quantity of faunal remains (n = 30,398) was found in this locus. The vast majority of these was identified as jackrabbit (*Lepus californicus*; n = 6,353) or rabbit-sized mammal (n = 21,744). In smaller numbers (in order of frequency) were rodent-sized mammals (n = 1,029), unidentified lizard (n = 275), kangaroo rats (*Dipodomys*; n = 211), deer-sized mammal (n = 141), cottontail rabbit (*Sylvilagus audubonii*; n = 106), horned lizard (*Phrynosoma*; n = 104), woodrat (*Neotoma lepida*; n = 91), gopher snake (*Pituophous melanoleucus*; n = 69), a variety of birds (mostly unidentified; n = 66), dog/coyote or coyote-sized (*Canis*; n = 44), pocket mouse (*Perognathus*; n = 30), ground squirrel (*Spermophilus*, *Ammospermophilus*; n = 33), tortoise (*Xerobates agassizii*; n = 22), snake (*Crotalus*, *Arizona elegans*, unidentified snake; n = 21), unidentified artiodactyl (n = 18), pocket gopher (*Thomomys bottae*; n = 7), sheep (*Ovis*; n = 7), lizard (*Cnemidophorous tigris*, *Uta*, *Sceolporous*, *Sauromalus obesus*, *Disposaurus dorsalis*; n = 6), weasel (*Mustela frenata*; n = 2), mouse (*Peromyscus*; n = 2), and one each of grey fox (*Urocyon cinereoargenteus*) and deer (*Odocoileus hemionus*) (Yohe and Goodman 1991).

Most of the botanical remains from Locus 1 were juniper (*Juniperus californica*) seeds associated with the structure (see above), although a few were discovered in other areas of the midden (Sutton 1991b:139). While juniper was used as food by the Kawaiisu (Zigmond 1986:399), the seeds from this locus are more likely from structural debris or firewood.

Locus 2. The faunal remains from Locus 2 (n = 800) were dramatically fewer than in Locus 1. However, once again, jackrabbit (*L. californicus*; n = 156) and rabbit-sized (n = 610) elements were predominant (Yohe and Goodman 1991), followed by deer-sized (n =

19), cottontail rabbit (*S. audubonii*; n = 3), kangaroo rat (*Dipodomys*; n = 3), two each of woodrat (*N. lepida*) and pocket gopher *(T. bottae*), and one each of mouse (*Peromyscus*), ground squirrel (*A. leucurus*), and artiodactyl. No botanical remains were recovered from Locus 2.

Dating

Locus 1. The dating of Locus 1 was determined by radiocarbon, typological, and obsidian analyses (Sutton 1991b:141-142). Two of the radiocarbon assays came from charcoal in the structure and two from charcoal in two of the hearths. The radiocarbon dates from the structure were 940 ± 100 and 1,300 ± 100 RCYBP (uncorrected). The assays from the two hearths returned results of 940 ± 80 RCYBP (uncorrected) and modern. The typology for the projectile points indicated a Rose Spring Period occupation from the lower intact deposit, while the upper disturbed deposit dated to the Late Prehistoric Period (Sutton 1991b:141-142). The bead typology supported this evidence.

Eighteen projectile points, a flake, and a biface were submitted for obsidian sourcing and hydration analysis (Sutton 1991b:140-141). All of them were chemically characterized to the Coso Volcanic Field. Ten of the points submitted were Rose Spring series, four were Desert Side-notched, three were Cottonwood, and one was the Humboldt. The hydration measurements ranged between 12.0 and 1.1 microns, with a cluster of values (n = 13) between 2.6 and 5.5. The 12.0-micron measurement was on a Rose Spring point that had two readings, the other one being 5.3 microns. Disregarding that reading, the hydration results strongly suggested a Rose Spring Period occupation. No calendar dates were calculated for these obsidian results "due to the uncertainty of a Coso rate in light of unknown temperature variables" (Sutton 1991b:141).

Locus 2. Radiocarbon dating at Locus 2 was not possible, as no appropriate materials were recovered (Sutton 1991b:176). The projectile points provided an occupation span between the Rose Spring and Late Prehistoric periods, with perhaps a slightly greater occupation during the latter period, as three of the points were Desert series, while only one was Rose Spring series. This argument was supported by the bead typology (Sutton 1991b:176-177). In addition, obsidian analysis was performed on two of the Desert series projectile points. Both were chemically characterized to the Sugarloaf source of the Coso Volcanic Field. One specimen had a rind measurement of 3.0 microns, while the other specimen had a reading of 2.5 microns. Sutton (1991b:176-177) suggested that the obsidian results provided "a hint . . . that the late Prehistoric occupation of Locus 2 slightly predates that of Locus 1."

Interpretations

Locus 1. Locus 1 at CA-KER-2211 was interpreted as a multicomponent occupation site with an early component dating to the Rose Spring Period (beginning about A.D. 1200) and a later component dating to the Late Prehistoric Period (Sutton 1991b:142). Agricultural disturbance was evident in the entire late component and part of the earlier component, "masking artifact differences between the two" (Sutton 1991b:142).

Nevertheless, Sutton (1991b:142) observed that there appeared to be a major difference in the ground stone inventory between the two occupations, in that the Rose Spring component contained only a few manos or mano fragments, while the Late Prehistoric component contained significant numbers of milling stones, many of them intact. Further, a majority of the metates and manos were found in the northern section of the locus, some distance from the Rose Spring deposit. While this could be due to sampling bias or agricultural disturbance, Sutton (1991b:142) argued that "the obvious

disparity between the two components suggests that the dichotomy is real." A similar pattern was observed at the neighboring Koehn Lake site (Sutton 1986, 1990; see above).

The features and structure at Locus 1 provided evidence that occupation of CA-KER-2211 was "reasonably substantial" (Sutton 1991b:142). The agricultural disturbance that breached both the earlier and later components likely destroyed many of the features at Locus 2 that may have been present at one time, but the large amount of fire-affected rock suggested that hearths may have been present. The differences in the ground stone and core assemblages between the two components were not reflected in the faunal remains, both of which were dominated by jackrabbits, indicating a continuing focus on this resource (Sutton 1991b:143).

The occurrence of obsidian and shell beads indicated that the occupants of the site participated in some type of regional trading network. On the other hand, the amount of cortical specimens on the obsidian flaked stone tools, most of which were derived from the later component, provided evidence that the obsidian was transported to the site as rough bifaces and/or cores (Sutton 1991b:143). This may be indicative that the inhabitants were obtaining the obsidian themselves rather than trading for it. Finally, the juniper specimens recovered from the structure at Locus 1 demonstrated that the environment was cooler and wetter during the occupation span of CA-KER-2211 than it is today (Sutton 1991b:143).

Locus 2. Locus 2 was interpreted as a camp (Sutton 1991b:177). Similar to Locus 1, there was a considerable amount of fire-affected rock on the surface of this locus, again hinting that hearths may have been present at one time. The frequency of milling equipment and cores suggested a site function similar to the Late Prehistoric Period component of Locus 1. The primary subsistence focus appears to have been on the

acquisition of hares, as well as the processing of unknown resources on the milling equipment and the manufacture of cores (Sutton 1991b:177). The lower frequency of artifacts overall, as compared with Locus 1, reflected "less intensive use of Locus 2, rather than a different function" (Sutton 1991b:177).

Other Cantil Sites

In addition to CA-KER-2211, seven smaller prehistoric sites and one historical site were also investigated at Cantil. No further consideration is given to the historical site here, but the prehistoric sites include CA-KER-2209, -2210, -2212, -2214, -2215, -2217, and -2218. Site CA-KER-2217 was not excavated and thus is not discussed further.

Site Descriptions

All six of the sites discussed below are located within five km. of each other, adjacent to CA-KER-2211 and a short distance southwest of CA-KER-875 (Koehn Lake) in the Fremont Valley (Sutton 1991b). The approximate dimensions of the sites are as follows (in order by trinomial): 300 by 225 m. (CA-KER-2209); 130 by 100 m. (CA-KER-2210); 135 by 140 m. (CA-KER- 2212); 75 by 75 m. (CA-KER-2214); 100 by 150 m. (CA-KER-2215); and 35 by 60 m. (CA-KER-2218). The sites were generally identified as relatively small and/or very diffuse artifact scatters (Sutton 1991b). Five of the sites are located between Cottonwood Creek to the west and Cache Creek to the east, while the sixth site (CA-KER-2215) is situated on the east side of Cache Creek (Sutton 1991b:22). All of the sites had been disturbed by agricultural activities.

Field Methods

The test units for all of the Cantil sites were either 1 by 1 m. or 1 by 2 m. in size. Surface scrapes and backhoe trenches were conducted at a few of them, and all were

surface collected. All were excavated in 10-cm. levels and screened through 1/8-in. mesh (Sutton 1991b).

Features

Only one feature was identified from all six of these sites, which was a hearth discovered at CA-KER-2218 (Sutton 1991b:72). A soil sample was taken from this feature in order to obtain materials for radiocarbon assay, as well as for faunal and botanical analyses (Sutton 1991b:79).

Material Culture

The material culture from the six sites at Cantil included relatively small to very small quantities of flaked and ground stone implements, green slate fragments, and an *Olivella* shell bead (Sutton 1991b). The flaked stone specimens included projectile points, bifaces, unifaces, chopping tools, cores, hammerstones, modified flakes, and debitage. The largest artifact inventory was recovered from CA-KER-2209 (n = 216), while the smallest inventory came from CA-KER-2214 (n = 39). Not surprisingly, most of the artifacts consisted of debitage. Of the flaked stone items, chalcedony was clearly the predominant material; of the 567 flaked stone tools and debitage from all six sites, 308 (54%) were made of chalcedony, while only 49 (8.6%) were made of obsidian. Other materials represented in the flaked stone inventory were jasper, rhyolite, quartzite, chert, basalt, and quartz. CA-KER-2209 contained the majority of the chalcedony artifacts (n = 111).

The projectile point types included a single obsidian Cottonwood from CA-KER-2209; one obsidian Desert Side-notched from CA-KER-2210; two obsidian Humboldts, one from CA-KER-2209 and one from CA-KER-2212; one chert Gypsum Cave and one rhyolite Elko Eared from CA-KER-2214; and five unclassified points, four from CA-

KER-2209 and one from CA-KER-2214 (of obsidian, chert, and chalcedony) (Sutton 1991b). The remainder of the flaked stone tools consisted of small quantities (less than six each) of hammerstones, bifaces, modified flakes, unifaces, and chopping tools. There was a larger amount of cores, which numbered 32 and were distributed among all sites except CA-KER-2214. However, the majority of the cores came from CA-KER-2209 (n = 10) and -2212 (n = 12).

Ground stone implements from the six sites included metates, manos, and pestles (Sutton 1991b). Materials represented in the ground stone assemblages included rhyolite, basalt, sandstone, breccia, granite, quartzite, and schist. There did not appear to be a pattern in the use of any particular material for the ground stone. The largest quantity of ground stone artifacts came from CA-KER-2209 (n = 34), followed in order of abundance by CA-KER-2210 (n = 27), CA-KER-2218 (n = 18), CA-KER-2214 and -2215 (n = 14 each), and CA-KER-2212 (n = 2). A single shell bead from CA-KER-2218 was identified as a *Olivella biplicata* Class J wall disk (per Bennyhoff and Hughes 1987; Sutton 1991b:77). In addition, two incised stone fragments were recovered from CA-KER-2210, and three incised slate fragments came from CA-KER-2215.

Faunal and Botanical Remains

Few faunal or botanical remains were recovered at any of these six sites (Sutton 1991b). At CA-KER-2209, eight fragments were identified, including two *Lepus californicus*, five rabbit-sized, and one large mammal. Faunal remains from CA-KER-2210 included 143 fragments, 23 identified as hare or rabbit (21 *Lepus californicus,* one *Sylvilagus audubonii*, one lagomorph), as well as 113 fragments of medium mammal and small quantities (less than two each) of lizards, birds, and rodents. At CA-KER-2214, there was a single mammal vertebra identified. Five bone fragments were recovered

from CA-KER-2215, including four *Lepus californicus* and one unidentified rodent. CA-KER-2218 produced 205 small bone fragments, which were predominantly *Lepus californicus* (n = 33), along with a small number of *Sylvilagus audubonii* (n = 3), one fragment of fox (*Urocyon* sp.), a small number of large mammal (n = 4), and a larger number of unidentified medium mammal (n = 164), many of which may have been hare. No faunal remains were recovered at CA-KER-2212, and no botanical remains were identified at any of the sites (Sutton 1991b).

Dating

CA-KER-2209. Sutton (1991b:36) noted that all of the projectile points except the Cottonwood specimen were heavily sandblasted, suggesting that the site predates the Rose Spring Period. The Cottonwood point, then, was considered to be essentially an "isolate" and not reflective of the antiquity of the site (Mark Q. Sutton, personal communication 2005). In addition, Sutton (1991b:36) argued that the geographic position of the site next to Cottonwood Creek, away from Koehn Lake, suggested that it was inhabited prior to the presence of the Rose Spring Period lake stand.

Moreover, the near absence of obsidian flakes at CA-KER-2209, coupled with the presence of the five large obsidian projectile points or point fragments (including the Humboldt specimen), is more characteristic of the Gypsum Period than the Rose Spring Period (Sutton 1991b:36). This is because projectile points are assumed to have been dart tips prior to the Rose Spring Period and the emergence of the bow and arrow, and would therefore have been larger, with little tool reworking and reuse of such points. This would at least partly account for the paucity of obsidian flakes at the site. The presence of the Humboldt point lends support for this argument, as this point type is often thought to date prior to the bow and arrow, although its temporal significance has not

been firmly established. Taking all of these inferences into consideration, while an accurate age for CA-KER-2209 could not be determined, for the purpose of this study it is considered to date to the Gypsum Period.

The five obsidian projectile points were submitted for sourcing and analysis. All were chemically characterized to the Coso Volcanic Field. Due to the sandblasting, only the Cottonwood point could be measured, producing a rind measurement of 2.7 microns (Sutton 1991b:35).

CA-KER-2210. Two obsidian flakes and the projectile point from this site were submitted for hydration analysis, which had measurements of 3.3, 3.3, and 5.2 microns, respectively (Sutton 1991b:45). The Desert Side-notched point suggested a Late Prehistoric Period occupation, which is supported by the obsidian hydration results on the two flakes, although the 5.2 measurement on the projectile point is somewhat higher than would be expected for this time period. All three specimens were chemically characterized to the Coso Volcanic Field.

CA-KER-2212. No diagnostic artifacts or radiocarbon specimens were recovered from this site. Obsidian sourcing and hydration analyses were conducted on three specimens, two flakes and the Humboldt projectile point, all derived from the Coso Volcanic Field. The Humboldt point had an obsidian rim measurement of 3.7 microns. One of the flakes measured 20.0 microns and the second had two readings of 18.6 and 20.8 microns. Sutton (1991b:53) suggested that these latter results represented either outliers or "the oldest site so far known in the Antelope Valley."

CA-KER-2214. The Gypsum Cave and Elko Eared projectile points from CA-KER-2214 indicated a Gypsum/Elko occupation (ca. 4,000 to 1,500 B.P.) (Sutton 1991b:59). No other chronometric or typological data were available for this site.

CA-KER-2215. No radiocarbon samples or diagnostic artifacts were recovered from CA-KER-2215. Obsidian rim measurements on two bifaces (4.5 and 5.6 microns) suggested an occupation prior to the Late Prehistoric Period, perhaps as early as the Rose Spring Period, although this interpretation is tenuous in the absence of supporting evidence (Sutton 1991b:68). Both specimens were characterized to the Coso Volcanic Field.

CA-KER-2218. The radiocarbon sample from the hearth at CA-KER-2218 returned a result of 2,490 ± 300 RCYBP (Sutton 1991b:79). This is suggestive of an occupation during the Gypsum Period. However, the *Olivella* bead is thought to date to the Late Period in southern California (Bennyhoff and Hughes 1987:136). As the bead and hearth were in the same test unit, it is difficult to interpret this discrepancy, especially since there were insufficient data recovered to determine whether the site may have had multiple components (Sutton 1991b:79). None of the obsidian specimens from this site was large enough for obsidian hydration and sourcing. Based on the radiocarbon date, then, the site is considered here to date to the Gypsum Period.

Interpretations

Four of the Cantil sites (CA-KER-2209, -2210, -2215, and -2218) were interpreted as small short-term or temporary camps. Sutton (1991b:36) suggested that the diversity of the artifacts from CA-KER-2209 indicated general, short-term habitation, rather than restricted activity (Sutton 1991b:36). Hunting and milling activities seem to have been equally important. While dating was problematic for this site, the decomposition of the artifacts (from sandblasting) may reflect a pre-Rose Spring Period occupation. CA-KER-2210 contained two concentrations of cultural material, which was interpreted as the remains of two small camps that may have been temporally unrelated (Sutton 1991b:46).

The abundance of ground stone and fire-affected rock at CA-KER-2210 site suggested the processing and cooking of unknown resources (Sutton 1991b:46).

At CA-KER-2215, milling and stoneworking appear to have been important activities, with hunting being of little importance (Sutton 1991b:68). The source for the slate fragments from CA-KER-2215 is unknown, but may be in the Slate Range northeast of Fremont Valley (Sutton 1991b:61). While it was unmodified, a fragment of shell that resembled *Haliotis* was recovered from this site, which would have originated from the Pacific coast and may indicate some type of trade. Even if it is a freshwater specimen, there is currently no evidence of mollusks from Koehn Lake or its tributaries (Sutton 1991b:66). At CA-KER-2218, Sutton (1991b:80) proposed that the presence of the hearth and milling implements indicated that it may have been a special purpose camp for the processing of food (Sutton 1991b:80). CA-KER-2218 was the only intact site of the six, although the northern portion of the site had been disturbed by modern activities.

Due to the dominance of cores, large flakes, and hammerstones, CA-KER-2212 was interpreted as small lithic workshop (Sutton 1991b:54). Further, Sutton (1991b:54) argued that while cores were manufactured at the site, tool production probably occurred elsewhere. The lack of milling equipment and other general use tools, as well as the absence of faunal and botanical remains, indicated that CA-KER-2212 probably was not a habitation site (Sutton 1991b:54). CA-KER-2214 was interpreted as a multifunctional Gypsum Period camp, as it contained both milling and hunting equipment (Sutton 1991b:60). This did not explain the absence of faunal and botanical remains, however. All of the obsidian specimens from these six sites that could be sourced were chemically characterized to the Coso Volcanic Field, demonstrating that either the occupants were part of an exchange system with other groups or that they traveled to obtain the obsidian.

Sutton (1991b:181) maintained that at least two major adaptational systems were represented at the Cantil sites, one dating to the Rose Spring Period and the other to the Late Prehistoric Period. Sometime during the transition between these two phases, ca. 1,000 years ago, the MCA occurred. This likely led to a change in resource exploitation, including the elimination of some resources and the addition of others (Sutton 1991b: 181). According to Sutton (1991b:181), observed differences in the ground stone assemblages at the Cantil sites provided evidence for this shift, although these differences may merely be indicative of a change in processing technology, irrespective of climate. The climate change may also have resulted in the retreat of human populations from the area as nearby Koehn Lake became desiccated (Sutton 1991b:181).

Rosamond Sites

The Rosamond sites were investigated during an archaeological testing program at CSUB between 1989 and 1990, as part of an environmental review process (Sutton 1993b:vii). A total of 23 sites was explored during the course of this program, two of which (CA-KER-519 and -520) had previously been recorded. Only 15 of the 23 sites were excavated, while the other eight were surface collected only. The following summarizes the results of only those sites that were excavated, which included CA-KER-519, -520, -2450, -2489, -2546, -2567, -2569, -2570, -2608, -2762, -2763, -2765, -2767, -2768/H, and -2769. All of the sites are situated within the Antelope Valley of the western Mojave Desert.

Site Descriptions

The Rosamond sites ranged in size from about 33 by 33 m. to about 350 by 450 m., with most of the sites (n = 10) closer in size to the largest site than the smallest one

(Sutton 1993b). Each site (or group of sites) in Sutton (1993b) was a separate article written by different authors; thus, they are discussed below in order by trinomial and author (or authors).

CA-KER-519. CA-KER-519 is located at the southern edge of the Rosamond Hills. In 1976, R. W. Robinson from Antelope Valley College recorded the site as being at least 550 by 700 m. in size. Construction activities since the 1970s have destroyed a large part of the site, which was later recorded as being ca. 110 by 350 m. in size (Parr 1993a).

CA-KER-520 and -2608. These two sites were investigated together (with two other sites that were not excavated) by Everson and Sutton (1993). Both sites are situated on an alluvial fan within a complex of sand dunes west of Rosamond on the western shore of Rosamond Lake (Everson and Sutton 1993:34). The largest site is CA-KER-520, measuring ca. 150 by 75 m., while CA-KER-2608 measured ca. 60 by 100 m.

CA-KER-2450. This site rests on the same alluvial fan as noted above, on the west side of Rosamond Lake (Sutton and Jackson 1993:10). The site is long and narrow, with dimensions of ca. 15 by 70 m.

CA-KER-2567, -2569, and -2570. These three sites, along with one other that was not excavated, were investigated by Osborne and Sutton (1993). These sites are south of Rosamond within the same dune complex as CA-KER-2450, directly adjacent to an ephemeral wash that drains into Rosamond Lake (Osborne and Sutton 1993:48). CA-KER-2567 measures ca. 90 by 60 m., CA-KER-2569 measures ca. 200 by 80 m., and CA-KER-2570 measures ca. 50 by 25 m.

CA-KER-2489, -2762, -2763, -2765, -2767, -2768/H, and -2769. This series of sites was part of 12 that were investigated by Everson et al. (1993), although only these seven were excavated. They are all located west of the town of Rosamond in the western

Rosamond Hills. CA-KER-2489 measures ca. 150 by 100 m., CA-KER-2762 measures ca. 500 by 100 m., CA-KER-2763 measures ca. 50 by 50 m., CA-KER-2765 measures ca. 450 by 250 m., CA-KER-2767 measures 150 by 100 m., CA-KER-2768/H measures ca. 400 by 300 m., and CA-KER-2769 measures ca. 75 by 125 m.

CA-KER-2546. Site CA-KER-2546 is located south of the Rosamond Hills at the northern margin of the Antelope Valley (Parr 1993b:137). The site covers an area of about 1,100 $m.^2$

Field Methods

All of the sites described here from Sutton (1993) were surface collected and excavated. Of a total of 61 test units placed at these sites, 15 were 1 by 1 m. and 46 were 1 by 2 m. in size, all of them excavated in 10-cm. levels. The majority of the test units were concentrated at CA-KER-2450 (n = 15), CA-KER-2567 (n = 16), and CA-KER-2569 (n = 11). All other sites contained four or fewer test units. All soils were screened through 1/8-in. mesh.

Features

Of the 15 sites discussed herein, only four contained features. These features are described below.

CA-KER-519. A surface rock concentration was identified where the single test unit was placed at this site. This feature may have been a hearth, although there was no evidence of fire (Parr 1993a:32).

CA-KER-520 and -2608. There were no features identified at CA-KER-520 or CA-KER-2608 (Everson and Sutton 1993).

CA-KER-2450. CA-KER-2450 contained two loci, designated Locus 1 and Locus 2. Thirteen 1 by 1 m. test units were placed in Locus 1, and two were placed in Locus 2. In

Locus 1, two hearths were identified within the test units. Hearth 1 contained a small amount of charcoal and two small rhyolite flakes (Sutton and Jackson 1993:15). Hearth 2 contained burned stones, one chalcedony flake, reddish-colored soil, a small amount of charcoal, and 40 fragments of burned medium mammal bone (Sutton and Jackson 1993:16).

CA-KER-2567, -2569, and -2570. Site CA-KER-2567 contained a concentration of dark soil that was "sufficiently distinct to be designated a feature" (Osborne and Sutton 1993:51). A scatter of fire-affected rock and a burned jackrabbit (*Lepus californicus*) phalanx recovered from this feature suggested that it may have been the remains of a hearth. Two other concentrations of dark soil were also documented at CA-KER-2567. One was near the hearth, which may indicate that it was part of that feature, although such an association was considered tenuous (Osborne and Sutton 1993:51). No features were identified at CA-KER-2569 or -2570.

CA-KER-2489, -2762, -2763, -2765, -2767, -2768/H, and -2769. At CA-KER-2489, two features were identified as bedrock mortars with shallow mortars and a single cupule, and another was described as a linear rock feature (Everson et al. 1993:91). The rock feature appeared to be a partially collapsed wall of unknown age or ethnic affiliation. No features were identified at any of the other sites in this series.

CA-KER-2546. No features were identified in the single test unit placed at CA-KER-2546 (Parr 1993b).

Material Culture

CA-KER-519. The surface collection at this site produced 38 pieces of debitage, all but one of which was made of rhyolite (Parr 1993a:Table 1). One of these specimens was edge-modified. One rhyolite metate fragment was also found on the surface. A

mere four debitage specimens were recovered from the 1 by 2 m. test unit, three of rhyolite and one of chalcedony (Parr 1993a:32).

CA-KER-520 and -2608. At CA-KER-520, the cultural remains (mostly debitage) consisted of 662 and 49 artifacts, respectively. The surface collection and three 1 by 2 m. test units at CA-KER-520 produced 653 debitage specimens, 440 of which were collected from the surface (Everson and Sutton 1993:Table 1).

Besides the debitage, the flaked stone items at CA-KER-520 included a projectile point, two biface fragments, and five cores. The projectile point was a complete rhyolite Cottonwood Triangular type. The bifaces were made of obsidian and rhyolite, and the cores were made of rhyolite (n = 4) and chalcedony. One granitic ground stone specimen was also recovered from the surface. At CA-KER-2608, the 49 artifacts recovered from surface collection and a 1 by 2 m. test unit consisted of 48 rhyolite flakes and one complete rhyolite biface (Everson and Sutton 1993:45).

CA-KER-2450. This site produced 724 artifacts, all but three of which were debitage (Sutton and Jackson 1993:16-17). Those three consisted of an obsidian Rose Spring series projectile point and two rhyolite cores from the vicinity of one of the hearths. Most of the debitage (n = 708) was recovered from Locus 1. Debitage material included rhyolite (n = 603; 83.6%), chalcedony (n = 82; 11.6%), and obsidian (n = 9; 1.3%).

CA-KER-2567, -2569, and -2570. A total of 685 artifacts was recovered from CA-KER-2567, the majority of which was debitage (94.5%) (Osborne and Sutton 1993:55). Other flaked stone items included five Rose Spring series projectile points or point fragments (three obsidian, two chalcedony), one chalcedony biface, two unifaces (one chalcedony, one rhyolite), and 16 cores (12 rhyolite, 4 chalcedony; all but one from Locus 2). The debitage material was predominantly rhyolite (n = 580; 89.6%), with

chalcedony being the next most abundant material (n = 61; 9.4%) (Osborne and Sutton 1993:59). The ground stone implements from CA-KER-2567 consisted of one intact granitic mano from Locus 2, eight mano fragments (six granitic, two rhyolite; seven from Locus 2), and five metate fragments from Locus 2 (three granitic, two rhyolite).

At CA-KER-2569, 940 artifacts were recovered, most of them debitage (n = 928; 98.7%) and most from the surface (n = 655; 70.6%) (Osborne and Sutton 1993:70). The surface artifacts included numerous metate fragments (from the same specimen), an obsidian Pinto series projectile point, six bifaces (four rhyolite, one chalcedony, one obsidian), three unifaces (two chalcedony, one rhyolite), and a rhyolite core (Osborne and Sutton 1993:71-73). The debitage materials consisted primarily of rhyolite (n = 824; 88.8%), distantly followed by chalcedony (n = 92; 9.9%) and obsidian (n = 7; 0.7%). Sandblasting was evident on almost all of these specimens, indicating that they may have rested on the surface for some time (Osborne and Sutton 1993:73).

The artifact inventory recovered from the single test unit at CA-KER-2570 consisted of 86 items, almost all debitage (n = 79). Six rhyolite cores and a rhyolite metate fragment made up the remainder of the assemblage (Osborne and Sutton 1993:79). The majority of the debitage materials was rhyolite (n = 75; 95%), along with four specimens of chalcedony. No obsidian was recovered from this site.

CA-KER-2489, -2762, -2763, -2765, -2767, -2768/H, and -2769. The first site in this series (CA-KER-2489) is a rockshelter that contained milling features (see above), as well as quarrying and lithic reduction materials (Everson et al. 1993:87). The artifact inventory included 178 pieces of debitage and 58 modern items derived from the surface and the single test unit. In order of abundance, the debitage material was rhyolite (n = 175; 98%), jasper (n = 2), and chert (n = 1). At CA-KER-2762, 92 artifacts were

recovered, including three rhyolite cores, one rhyolite biface, and 88 pieces of rhyolite debitage (Everson et al. 1993:97). A total of 125 artifacts came from the test unit at CA-KER-2763, including five cores (four rhyolite, one jasper), a modified rhyolite flake, and 119 pieces of rhyolite debitage (Everson et al. 1993:101).

A surface collection and the four test units at CA-KER-2765 resulted in the recovery of 885 artifacts (Everson et al. 1993:106). These consisted of one obsidian Pinto series projectile point, four bifaces (one each of obsidian, rhyolite, jasper, and quartz), one granitic ground stone fragment, and 879 pieces of debitage. The debitage materials included rhyolite (n = 848; 96.5%), chalcedony (n = 17), six each of obsidian and quartz, and two of jasper (Everson et al. 1993:111).

The artifact assemblage from the surface collection and test unit at CA-KER-2767 consisted of 1,053 artifacts, all but seven of which were debitage (n = 1,046) (Everson et al. 1993:112). Those seven consisted of two biface fragments (one obsidian, one rhyolite) and five rhyolite cores (Everson et al. 1993:114). The debitage materials were clearly outnumbered by rhyolite (n = 1,032), distantly followed by chalcedony (n = 14).

Site CA-KER-2768/H contains both a prehistoric and historical component (the historical component is not discussed here) (Everson et al. 1993:116). The surface collection and single test unit at this site produced 239 prehistoric artifacts, all but one of which was debitage. That single specimen was a chalcedony Rose Spring series projectile point. The debitage materials included rhyolite (n = 208; 87.4%), chalcedony (n = 29; 12.2%), and jasper (n = 1; 0.4%).

At CA-KER-2769, a surface collection and two test units resulted in the recovery of 1,687 artifacts, including projectile points, bifaces, cores, a hammerstone, and debitage (Everson et al. 1993:120). The projectile points consisted of 11 obsidian Rose Spring

series and five unclassified types (Everson et al. 1993:122). One complete biface and three fragments were all made of rhyolite. The cores included eight rhyolite specimens and one chert specimen. The single hammerstone was a small quartzite cobble with extensive pounding damage. Of the 1,657 debitage pieces, 1,365 (82.4%) were rhyolite, 166 (10.0%) were obsidian, and 126 (7.6%) were chalcedony (Everson et al. 1993:126).

CA-KER-2546. The artifact inventory from CA-KER-2546 consisted of an obsidian biface fragment, an incised green slate fragment, eight rhyolite cores, and 120 pieces of debitage from the surface and the test unit (Parr 1993b:139-142). The materials for the debitage included rhyolite (n = 105; 87.5%), chalcedony (n = 8; 6.7%), obsidian (n = 3; 2.5%), jasper (n = 2; 1.7%), and metasedimentary stone (n = 2; 1.7%) (Parr 1993b:142).

Faunal and Botanical Remains

CA-KER-519. One small mammal bone fragment was recovered from the test unit placed at this site (Parr 1993a:32). No botanical remains were recovered from this site.

CA-KER-520 and -2608. Few faunal remains and no botanical remains were recovered from CA-KER-520. These specimens were identified merely as rodents, lagomorphs, and canid (Everson and Sutton 1993:38). At CA-KER-2608, one unburned bone fragment (probably lagomorph) was found in the test unit. There were no botanical remains found at this site.

CA-KER-2450. A total of 305 small bone fragments were recovered from CA-KER-2450, all but two from the test units at Locus 1. Only 14 of these specimens could be identified to genus level (all *Lepus*), although 264 were identified as medium mammal and three were listed as unidentified rodent, some of which may be rabbit (Sutton and Jackson 1993:22). Botanical remains consisted of charcoal and burned resin. The resin resembled burned mesquite (*Prosopis* sp.) (Sutton and Jackson 1993:22). Immunological

analysis on the projectile point showed that pronghorn (*Antilocapra americana*) protein was present on the point (Sutton and Jackson 1993:22).

CA-KER-2567, -2569, and -2570. Faunal remains from CA-KER-2567 consisted of 413 elements. Of the 82 specimens identified to at least the genus level, *Lepus californicus* was the most abundant (n = 61), followed by *Sylvilagus audubonii* (n = 7). Other identified remains included rattlesnake (*Crotalus*, n = 5), rodents (*Dipodomys* [n = 4], *Ammospermophilus* [n = 2], *Perognathus* [n = 2], unidentified rodents [n = 3]), desert tortoise (*Xerobates agassizii*, n = 1), and unidentified reptiles (n = 14) and birds (n = 3) (Osborne and Sutton 1993:65). There were also 304 small-medium mammal elements and two identified as lagomorph, most of which likely represented the remains of *Lepus californicus* or *Sylvilagus audubonii* (Osborne and Sutton 1993:59). Botanical remains from this site consisted of a single burned juniper seed (*Juniperus* cf. *californicus*).

Faunal remains from CA-KER-2569 included 62 bones, most of which were identified only as small-medium mammal (Osborne and Sutton 1993:76). Of those identified further to genus or species (n = 29), jackrabbit (*Lepus californicus*) was dominant (n = 20), with one or two specimens each of collared lizard (*Crotophytus*), horned lizard (*Phrynosoma*), ground squirrel (*Ammospermophilus*), pocket mouse (*Perognathus*), and kangaroo rat (*Dipodomys*). As none of these remains was burned, it is possible that they were not related to prehistoric cultural activity. There were no botanical remains recovered from CA-KER-2569.

There were 151 small bone fragments recovered from CA-KER-2570 (Osborne and Sutton 1993:85). Of those elements identified to genus or species, 20 were jackrabbit (*Lepus californicus*), 12 were kangaroo rat (*Dipodomys* sp.), one was pocket mouse (*Perognathus* sp.), one was wood rat (*Neotoma* sp.), and one was bobcat (*Lynx rufus*).

There were also three or fewer specimens of unidentified snake, reptile, and bird. It is likely that *Lepus californicus* was also represented among the 110 unidentified small mammal remains, although since only two of the specimens was burned, it is possible that none of these remains represented cultural activity (Osborne and Sutton 1993:82). No botanical remains were discovered at CA-KER-2570.

CA-KER-2489, -2762, -2763, -2765, -2767, -2768/H, and -2769. The test unit at CA-KER-2489 produced four small long bone fragments, including a small rodent and three that were probably lagomorph (Everson et al. 1993:91). Faunal remains from CA-KER-2765 consisted of 21 fragments, mostly long bones from rodents and lagomorphs. Many were burned, indicating their likely cultural origin (Everson et al. 1993:111). At CA-KER-2769, 51 bone elements were recovered, many of them burned. While they could not be identified to genus or species, most of them likely represented rodents and lagomorphs (Everson et al. 1993:122). There were no botanical remains recovered from any of these sites, and there were no faunal remains from CA-KER-2762, -2763, -2767, or -2768/H (Everson et al. 1993).

CA-KER-2546. The test unit at CA-KER-2546 produced 46 fragments of small mammal bone, identified only as rabbit and rodent. These remains were deemed to be noncultural (Parr 1993b:145). No botanical remains were recovered from this site.

Dating

CA-KER-519. No materials suitable for dating were obtained from CA-KER-519 (Parr 1993a).

CA-KER-520 and -2608. The Cottonwood projectile point from CA-KER-520 dates to the Late Prehistoric Period, although a rim measurement of 5.0 microns on one of the obsidian bifaces (characterized to the Coso Volcanic Field) suggests a slightly earlier

occupation (perhaps late Rose Spring) (Everson and Sutton 1993:41). No data appropriate for dating were discovered at CA-KER-2608.

CA-KER-2567, -2569, and -2570. Three obsidian Rose Spring series projectile points and one flake from CA-KER-2567 were submitted for obsidian sourcing and hydration (Osborne and Sutton 1993:65). All of these specimens were derived from the Coso Volcanic Field. Two of these artifacts (one point and the flake) were too weathered for rim measurement, but the other two points had values of 2.9 and 4.1 microns. The specimen with the 4.1 reading had a second measurement of 9.2 microns from a remnant detachment scar, suggesting that it may have been scavenged. Both the obsidian results and the projectile point types argued for a Rose Spring Period occupation of the site (Osborne and Sutton 1993:66).

At CA-KER-2569, projectile point typology and the obsidian hydration were used to date the site (Osborne and Sutton 1993:76). Nine obsidian specimens were submitted for sourcing and hydration, including the Pinto point, a biface, and seven flakes. All nine were chemically characterized to the Coso Volcanic Field. The Pinto point and three other specimens could not be measured, but of the remaining pieces, the readings were 2.6, 7.4, 8.4, 9.0, and 14.1 microns (Osborne and Sutton 1993:78). The 2.6 micron reading was a second measurement on a flake and probably indicates subsequent use of that item. Disregarding that reading, the obsidian values and the Pinto point argued for a Pinto Period occupation of the site (but see Flenniken and Wilke 1989). There were no materials appropriate for dating from CA-KER-2570 (Osborne and Sutton 1993:82).

CA-KER-2450. A radiocarbon sample from Hearth 2 provided an assay of 1,110 ± 50 RCYBP (Sutton and Jackson 1993:23). This date corresponds with the Rose Spring Period, as does the Rose Spring projectile point. Obsidian analysis on two flakes and the

projectile point provided hydration rim measurements of 3.4, 3.6, and 4.4 microns. These were not converted to calendar dates, but the values are consistent with Rose Spring times (Sutton and Jackson 1993:23). All three of these specimens were characterized to the Coso Volcanic Field.

CA-KER-2489, -2762, -2763, -2765, -2767, -2768/H, and -2769. At CA-KER-2765, four obsidian specimens (all from the Coso Volcanic Field) provided micron values of 7.4, 8.2, 9.1, and 11.8. Along with the Pinto projectile point from this site, these data suggested a Pinto age for this site (Everson et al. 1993:111). At CA-KER-2768/H, the Rose Spring series projectile point suggested occupation during this time (Everson et al. 1993:119).

The 11 Rose Spring projectile points, an unclassified point fragment, and four flakes from CA-KER-2769 were submitted for obsidian sourcing and hydration (Everson et al. 1993:123). All of these specimens were chemically characterized to the Coso Volcanic Field. The micron values on 14 of the specimens (including all of the Rose Spring points) fell within the generally accepted time frame for the Rose Spring Period. Those values ranged between 3.3 and 5.5 microns, with nine of those 14 falling between 4.3 and 4.8 microns. There was also one flake with a value of 8.8 microns, suggesting an earlier occupation of the site (Everson et al. 1993:123, 126).

The Rose Spring projectile points and the obsidian data provided evidence for a Rose Spring Period occupation of CA-KER-2769. No chronometric data were available for CA-KER-2489, -2762, -2763, or -2767, so the ages of these sites are unknown (Everson et al. 1993).

CA-KER-2546. No chronometric data were available for this site (Parr 1993b), so the age of this site remains unknown.

Interpretations

CA-KER-519. Site CA-KER-519 was interpreted as a lithic scatter that "represents a reduction area for lithic material, primarily rhyolite" (Parr 1993a:32). The presence of cortex on the flakes suggested early-stage lithic reduction, indicating that the stone was procured locally and the tools manufactured on site. The metate fragment represented some level of domestic activity at the site (Parr 1993a:32).

CA-KER-520 and -2608. Everson and Sutton (1993:41) interpreted CA-KER-520 as a lithic reduction site where rhyolite nodules, apparently from a nearby source, were reduced into tools or blanks (Everson and Sutton 1993:41). The presence of burned bone, the ground stone fragment, and the projectile point indicated that the site may also have functioned as a temporary camp (Everson and Sutton 1993:41). Site CA-KER-2608 was a sparse lithic scatter interpreted as a lithic reduction locality (Everson and Sutton 1993:45). The rhyolite specimens probably came from a source about two kilometers north of the site, after which they were transported to the site (Everson and Sutton 1993:45). There was no evidence that the site functioned as an actual camp, but it may have been part of a complex that included all of the Rosamond sites (Everson and Sutton 1993:45).

CA-KER-2450. This site was interpreted as a temporary camp where lagomorphs were processed (Sutton and Jackson 1993:23). The dominance of rhyolite and chalcedony was deemed by Sutton and Jackson (1993:24) to be similar to that seen at CA-LAN-787 and -714 (Sutton 1988), while the frequency of chalcedony was similar to the Cantil sites (see above). The presence of the pronghorn protein suggested that hunting occurred on the floor of the Antelope Valley during the Rose Spring Period (Sutton and Jackson 1993:22).

CA-KER-2567, -2569, and -2570. Site CA-KER-2567 was interpreted as a small habitation site or temporary camp (Osborne and Sutton 1993:66). This interpretation was supported by the variety of artifacts and the hearth discovered at the site. The dearth of obsidian debitage indicated that the projectile points of this material may have been manufactured elsewhere (Osborne and Sutton 1993:66). The presence of ground stone implements demonstrated that the occupants likely resided at the site for more than a brief period of time. The greater frequency of artifacts in Locus 2 than in Locus 1 suggested that the former witnessed more intensive activity than the latter. Osborne and Sutton (1993:66) also maintained that some of the other sites in this study may have been satellite sites for specialized activities.

Site CA-KER-2569 was viewed as a small camp/workshop locality for the refinement of rhyolite tools (Osborne and Sutton 1993:77). The source for this rhyolite is probably in the Rosamond Hills. The distribution of artifacts indicated the presence of several activity areas. CA-KER-2570 was interpreted as a short-term, possibly single-event rhyolite reduction site (Osborne and Sutton 1993:82). There was virtually no evidence of extended habitation or food processing at this site. The rhyolite was likely brought in from a local source (Rosamond Hills?). As the site once rested on a playa with subsequent dune formation, it was further postulated that the "origin of the sand may relate to a xeric period in which the margins of Rosamond Lake retreated" (Osborne and Sutton 1993:82). According to Osborne and Sutton (1993:82), there is evidence of such events occurring in the western Mojave Desert at least twice, once during the middle Holocene and again about 1,000 years ago (i.e., during the MCA).

CA-KER-2489, -2762, -2763, -2765, -2767, -2768/H, and -2769. Site CA-KER-2489 is a rockshelter interpreted as a milling, quarrying, and lithic reduction locale (Everson et

al. 1993:92). The large quantities of primary and secondary reduction flakes from the site indicated significant stone tool manufacturing at the site (Everson et al. 1993:92). The bedrock mortars further suggested food processing of some kind, perhaps indicating that the aboriginal flintknappers stayed for a somewhat extended period of time while they exploited the stone resources in and around the site. Everson et al. (1993:97) maintained that CA-KER-2762 was a quarry and lithic reduction site. The large amount of rhyolite primary reduction flakes and broken nodules of rhyolite demonstrated the importance of this material to the site occupants (Everson et al. 1993:97).

CA-KER-2763 was viewed as a lithic reduction workshop in close proximity to high-quality rhyolite deposits at CA-KER-2489, -2762, and -2769 (Everson et al. 1993:102). There was no evidence of habitation at this site, although the flintknappers may have stayed at some of the other sites in this complex. CA-KER-2765 was described as a Pinto Period habitation and lithic reduction site (Everson et al. 1993:112). The burned bones suggested cooking activities, and the rhyolite flakes demonstrated local quarrying. The characteristics of the flakes indicated that unfinished blanks were transported to the site, where they would have become finished tools. Everson et al. (1993:112) suggested that CA-KER-2765 was a base camp for groups of flintknappers who would occasionally travel to the area to obtain chalcedony and high-grade rhyolite.

Site CA-KER-2767 was also interpreted as a lithic reduction locale, with rhyolite being reduced into tools and/or blanks that could be transported from the local quarry to the site. There were no data to indicate habitation, but the inhabitants may have camped at some of the other sites reported in this study (Everson et al. 1993:116). The prehistoric component of CA-KER-2768/H was similarly described as a lithic quarry and reduction site where rhyolite nodules were processed. There was no evidence of habitation at this

site (Everson et al. 1993:119). As with several of the other sites in this series, CA-KER-2769 was also interpreted as a quarry and lithic reduction site (Everson et al. 1993:127). While there was no evidence of habitation at this site, Everson et al. (1993:127) argued that its proximity to CA-KER-2765 indicated "prolonged or repetitive lithic procurement activity operating from [this] base camp" (Everson et al. 1993:127).

CA-KER-2546. Site CA-KER-2546 was deemed to represent a rhyolite reduction area, and "possibly as a short-term camp associated with the lithic reduction activity" (Parr 1993b:145). The rhyolite was probably procured from the nearby Rosamond Hills. While the obsidian flakes and incised green slate fragment represent only a very minor portion of the cultural materials, their presence at the site is indicative of long-distance travel or trade activities (Parr 1993b:145). Domestic activities were evident at the site in the form of fire-affected rock on-site and by ground stone materials found at a nearby site (CA-KER-2547, located 72 m. from CA-KER-2546) and an isolated portable metate found a similar distance from CA-KER-2546 (Parr 1993:145).

Summary and Discussion of the Rosamond Sites. The descriptions for the 15 sites from the Rosamond site complex (Sutton 1993) generally fall into three categories; quarry and/or lithic reduction sites (CA-KER-519, -2608, -2570, -2762, -2763, -2767, -2768/H, -2769), base camp or habitation sites (CA-KER-520, -2450, -2567), or a combination of both (CA-KER-2489, -2546, -2569, -2765). The predominant material worked by the inhabitants of these sites was overwhelmingly rhyolite, which was available locally. As would be expected, all of the obsidian from the Rosamond sites originated from the Coso Volcanic Field. As noted above, this suggests some type of long-distance trade with other groups and/or that the prehistoric Rosamond inhabitants traveled to Coso to obtain the obsidian themselves.

Immunological analysis on 17 Rose Spring points and two unclassified points from three sites (CA-KER-2450, -2567, and -2769) produced negative results for 12 of those specimens (Newman 1993a:150). However, as noted above, a Rose Spring point from CA-KER-2450 tested positive for pronghorn, suggesting that there may have been pronghorn exploitation in the Antelope Valley during the Rose Spring Period. Two specimens tested positive for rabbit and one each for deer and guinea pig (probably porcupine), all four from CA-KER-2769. This provided further evidence that the site occupants exploited deer, rabbits, and rodents (Parr 1993:127).

Sutton and Jackson (1993:23) observed that "There is a growing sense that the valley was most heavily occupied during Rose Spring times, abandoned during the Late Prehistoric." They added that the prevailing interpretation of the prehistory of the neighboring Fremont Valley to the north of Rosamond is "that a major environmental shift occurred circa 1,000 B.P. with the climate becoming increasingly arid" (Sutton and Jackson 1993:23).

Rogers Lake Sites

In the mid-1990s, excavations were undertaken at Rogers Dry Lake within the confines of Edwards Air Force Base (EAFB) as part of a long-term survey and testing program on the base (Byrd et al. 1994). Six sites (CA-KER-526, -533, -1180, -1765, -3377, and -3379) near the eastern shoreline of Rogers Lake in the Antelope Valley were evaluated for the purpose of determining the eligibility of these sites for the National Register of Historic Places. Five of the sites had low artifact densities and were considered short-term or episodic encampments, while the sixth (CA-KER-526) was a large site with a dense and diverse artifact density. The vegetation of all six sites is

primarily saltbush, burro brush, and cheese brush, with Joshua trees scattered throughout the region (Byrd et al. 1994). All but one of the sites are at an approximate elevation of 700 m., the one exception being CA-KER-3379, which is at an elevation between 864 and 875 m.

Site Descriptions

CA-KER-526. This site is located amid dunes and small playas about 300 m. east of the shore of Rogers Lake, and covers an area of almost 36,000 m.^{2} Modern construction activities have partially damaged the site (Byrd et al. 1994:23-26). CA-KER-526 is the largest of the six sites that were excavated for this project. Two phases of occupation were proposed at the site, with the earlier component referred to as Phase 1 and the later component referred to as Phase 2. Some items were unphased and were labeled Phase 0. Those designations are utilized below where appropriate for clarity.

CA-KER-533. This site is located roughly 200 m. north of CA-KER-526 and is just under 9,000 m.^{2} in size (Byrd et al. 1994:69). It is "situated in an irregular semi-circular arc formed by the dune crests" (Byrd et al. 1994:69). The site had a low artifact density and concentrations of fire-affected rock.

CA-KER-1180. Located about 500 m. north of CA-KER-533, this site is about 28,000 m.^{2} (Byrd et al. 1994:83). The site consists of two loci, one on each side of the north-south trending road that bisects it. All but 14 of the 242 artifacts collected from the site came from the surface.

CA-KER-1765. This site is the most southern of all of the Rogers Dry Lake sites in this investigation and covers about 233 m.^{2} (Byrd et al. 1994:101). It is on a sandy blowout on the east side of a dune. There were only 27 artifacts recovered from CA-KER-1765.

CA-KER-3377. Located at the northeast edge of Rogers Dry Lake, CA-KER-3377 has an areal extent of 5,000 $m.^2$ (Byrd et al. 1994:107). It is on the north slope of a sand dune bordered by a playa. The artifact collection consisted of 115 items, 100 from the surface and 15 from the excavation units (Byrd et al. 1994:107).

CA-KER-3379. CA-KER-3379 site is the northeasternmost site of the project and covers ca. 5,000 $m.^2$ (Byrd et al. 1994:120). It is situated on a small blowout adjacent to a large dune. The site has a very low artifact density.

Field Methods

Along with extensive surface collections, the investigations by Byrd et al. (1994) included a total of 149 shovel test pits (STPs) and 48 1 by 1 m. test units (TUs). CA-KER-526 had 88 STPs and 19 TUs, CA-KER-533 had 16 STPs and 12 TUs, CA-KER-1180 had 34 STPS and 8 TUs, CA-KER-1765 had 11 STPs and 3 TUs, CA-KER-3377 had no STPs and 3 TUs, and CA-KER-3379 had no STPs and 3 TUs (Byrd et al. 1994:23). The STPs and TUs were excavated in 10-cm. levels, and all soil was screened through 1/8 in. mesh.

Features

CA-KER-526. One feature was discovered at this site, described as a concentration of fire-affected rocks that may have been the remnants of a hearth, although there was no soil discoloration and virtually no charcoal within the feature (Byrd et al. 1994:39). It consisted of about 30 rocks in an area of 2.5 m. Artifacts associated with this feature included debitage, three cores, one mano, one hammerstone, and a shell bead.

CA-KER-533. Four concentrations of fire-affected rock were documented at this site (Byrd et al. 1994:73). All of these features were ca. 1.5 m. in diameter and could be observed on the surface. Two of the features were interpreted as hearths, while the other

two were regarded as possibly deflated hearths or the remnants of hearth cleaning. Charcoal was recovered from one of these features for radiocarbon dating (see below).

CA-KER-1180. The features at this site consisted of three concentrations of fire-affected rock that lacked integrity and could not be positively identified as hearths (Byrd et al. 1994:86). Small amounts of artifacts, bone, and charcoal were recovered from these features, and two radiocarbon samples were submitted for analysis (see below).

CA-KER-1765. A scatter of fire-affected rock at this site may have represented the remains of a hearth (Byrd et al. 1994:101). No other features were identified at this site.

CA-KER-3377. No features were identified at CA-KER-3377 (Byrd et al. 1994).

CA-KER-3379. Three concentrations of fire-affected rock were documented at CA-KER-3379, only one of which was considered to be the remains of a hearth (Byrd et al. 1994:120).

Material Culture

CA-KER-526. A total of 5,627 artifacts was recovered from the surface of this site, while the STPs and TUs produced 4,278 artifacts (Byrd et al. 1994:39), for a site total of 9,905. These included flaked and ground stone tools, shell ornaments, and a fired clay object. Some of these items were modern and are not considered further below. Of those 9,905 artifacts, 2,016 were assigned to Phase 1, 6,619 were assigned to Phase 2, and 1,270 were assigned to Phase 0 (Byrd et al. 1994:Table 6).

The flaked stone assemblage consisted of 2,007 pieces of debitage in Phase 1, 6,380 in Phase 2, and 1,246 in Phase 0, although Byrd et al. (1994:42) provided detailed tabulations only for Phases 1 and 2. For both phases, the debitage material was mostly chert (n = 5,952), followed by volcanic (n = 1,029), chalcedony (n = 848), quartz (n = 515), and very small amounts of obsidian (n = 26), silicified wood (n = 12), and quartzite

(n = 4; Phase 2 only). In addition to the debitage, the following was included in the artifact assemblage: 38 cores, 33 in Phase 2 and five in Phase 0; 10 utilized flakes, six in Phase 2 and four in Phase 0; 28 unifacial tools, one in Phase 1 and 27 in Phase 2; 81 bifacial tools, five in Phase 1, 68 in Phase 2, and eight in Phase 0. The predominant material type for these tools was chert, followed distantly by chalcedony, volcanic, and quartz (Byrd et al. 1994:46). One of the bifacial tools was the upper portion of a dart point.

Other artifacts included 26 percussing tools (25 in Phase 2 and 1 in Phase 0), ground stone items (57; 1 in Phase 1, 51 in Phase 2, and 5 in Phase 0); one fired clay object in Phase 2; 18 shell beads (one in Phase 1 and 17 in Phase 2); one bone tool in Phase 2; one decorated bone in Phase 2; and one piece of red pigment in Phase 0 (Byrd et al. 1994:42). The materials of the percussing tools consist of porphyritic volcanic, quartz, quartzite, granitic, and sandstone, most of which are porphyritic volcanic and quartz. The ground stone artifacts were found mostly in the Phase 2 occupation, and include a single metate fragment from Phase 1; a metate, two manos, and two pestles from Phase 0; and 25 manos, 25 metates, and one shaped and grooved stone from Phase 2. A variety of materials is represented in the ground stone tools, including basalt, granitic, gabbro, porphyritic volcanic, quartzite, schist, sandstone, and slate (Byrd et al. 1994:56-57). Half of the manos were fire-affected.

The clay object came from Phase 2 and was thought to represent Topoc Buff (Byrd et al. 1994:58). It may be the remnant of a figurine, but it was too small to state with any certainty. The shell beads are made of *Olivella biplicata* (n = 17) and *Tivela stultorum* (n = 1) (Byrd et al. 1994:59). They represent various types as described in Bennyhoff and Hughes (1987) with wide-ranging dates (see below). The two bone artifacts consist of

the tip of an awl and an incised decorated fragment (Byrd et al 1994:58). The red ocher fragment may have been used as a pigment.

CA-KER-533. All but two of the total artifacts (n = 37) from this site came from the surface (Byrd et al. 1994:69), most of it debitage (n = 18). Other flaked stone artifacts included cores (n = 2), unifacial tools (n = 3), and bifacial tools (n = 8). There were also five ground stone artifacts and one percussing tool. In order of abundance, the toolstone for all but the ground stone implements was chert (n = 16), quartz (n = 6), volcanic (n = 6), chalcedony (n = 2), quartzite (n = 1), and granitic (n = 1) (Byrd et al. 1994:77). The ground stone artifacts were identified as a mano and four metates made of basalt, granitic, and volcanic (Byrd et al. 1994:79).

CA-KER-1180. Debitage was by far the most abundant artifact class at this site, numbering 219 of the total artifact count of 256 (Byrd et al. 1994:83). Other flaked stone artifacts included one core, four unifacial tools, and 10 bifacial tools. One of the bifaces was identified as a Desert Side-notched projectile point. There were also 15 ground stone artifacts, six ceramic fragments, and one percussing tool. The ground stone artifacts consisted of seven manos, six metates, one mortar/bowl, and one indeterminate fragment (Byrd et al. 1994:93). The toolstone material for these artifacts consisted primarily of chert (n = 164), followed in much smaller numbers by (in order of abundance), volcanic, obsidian, chalcedony, granitic, quartz, quartzite, and schist. Five of the ceramics fragments were identified as Topoc Buff and one as a subtype of Colorado Buff Ware (Byrd et al. 1994:95). Four of the fragments were body sherds and two were rim sherds.

CA-KER-1765. The 27 artifacts from this site included 22 pieces of debitage, one core, two bifacial tools, and two percussing tools. Of those 27 artifacts, 20 came from the surface and seven from the excavations (Byrd et al. 1994:101). The material for these

tools consisted of quartz (n = 24) and chert (n = 3). The bifaces were thought to be the remnants of biface blanks (Byrd et al. 1994:104).

CA-KER-3377. The artifact classes represented among the 115 items recovered at this site consisted of 96 pieces of debitage, two cores, one utilized flake, eight bifacial tools, two percussing tools, and six ground stone implements (Byrd et al. 1994:107). The ground stone items included five metates and a mano, all made of schist or granitic material (Byrd et al. 1994:114). The raw material for the other artifacts included (in order of abundance) chert (n = 77), chalcedony (n = 16), quartz (n = 11), and obsidian (n = 5) (Byrd et al. 1994:111). One of the bifaces was a dart point preform that was nearly complete. Of the other seven biface fragments, three fit together, forming the tip of the biface. Two other fragments were also refitted, representing the base of the biface (Byrd et al. 1994:113). The percussing tools consist of one complete and one fragmentary hammer/pecking tool.

CA-KER-3379. The artifact collection from this site consisted of only eight pieces of debitage, four made of chert, three of chalcedony, and one of quartz (Byrd et al. 1994:120). Patination was observed on three of these flakes.

Faunal and Botanical Remains

CA-KER-526. The excavations at CA-KER-526 also produced more than 12,000 ecofacts, most of which were vertebrate faunal remains (Byrd et al. 1994:41). The vast majority of those remains came from Phase 2 (Hudson 1994:Table 51). Vertebrate animals represented in the faunal assemblage from Phase 1 included jackrabbit (*Lepus californicus*; n = 35), hare/rabbit (Leporidae; n = 53), pocket gopher (*Thomomys bottae*; n = 1), woodrat (*Neotoma* sp.; n = 1), rodent (Rodentia; n = 1), and small mammal (n = 69). Phase 2 consisted of small mammal (n = 2,311), medium mammal (n = 8), large mammal

(n = 14), badger (*Taxidea taxus*; n = 10), jackrabbit (*L. californicus*; n = 674), cottontail rabbit (*Sylvilagus audubonii*; n = 2), rabbit (*Sylvilagus* sp.; n = 5), hare/rabbit (Leporidae; n = 559), pocket gopher (*T. bottae*; n = 10), kangaroo rat (*Dipodomys* sp.; n = 3), woodrat (*Neotoma* sp.; n = 9); and rodent (Rodentia; n = 21). There were also small numbers of reptiles, amphibians, and birds. In addition, immunological analysis on six artifacts from this site produced positive results on two, one for rabbit and one for deer (Newman 1994:134).

Pollen analysis was conducted at CA-KER-526 by Smith and Anderson (1994) on two samples, one from Phase 1 and one from Phase 2. While the Phase 1 sample was determined to be sterile, the Phase 2 sample was much more productive. Of those species containing more than two specimens, the Phase 2 pollen sample produced grains of pine (*Pinus* sp.), Cupressaceae (including juniper), ash and ash aggregates (*Faxinus* sp.), oak (*Quercus* sp.), Rosaceae, wolfberry (*Lycium* sp.), Mormon tea (*Ephedra* sp.), bursage/ ragweed (*Ambrosia* sp.), sunflower family (Compositae), grass family (Gramineae), Cheno-ams, buckwheat (*Eriogonum* sp.), and pea/bean family (Leguminosae). Smith and Anderson (1994:128) observed that there was no definitive evidence that any of these pollen taxa were cultural in nature, as many of these species occur in this part of the Mojave Desert today. The sunflower family and Cheno-ams, however, were known to have been utilized ethnographically.

CA-KER-533. A small number of vertebrate (n = 183) and invertebrate (n = 1) remains was recovered from this site. The majority of the vertebrate remains is small mammal bone (Byrd et al. 1994:76). Taxa represented in the vertebrate specimens included jackrabbit (*Lepus californicus*; n = 11), rabbit (*Sylvilagus* sp.; n = 1), hare/rabbit (Leporidae; n = 12), rodent (Rodentia; n = 2), small mammal (Mammalia; n = 32), and

vertebrate (Vertebrata; n = 125) (Hudson 1994:144). Analysis of the botanical remains from CA-KER-533 produced only two samples that were large enough for identification, which were fragments of wood charcoal identified as "saltbush-type" (Klug and Popper 1994:128).

CA-KER-1180. A total of 60 fragments of vertebrate faunal remains and one shell fragment were recovered from CA-KER-1180. The number of identified specimens included one each of jackrabbit (*Lepus californicus*), rabbit (*Sylvilagus* sp.), rodent (Rodentia), rattlesnake (*Crotalus* sp.), and desert tortoise (*Gopherus agassizii*). There were also three small mammal (Mammalia) and 52 vertebrate (Vertebrata) remains. Immunological analysis on the projectile point was negative (Newman 1994:132).

CA-KER-1765. A total of 29 bone fragments were the only ecofactual materials recovered from this site. Six of these were identified as rabbit (*Sylvilagus* sp.), seven as small mammal (Mammalia), and 16 as vertebrate (Vertebrata) (Hudson 1994:145).

CA-KER-3377. The ecofactual material from this site consisted of 13 bone fragments and one unmodified *Haliotis* shell (Byrd et al. 1994:107). The bones were identified as small mammal (Mammalia; n = 3) and vertebrate (Vertebrata; n = 10) (Hudson 1994:145).

CA-KER-3379. The two bone fragments recovered at this site were identified only as small mammal limb shafts (Hudson 1994:145). Both appeared to be recent intrusions (Byrd et al. 1994:120). In addition, analysis of the botanical specimens indicated the presence of a small amount of wood charcoal (Klug and Popper 1994:131).

<u>Dating</u>

CA-KER-526. Chronological data from this site was derived from two radiocarbon dates, obsidian hydration, and the shell beads. Two samples of charcoal fragments from

one of the Phase 2 units produced dates of 3,670 ± 70 RCYBP (calibrated between 2,138 and 1,935 B.C.) and 3,770 ± 70 RCYBP (calibrated between 2,285 and 2,041 B.C.). Both of these dates were deemed to be indicative of the Phase 2 (or Gypsum Period) occupation of the site (Byrd et al. 1994:156). Although the context of the charcoal specimens is somewhat ambiguous, since the radiocarbon dates were generally consistent with the shell bead and obsidian hydration data (see below), the designation of the site as early Gypsum Period was deemed appropriate (Brian F. Byrd, personal communication 2005). The shell bead data also suggest the presence of Rose Spring and Late Prehistoric period components as well, although they are very minimal in their expressions and may represent "noise" in terms of the overall site occupation. Thus, with some caution, CA-KER-526 is considered to be a single-component Gypsum Period site for the purposes of this study (but see below).

Nine obsidian specimens were submitted for sourcing and seven for hydration. All of the specimens were derived from the Coso Volcanic Field (Shackley 1994a:157). The seven specimens submitted for hydration analysis producing means of 7.5, 7.5, 7.6, 7.7, 8.7, 9.6, and 13.3 microns. Two of these specimens were determined to be of Coso origin, and the rest were referred to as "probably Coso" (Origer 1994:162). The shell beads provided four date ranges; 1,150 to 450 B.P., 1,650 to 1,150 B.P. and later, 3,050 to 1,950 B.P., and 3,950 to 2,150 B.P. (Byrd et al. 1994:59).

CA-KER-533. A radiocarbon sample from one of the hearths at this site resulted in an assay of 1,890 ± 80 RCYBP (calibrated between A.D. 59 and 235) (Byrd et al. 1994: 156). No other temporally sensitive data were derived from the site. Although Byrd et al. (1994:81) used the term Late Prehistoric Period to classify the age of CA-KER-533, in this context they are referring to anything post-Gypsum (Brian F. Byrd, personal

communication 2005). Since this study makes a distinction between the Late Prehistoric and Rose Spring periods, it is classified here as a very early Rose Spring Period site, although it could also be considered a very late Gypsum Period site.

CA-KER-1180. Radiocarbon samples from two of the features at CA-KER-1180 were submitted for assay, returning results of 690 ± 50 RCYBP (calibrated between A.D. 1283 and 1379) and 180 ± 130 (calibrated between A.D. 1638 and 1955) (Byrd et al. 1994:156). Although five obsidian artifacts were submitted for sourcing (all chemically characterized to the Coso Volcanic Field; [Shackley 1994:158]), none was submitted for hydration analysis. Other chronological data included the Desert Side-notched projectile point and the ceramics. All of the chronological data indicate a Late Prehistoric Period occupation (Byrd et al. 1994:95).

CA-KER-3377. One obsidian specimen of Coso origin and two specimens that were possibly Coso were submitted for hydration analysis. The mean hydration rim measurements were 3.7, 4.8, and 4.8 microns, suggesting to Origer (1994:164) that the site dated to the Late Prehistoric Period. The dart point preform is suggestive of an earlier occupation, although dart points can occur in multiple archaeological contexts.

CA-KER-1765 and -3379. No chronological data were recovered from these three sites, and they remain undated (Byrd et al. 1994:104).

Interpretations

Based on the chronological data available from four of the Rogers Dry Lake sites (CA-KER-526, -533, -1180, and -3377), CA-KER-526 was interpreted as a large, early Gypsum Period base camp, while CA-KER-533, -1180, and -3377 were interpreted as Late Prehistoric temporary or short-term camps (Byrd et al. 1994:67, 81, 95, 104, 114). The latter three were further defined as short-term "forager residential bases or field

camps" (Byrd et al. 1994:168). No chronological data were obtained from CA-KER-1765 or -3379, although they were considered to represent "very short-term encampments characterized by cooking activities" (Byrd et al. 1994:167). The presence of obsidian and marine shell at some of the study sites provided evidence for trade and/or direct access (Byrd et al. 1994:170).

Within the EAFB, 11 site types have been defined, based primarily on surface investigations: village/base camps, temporary camps, rockshelters, milling stations, lithic scatters, quarries, cremations, rock alignments, rock art, hearths/roasting pits, and bone scatters (Byrd et al. 1994:165). The vast majority of the sites associated with EAFB is temporary camps and lithic scatters, with only four village/base camps identified. Based on these data, including their study, Byrd et al. (1994:165) proposed three settlement models for the Antelope Valley. One was characterized as a foraging pattern, in which there are small camps with at least annual residential shifts. The second was described as a "strong collecting strategy represented by sedentary village sites" (Byrd et al. 1994:165) as well as smaller satellite sites. The third model would be one in which fusion-fission occurred, "with aggregation camps and smaller, short-term residential camps" (Byrd et al. 1994:165).

Given the importance of discovering Gypsum Period sites in the western Mojave Desert in terms of understanding culture change during the Holocene, the context and association of the radiocarbon samples from CA-KER-526 are critical. This is especially true in light of the interpretive problems of dating obsidian artifacts and shell beads, which were also recovered at the site (as was a dart point fragment; see above). While the test unit from which the charcoal was derived for radiocarbon assay contained the greatest number of artifacts, there was no feature associated the unit; as such, the

radiocarbon samples consisted of loose charcoal from the levels of the unit. In the absence of a clear cultural context for the charcoal, the obsidian rim values and shell bead data are somewhat suspect in determining the age of the site, particular since most of the rim values are not remarkably distinct in their antiquity (see Table 6). With that caveat in mind, the combination of the dart point, the radiocarbon assays, the obsidian data, and the shell beads, CA-KER-526 is treated herein as a Gypsum Period site.

CA-KER-4619 (Cross Mountain Site)

Site Description

In 1996, a crew from CSUB (including this author) conducted salvage excavations at the Cross Mountain Site (Figure 12), a large habitation site and cemetery in the southern Sierra Nevada just south of Jawbone Canyon (Gardner et al. 1996, 1997). While the site may not fall technically within the Mojave Desert (depending on how the boundaries are defined), it is immediately adjacent to (and likely overlaps) the extreme western margin. The minimum dimensions of the site are 120 by 80 m. It is probably much larger, but time did not allow a complete determination of the site dimensions. The cemetery is situated in the sidewall of a streambed that has been cut by erosion, thereby exposing some of the burials. The slope above the streambed contains a midden where additional human remains were recovered from the surface (Gardner et al. 1997:1-2).

Field Methods

The landowner had granted permission only for limited excavations to salvage the burials, so no formal excavations beyond the burials were conducted (Gardner et al. 1996, 1997). The site was mapped, and features and artifacts on the surface were described and photographed but not collected. As the burials were located approximately a meter

Figure 12. Overview of the Cross Mountain site (CA-KER-4619), taken in 1996. (Photograph in the possession of the senior author.)

below the surface of an unstable ridge, it was deemed impractical to excavate vertically down to the burials. Therefore, for those burials that had been exposed by the streamcut, the decision was made to excavate horizontally into the side of the bank (Gardner et al. 1997:2). Soil from the burials was screened through 1/8-in. mesh and spot-screened through 1/16-in. mesh. In addition, a limited surface collection was conducted around one of the hearths, and soil and radiocarbon samples were taken from another hearth.

Features

Each burial was designated as a separate feature. Other features included two hearths and a bedrock mortar. Analyses of the burials resulted in the identification of one juvenile, three infants, and at least five adults. The juvenile (7 years ± 24 months) was adorned with several bead strings consisting primarily of *Olivella* beads, but interspersed with steatite ring and disk beads. A total of 518 beads was recovered, many still in their

stringing position (Gardner et al. 1997:5). Other beads found with this individual were *Haliotis* disks and clamshell tubes. The beads associated with the strings on this individual were placed in such a way that a pattern began to emerge, although the precise pattern could not be determined due to gaps in the strings. The presence of these beads suggested that this young child was imbued with ascribed status.

Another burial, that of an adult (probably male), had three rectangular *Haliotis* ornaments that appeared to be part of a necklace (Gardner et al. 1997:6). In the course of excavating this individual, a separate burial containing three infants was discovered underneath (Gardner et al. 1997:6). The position of these infants within the pit clearly demonstrated that this burial was a single event; i.e., that they were all buried on the same day. One of the infants was about a year old and the other two were about six months old. DNA analysis on one deciduous tooth from each of these three infants indicated that there were at least two lineages represented (Gardner et al. 1998, 2002).

One of the hearth features was located close to the surface between two of the burials (Gardner et al. 1997:12). Soil and radiocarbon samples were taken from this hearth. The other hearth was located on the bank above the burials. Two turtle bone fragments and two pottery fragments were collected from the surface of this hearth (Gardner et al. 1997:12). The third feature was initially noted as a large bedrock outcropping along the northern end of the site, west of the burials. Much of this outcropping was covered with a light layer of soil, obscuring the surface of it; however, in the only place where the soil was brushed away from the surface, a single bedrock mortar was discovered (Gardner et al. 1997:12). It seems likely, then, that other mortars exist under the soil on this outcropping, although time did not permit further investigation of this possibility (Gardner et al. 1996, 1997).

Material Culture

While no large-scale excavations or collections were conducted at the Cross Mountain Site, many of the constituents that were visible on the surface of the site were observed and documented in the field. Although time limitations precluded an accurate tabulation and distribution of artifacts, they included projectile points, bifaces, manos, metates, pestles, cores, hammerstones, stone bowls, and a multitude of flakes of various materials (e.g., chert, chalcedony, basalt, obsidian). Among the projectile points were Rose Spring and Desert series specimens (Gardner et al. 1996, 1997). The material culture also included the shell beads and ornaments associated with the burials. Of the *Olivella* beads found with the juvenile, most were identified as Type E1a, although there were also a few K1 cupped beads (Bennyhoff and Hughes 1987).

Faunal and Botanical Remains

The few faunal specimens removed from the soil sample of one of the hearths consisted of small and medium size mammals, including jackrabbit (*Lepus californicus*) and an unidentified cervid. The sparse botanical specimens were identified as juniper seeds, and there was a considerable amount of charcoal of unknown taxa (Gardner et al. 1997:12-13).

Dating

A radiocarbon assay was obtained on human bone (two of the infant ribs), which returned a date of 460 ± 60 RCYBP (Gardner et al. 1997:13). The calibrated results were somewhat ambiguous, as the time curve was intersected in two places, providing two date ranges; A.D. 1400 to 1520 and A.D. 1570 to 1630. This was problematic because the initial thought—based primarily on the artifact types and to some degree on the well-preserved condition of the human remains—was that since no trauma was observed on

any of the bones, these burials provided further evidence for post-Columbian, pre-mission disease dispersal in California (e.g., Preston 1996; Reff 1992; Verano and Ubelaker 1992). While this hypothesis is not ruled out by the radiocarbon evidence, it is also possible that the site predates that time.

One of the hearths was also radiocarbon dated, returning a result of 370 ± 60 RCYBP, calibrated between A.D. 1430 and 1655 (Gardner et al. 1997:14), which did not help to further constrain the age of the site to determine whether it was post-Columbian. In addition, the Rose Spring and Desert series projectile points indicated an occupation span throughout the Rose Spring and Late Prehistoric periods.

Interpretations

The Cross Mountain Site was interpreted as a large village with an associated cemetery (Gardner et al. 1997:14). An on-site evaluation of the artifact assemblage demonstrates a wide range of activities, and the presence of a substantial midden and cemetery reflects long-term occupation. At some point, it seems certain that the course of the stream that runs along the northern side of the site changed. Originally, the water level was such that the bedrock outcropping was likely submerged. As the stream receded in an easterly direction, it began to erode the midden, resulting in an exposure some three meters deep, revealing the burials. It is unknown how many of these burials had already been lost to erosion by the time of this study (Gardner et al. 1997:14).

The ethnicity of the site inhabitants was unclear (Gardner et al. 1997:14). Both the Kawaiisu and the Tübatulabal were known to have lived in the southern Sierra Nevada (Smith 1978; Zigmond 1986). It has been reported that both of these groups buried their dead, although Driver (1937:99) reported cremations for the Kawaiisu and an isolated Kawaiisu cremation has been documented from the Sand Canyon area (Siefkin and

Sutton 1995). Sutton (1991b:181) postulated a model of late occupation of the southern Sierra Nevada by the Kawaiisu as the western Mojave Desert began to dry up. Lacking any model of Tübatulabal settlement, the presence of this late village suggests that the site was occupied by the Kawaiisu (Gardner et al. 1997:14).

CA-KER-5043 (Coffee Break Site)

Site Description

In order to test the prevailing model of settlement and subsistence in the western Mojave Desert (Sutton 1990, 1991a, 1991b; see Chapter 1 for details), Gardner (2002) investigated the Coffee Break Site (CA-KER-5043; Figure 13), located at the base of Last Chance Canyon in Red Rock Canyon State Park. The site is situated at an elevation of 3,040 ft. and covers an area of ca. 3,100 m.^{2} (Gardner 2002:34). It rests on a bench, with a small ridge to the east that protects the bench during flash floods. Several drainages run through the site, including a large spring about 130 m. to the west and Last Chance Canyon Wash to the south.

At the time of Gardner's (2002) field work, which took place in the summer of 1997, the site contained an extensive midden and a light scatter of artifacts on the surface, including flaked and ground stone fragments. Portions of the site, primarily the western and southern ends, appeared to have been damaged by water erosion (Gardner 2002:34). However, as there was little evidence of any subsurface damage, the site was thought to retain integrity.

Field Methods

Prior to Gardner's (2002) study, three obsidian flakes had been collected from the surface of the site by DPR personnel for obsidian sourcing and hydration analysis. At the

Figure 13. Overview of the Coffee Break Site (CA-KER-5043) during the field work in the summer of 1997. (Photograph in the possession of the author.)

time Gardner (2002) excavated the site, a limited surface inventory of the site was conducted, during which a few formed artifacts were documented (Gardner 2002:34; see below). Five 1 by 2 m. and one 1 by 1 m. test units were excavated in 10-cm. levels, in what was considered to have been the primary occupation area of the site. All material was screened through 1/8-in. mesh (Gardner 2002:35). Column samples were taken from every unit and bulk soil samples were taken from two of the features.

<u>Features</u>

Five features were documented at the Coffee Break Site. The first was a hearth discovered in one of the test units. One of the walls of this hearth was a large metate fragment. Charcoal from the sample was submitted for radiocarbon assay (Gardner 2002:40). Another test unit contained what appeared to be a deflated hearth containing

several pieces of fire-affected rock, although it was devoid of charcoal or other organic remains (Gardner 2002:42). An ash pit containing faunal and botanical remains, including charcoal, was discovered in a third unit (Gardner 2002:44).

Two ground stone scatters were also documented from consecutive levels of one of the test units. While they were recorded as two separate features, their proximity to each other in the unit indicated that they were likely directly associated (Gardner 2002:42). One of these features contained two intact manos and two mano fragments, as well as an expended core and a jasper flake. The other feature included a core, a metate midsection, and an intact mano (Gardner 2002:42).

<u>Material Culture</u>

The surface inventory produced a Rose Spring series projectile point, two metate fragments, a small hammerstone, and two intact manos. In the test units, the artifact collection consisted of flaked stone, ground stone, and shell beads (Gardner 2002:44-55).

Flaked stone artifacts consisted of six projectile points, three bifaces, six cores, two edge-modified flakes, and 1,099 pieces of debitage (Gardner 2002:46-47). Along with the Rose Spring point from the surface, five additional obsidian projectile points were recovered, which were chemically characterized to the Coso Volcanic Field. Three of these were typologically classified as Rose Spring series, one as a Humboldt series, and one as an dart point base (Gardner 2002:47). In addition, two chert/chalcedony bifaces, one jasper biface fragment, four multidirectional cores, two expended cores, and two edge-modified flakes were recovered. Three of the cores were found within features. The cores reflect flake production for tool blanks (Gardner 2002:47). There were also 1,099 pieces of debitage derived from the test units, the column samples, and the soil samples. The vast majority of these specimens was either jasper (42%) or chert/

chalcedony (47%), but other materials included obsidian (9%), basalt (1%), and quartzite (1%) (Gardner 2002:47-52).

The ground stone specimens consisted of five complete manos (all made of andesite), six mano fragments (of andesite, basalt, and quartzite), five metate fragments (one basalt, three schist), and a basalt hammerstone (Gardner 2002:52-53). All of these specimens came from feature contexts. The basalt metate fragment was utilized as one of the sides of the hearth (Gardner 2002:53). A schist metate fragment from one of the ground stone scatters appeared to be a broken-out midsection, suggesting that the metate was "killed," or ritually broken by knocking the bottom out (e.g., Moratto 1984:129; Wallace 1954:117).

Thirteen *Olivella* shell beads were also recovered from the Coffee Break Site (Gardner 2002:53-55). Using the classification system of Bennyhoff and Hughes (1987), seven of the beads were typologically identified as G1 (tiny saucer), two as E1a (round thin lipped), two as G2 (normal saucer), one as F2a (full saddle), and one as F3b (small saddle) (Gardner 2002:53).

Faunal and Botanical Remains

The faunal remains from the Coffee Break site consisted of 2,829 specimens. Due to extreme fragmentation of most of these remains, taxonomic identification was largely restricted to a simple differentiation between very small, small, medium, and large mammal (Gardner 2002:56-62). Only 51 (1.7%) of the faunal remains could be identified beyond class and size. Among the identified specimens, 47 were members of the Leporidae family, 15 of which were further identified as *Lepus*. Other remains included two artiodactyl, one cf. *Neotoma*, and one cf. *Dipodomys*. Although the sample size for Leporidae was very small, the minimum number of individuals was calculated on

the basis of the presence of seven distal humeri, for a total of four individuals (Gardner 2002:58). The absence of desert tortoise (*Gopherus agassizii*) was considered curious, as numerous specimens of this dependable resource have been recovered at other sites in the southwestern Great Basin (Gardner 2002:58).

The few botanical remains from the site consisted almost entirely of modern vegetation (Gardner 2002:62-63). However, there was a number of charcoal samples from the hearth and the ash pit. The majority of the charcoal specimens (115 pieces) was identified as a woody member of the Asteraceae (sunflower) family, and was likely used as firewood. Small amounts of *Atriplex* and *Larrea tridentata* were also identified.

Dating

As noted above, six obsidian projectile points were identified as Rose Spring series and one as Humboldt series, while one was an unclassified dart point base (Gardner 2002:66). The Rose Spring points have been fairly securely dated to the Rose Spring Period. In addition, three radiocarbon samples were submitted for analysis. One was derived from the soil taken directly beneath the hearth. An AMS assay on the charcoal from this soil sample returned a result of 880 ± 50 RCYBP, calibrated between A.D. 1030 and 1265. This date supported the evidence for a Rose Spring Period occupation. However, two charcoal samples from the ash pit returned dates of 2,490 ± 60 RCYBP (calibrated between 800 and 405 B.C.) and 2,430 ± 80 RCYBP (calibrated between 800 and 380 B.C.) (Gardner 2002:66). These dates suggested an earlier occupation dating to the Gypsum Period, although the extent of that occupation is unclear.

The 23 specimens submitted for obsidian sourcing and hydration included all six projectile points and 17 pieces of debitage, all of which were chemically characterized to the Coso Volcanic Field (Gardner 2002:67-70). The majority of the rim measurements

fell between 3.1 and 5.7 microns, although two specimens (including the dart point) had mean rim measurements of 11.3 and 11.6 microns. The *Olivella* shell beads generally date between the late Middle Period and the terminal Late Period, a time spanning between approximately A.D. 300 and 1500 (Bennyhoff and Hughes 1987:149). Chester King assigned all of the beads to his M4 phase of the Middle Period (approximately A.D. 700 to 900) (Gardner 2002:66). Both the Bennyhoff and Hughes (1987) and King (1990) chronologies provided evidence for a Rose Spring Period occupation.

Interpretations

The age range produced by all of the dating techniques strongly suggested that the primary occupation of the Coffee Break Site was between about 1,200 and 700 B.P., or during the Rose Spring Period (Gardner 2002:71). Support for this came from one of the radiocarbon assays, the projectile point typology, most of the hydration rim measurements, and the *Olivella* shell beads, all of which demonstrated a Rose Spring Period occupation. However, the thicker hydration rims on two of the obsidian specimens and the two radiocarbon results from the ash pit provided evidence of an earlier, perhaps sporadic, occupation of the site (Gardner 2002:80). The early Gypsum Period is thought to have been a somewhat cooler and wetter time than the previous Pinto Period. During this time, it has been suggested that settlements were based near streams or springs, such as that at the Coffee Break site (see Chapters 1 and 4).

During the subsequent Rose Spring Period, climatic conditions appear to have been much more mesic in the desert (Gardner 2002:78). The Coffee Break Site may have been inhabited intermittently during the Gypsum Period, and then toward the end of that time or during the early Rose Spring Period, it may have been abandoned in favor of nearby Koehn Lake. Then during the late Rose Spring Period, it may have been occupied once

again, perhaps seasonally, with Koehn Lake as the primary occupation center (Gardner 2002:78-80). The subsequent absence of evidence of a Late Prehistoric Period occupation suggests that toward the end of the Rose Spring Period, Koehn Lake was becoming increasingly desiccated, possibly requiring population movement to more secure water sources, such as stream and spring resources that may have become more profitable as the lake began to dry up (Gardner 2002:79).

One of the main resources at Coffee Break was lagomorphs, as well as a number of other small mammals. Based on the scant faunal remains, however, a determination of the season of occupation of the site could not be determined with any certainty (Gardner 2002:63). Nevertheless, as jackrabbits reach a breeding peak in the spring, the dearth of juvenile jackrabbit remains indicated a later procurement, possibly in the summer or fall season (Gardner 2002:63). Although McGuire et al. (1982) reported evidence of communal rabbit drives at the neighboring Bickel and Last Chance sites (see above), there was no evidence of communal rabbit drives at Coffee Break.

Site maintenance appears to have occurred at the site, judging by the presence of the ash pit (Gardner 2002:76). This indicated that the inhabitants were residing at Coffee Break for a somewhat extended stay. Further, all of the toolstone from the site is available at local quarries within a relatively short walking distance, although it could only be speculated that these quarries were the sources of the stone (Gardner 2002:77).

CA-KER-6106 (Freeman Spring)

Site Description

Freeman Spring (CA-KER-6106) is located near the junction of Highways 14 and 178, in the northwestern Mojave Desert south of Indian Wells Valley (Williams 2004:2).

The site is ca. 200 m. north-south by 150 m. east-west, and is divided into two major loci (Loci A and B), and one minor locus (Locus C). The major distinction of the Freeman Spring site is the extensive and very dark midden (see Figure 14). Continuing to erode out of the midden are numerous fire-affected rocks, flaked and ground stone, and faunal remains (Williams 2004:2). Both Locus A and Locus B have multiple bedrock mortars and slicks, and there is a single petroglyph on the north end of the site.

Field Methods

Five test units were placed at Freeman Spring, two each at Loci A and B and one at Locus C. However, Locus C was eventually determined to be a secondary deposit as the result of a modern road cut, and was only cursorily addressed by Williams (2004), so it is not discussed further here. The other four units were 1 by 2 m., and were excavated in 10-cm. levels (Williams 2004:2). Column samples were retrieved from the test units.

Features

Multiple features were discovered during the testing of Freeman Spring, including six hearths, a rock cairn, bedrock mortars (n = 6) and slicks (n = 18), and a petroglyph (Williams 2004:4). Three of the hearths came from Locus A and three from Locus B. The depths of these hearths ranged between 60 and 105 cm., while the depth of the rock cairn was 130 cm. (Audry Williams, personal communication 2004). Radiocarbon samples were taken from three of the hearths, two from Locus A and one from Locus B.

Material Culture

Rose Spring series projectile points were recovered from both Locus A (n = 1) and Locus B (n = 13). Of those, 12 were made of obsidian, one of chert, and one of chalcedony (Williams 2004:3). The density of debitage was interesting, in that Locus A only produced 8.8% (n = 637) of all flakes, while Locus B produced the rest (91.2%; n =

Figure 14. Part of the midden exposure at Freeman Spring (CA-KER-6106), taken in 2002. (Photograph courtesy of Audry Williams.)

6,570). In addition, 21 ground stone fragments were discovered, seven from Locus A and 14 from Locus B (Williams 2004:3). Thirteen of these ground stone items were classified as manos. A total of 21 beads was also found, 19 made from *Olivella*, one from *Haliotis*, and one from freshwater clam (Williams 2004:4).

Faunal and Botanical Remains

The faunal remains from Freeman Spring totaled more than 20,000 specimens (Williams 2004:3). A sample of 11,564 specimens was chosen for analysis. Of those, 1,854 were identified to at least class level. The vast majority of these remains is either *Lepus californicus* (n = 1,508; 81.3%), lagomorph (n = 282; 15.2%), or *Sylvilagus* (n = 24; 1.3%). Locus A produced only 30.8% (n = 6,251) of the faunal remains, while Locus B produced 69.2% (n = 14,066) (Williams 2004:3). Botanical remains consisted of a single burned yucca specimen from one of the hearth features at Locus A (Audry Williams, personal communication 2004).

Dating

Three radiocarbon samples from hearth contexts were submitted for analysis (Williams 2004:4). One sample was derived from TU-1 (Locus A) at 60 to 70 cm., producing an AMS date of 1,110 ± 40 RCYBP (A.D. 790 to 1020; 1,160 to 930 B.P.). The second sample also came from TU-1 at 90 cm., which produced a conventional date of 1,130 ± 60 RCYBP (A.D. 770 to 1020; 1,180 to 930 B.P.). The third sample came from TU-4 (Locus B) at 66 cm., resulting in a date of 1,110 ± 50 RCYBP (A.D. 870 to 1010; 1,080 to 940 B.P.). These three dates are statistically identical, suggesting that both loci were occupied contemporaneously (Williams 2004:4).

A total of 42 obsidian specimens were submitted for sourcing and hydration analyses, 26 from TU-4, 12 from TU-1, and four from TU-5 (Allen 2005). Most of the samples had mean hydration values between 3.01 and 5.90 microns (n = 27; 64%), with all but five of those 27 falling between 4.0 and 5.0 microns. An additional 11 (26%) had mean hydration values between 6.35 and 9.95 microns. Three samples had values of 10.09, 10.64, and 11.01 microns. These results support a predominant Rose Spring Period occupation for Freeman Spring, with a possible earlier component. The results of the sourcing analysis indicated that all 42 specimens were derived from the Coso Volcanic Field, with 38 further sourced to the West Sugarloaf subsource, two to the Sugarloaf Mountain subsource, and two to the West Cactus Peak subsource (Skinner 2005).

The *Olivella* shell beads were of several types, of which all but those with ambiguous temporal significance fall within the Rose Spring Period. Thus, the projectile points, the radiocarbon dates, and the *Olivella* beads all provided evidence that Freeman Spring is most likely a single-component Rose Spring Period site (Audry Williams, personal communication 2004).

Interpretations

Freeman Spring, located less than 20 miles north of the Coffee Break site, appears to be somewhat more complex than Coffee Break. However, the fact that it seems to be primarily a Rose Spring Period site (if not a single-component Rose Spring site) and had jackrabbit remains suggests that it served a similar purpose. That suggestion must be tempered, however, as the analysis at Freeman Spring is still incomplete. Subsistence was clearly focused on the exploitation of jackrabbits. This indicates a fall occupation for the site, as the ethnographic record indicates that jackrabbits were usually captured in the fall (Williams 2004:5; also see Steward 1938).

CA-KER-6188 (Terese Site)

Site Description

As part of the California Archaeological Site Stewardship Program, Rogers (2005) and Rogers et al. (2002) conducted survey, mapping, and excavation at the Terese Site (CA-KER-6188) in the northern El Paso Mountains on the southern margin of Indian Wells Valley near Ridgecrest. The site is located within ethnographic Kawaiisu territory (Rogers 2005:6). Koehn Lake (CA-KER-875) is about 20 miles southwest of the Terese Site.

Resting on sloping terrain above a dry watercourse, the site consists of three loci, one of which contains an extensive midden. Locus A has the densest concentration of rock rings and petroglyphs, along with ground and flaked stone scatters. Locus B is west of Locus A and is situated on a steep slope, its predominant trait being an extensive midden (Rogers 2003a:1). On another steep ridge south of Locus A is Locus C, which had the least number of features.

Field Methods

Two 1 by 2 m. test units were placed at the Terese Site, both in Locus A (Rogers 2003b:1; also see Rogers 2005; Rogers 2003c; Rogers et al. 2002). These were excavated in 10-cm. levels. In addition, two 50 by 50 cm. shovel test pits (STPs) were placed next to two petroglyph locations in order to recover obsidian debitage for dating and sourcing analyses. All of the soil from the excavation units and the STPs was screened through 1/8-in. mesh.

Features

The Terese site contains an extensive midden, along with 117 rock art panels (including petroglyphs and cupules), multiple lithic scatters, 24 rock rings, 60 bedrock mortars and slicks, and three check dams (Rogers 2005; Rogers and Rogers 2004). Only a few of these features had been documented at the time of this writing. During the excavations, a possible metate cache was discovered in TU-2 (Rogers 2003b:1). While no features were identified in TU-1, the soil was very black and contained charcoal and fire-affected rocks, suggesting that it may have been a hearth that had become dispersed.

Material Culture

Surface survey at the Terese Site in 2003 identified nearly 300 features and isolated artifacts or artifact scatters (Rogers 2003c). Many of the artifacts were formed flaked tools, including drills, bifaces, and other flaked stone items, as well as numerous ground stone implements.

The material inventory from the Terese Site excavations was limited, but the units produced flaked stone, ground stone, two *Olivella* sp. shell beads, and a *Tivela* sp. bead (Rogers 2005:15). The flaked stone artifacts included one chert biface fragment, five hammerstones (three quartzite, two basalt), and four cores (three chert, one obsidian).

The debitage from the two units and the STPs consisted of obsidian (n = 71), cryptocrystalline silicate (n = 618), and basalt (n = 8). A survey conducted on-site also produced cores (n = 20), bifaces (n = 3), projectile point fragments (n = 2), and debitage (n = 44; excluding lithic scatters).

From a survey conducted on-site, ground stone specimens included metates (n = 48), manos (n = 19), and pestles (n = 7). The test units and STPs produced one basalt metate fragment, 22 manos or mano fragments (21 basalt, one quartzite), and 25 unidentified ground stone fragments (23 basalt, two quartzite) (Rogers 2005:13-14). Several basalt fire-affected rocks were also recovered (most from TU-1), and a large number of others were observed in and around the site but were not collected.

Faunal and Botanical Remains

Although they have not yet been quantified or identified taxonomically beyond "small animal," a small number of bones was recovered from the Terese Site (Rogers 2003b). There were no reported botanical remains from the site.

Dating

A total of 13 obsidian samples from the Terese Site was submitted for sourcing and hydration (Rogers 2005:16). All of the specimens were chemically characterized to the Coso Volcanic Field. The 14 hydration rim measurements (including two readings from a single specimen) ranged between 4.0 and 13.0 microns, although the majority of the rims (n = 10, including the two from the same specimen) ranged between 4.0 and 6.0 microns. The other readings were 10.3, 10.9, 12.9, and 13.0 microns. These rim values suggest that the site dates primarily to the Rose Spring Period, but may also contain a late Gypsum Period component. The *Olivella* beads were identified as Type F2a full saddle (Rogers 2005; Rogers and Rogers 2004). This bead type is regarded as a Middle Period

marker artifact, although they "persist through the late phase" (Bennyhoff and Hughes 1987:130).

Interpretations

While the analysis for the Terese Site is incomplete, the site is quite complex. The rock art is similar to that of sites in the Coso area (Rogers and Rogers 2004:57). It also bears a resemblance to the rock art of the eastern Mojave Desert and Death Valley. Interestingly, though, it does not resemble known Kawaiisu pictograph examples (Rogers and Rogers 2004:65).

Comparing the Terese Site to the Coffee Break Site (Gardner 2002), Rogers and Rogers (2004:66; also see Rogers 2005) suggested that it may also represent a short-term habitation site that was reoccupied intermittently over a considerable period of time, taking advantage of the resources at Koehn Lake as well as springs in the nearby foothills of the El Paso Mountains. This argument is supported by the differences in the rock art, which suggest a sequence of occupations by different groups (Rogers and Rogers 2004:66).

CA-SBR-72 (Oro Grande Site)

Site Description

The Oro Grande Site (CA-SBR-72) is in the southwestern Mojave Desert on the west side of the Mojave River a few miles northwest of Victorville (Rector et al. 1983). The area where the site is located falls between the Garlock fault to the northwest and the San Andreas fault to the southwest. It rests at an elevation of 794 m. on one of many terraces that have been created during multiple climatic and tectonic events subsequent to the Pleistocene. Other terraces are visible to the west of the site (Rector 1983a:5). Oro

Grande contained a number of distinct loci encompassing approximately five acres (Rector 1983b:21).

Field Methods

Ten 1 by 2 m. test units were excavated in 10-cm. arbitrary levels. The units were excavated to an average depth of 50 cm., and all soil from the units was screened through 1/8-in. mesh. In addition, block excavations were undertaken where greater artifact densities were evident, and trenches were dug in order to extract geologic data (Rector 1983b:20-21).

Features

A large number of features was identified at Oro Grande, including 37 hearths, one rock-lined fire pit, two dense concentrations of fire-affected rock, single artifacts identified as features, and an area containing ancient human and animal tracks (Rector 1983b:24-27). While there were "concentrations of cultural material" (Rector 1983b:27) associated with the hearths, it was not clear to this author whether additional artifacts were associated with any of the other features.

Material Culture

The material culture from Oro Grande consisted of flaked stone, ground stone, shell and stone ornaments, and bone artifacts. The flaked stone assemblage contained 113 projectile points, 71 of which could be typed. These included Cottonwood Triangular Straight-based (n = 33), Cottonwood Triangular Concave-based (n = 33), Cottonwood Triangular Basal-notched (n = 1), Cottonwood Leaf-shaped (n = 1), Rose Spring Corner-notched (n = 1), Elko Eared (n = 1), and Humboldt Basal-notched (n = 1) (Rector 1983b; Jesperson 1983). The materials used in the manufacture of these points were chalcedony (46%), chert (19%), basalt (11%), rhyolite (9%), jasper (7%), obsidian (4%), quartzite

(3%), and opal (1%). There were also knives and knife fragments (n = 23), all but five of which were made of chert or chalcedony, with two of jasper and one each of basalt, quartz, and obsidian (Jesperson 1983:38-39).

Cutting tools (n = 8), scraping tools (n = 71), scraper planes/cores (n = 2), drilling and perforating tools (n = 20), gravers (n = 4), choppers (n = 3), cores (n = 20), and hammerstones (n = 5) of various materials were recovered as well (Jesperson 1983). Included in the flaked stone assemblage were 3,474 pieces of debitage, the majority of which were made of chalcedony (64%), followed by basalt (10%), chert (8%), jasper (5%), obsidian (4%), and rhyolite (4%), with smaller percentages of quartzite, andesite, quartz crystal, granitic material, gneiss, and feldspar crystal (Jesperson 1983:47).

Ground stone and miscellaneous artifacts numbered 179 specimens (Rector 1983c). Of the ground stone items related to subsistence, there were 66 manos or mano fragments, 54 metates or metate fragments, three complete pestles, and four mortar or bowl fragments. Most of these specimens were made of quartzite and granite, but schist and sandstone were also represented. Other items unrelated to subsistence included four pipe fragments, two incised slate fragments, six graphite schist fragments, 21 ocher fragments, a calcite crystal, two clear quartz crystals, and three fragments of fired clay (Rector 1983c:64-67).

The beads and other ornaments from Oro Grande were manufactured of stone from southern California and marine shells from the Pacific coast and the Gulf of California (King 1983:68). The shell beads (n = 148) were made predominantly of *Olivella* (n = 121), followed by *Megathura* (n = 8), *Dentalium* (n = 7), *Mytilus* (n = 5), *Haliotis* (n = 3), *Glycymeris* (n = 2), *Trivia* (n = 1), and *Conus* (n = 1). The majority of these shells beads were large or small *Olivella* saucers (n = 100). A shell pendant fragment was made of

Haliotis. There were 36 stone beads and one stone pendant, all made of schist (King 1983:80).

Also identified in the artifact assemblage were 50 specimens made of bone, including awls (n = 5), pointed tools (n = 5), a strigil (scraping tool), two antler tines that may have been modified, 10 unclassified bone tool fragments, a turtle shell rattle, a bone fragment painted with red ocher, and three bone fragments representing production waste (Langenwalter 1983; Rector 1983d). The human and animal tracks were discovered in the lower component of the site, which was dated at 5,070 ± 120 RCYBP (Rector 1983d:144).

Faunal and Botanical Remains

The faunal remains from Oro Grande consisted of a variety of large and small mammal species in small numbers (some only n = 1) (Langenwalter et al. 1983). Analysis of these remains was by minimum number of individuals (MNI) rather than number of identified specimens. This is unfortunate for the purposes of this study, as more than 100,000 specimens were recovered. The most common species that were clearly attributable to cultural factors (MNI site-wide) were jackrabbit (*Lepus californicus*, n = 150), cottontail rabbit (*Sylvilagus audubonii*, n = 26), and vole (*Microtus californicus*, n = 18). There was also a small MNI of desert tortoise (*Gopherus agassizii*, n = 9), tui chub (*Gila bicolor*, n = 5), chuckwalla (*Sauromalus obesus*, n = 4), western pond turtle (*Clemmys marmorata,* n = 3), and bighorn sheep (*Ovis canadensis*, n = 3), as well as a variety of birds, rodents, and reptiles (Langenwalter et al. 1983). There were also numerous unmodified molluscan remains (Rector 1983e).

The botanical remains included a variety of species, most represented by less than three specimens (e.g., *Chenopodium*, *Hypericum*, *Cyperus*, *Astragalus*, *Festuca*, *Scirpus*,

Eriogonum, *Quercus*). Those species with more than four specimens were identified as filaree (*Erodium* cf. *cicutarium*; n = 21), Indian rice grass (*Oryzopsis* cf. *hymenoides*; n = 15), California poppy (*Eschscholzia californica*; n = 12), juniper (*Juniperus californica*; n = 11), and Portulacaceae (*Calyptridium* cf. *umbellatum*; n =5).

As the sample size was so small (less than 100 specimens), it was difficult to discern subsistence patterns (McCarthy and Wilke 1983). Moreover, some of the remains were likely intrusive and not related to the prehistoric occupation of the site (McCarthy and Wilke 1983:107). On the other hand, of those remains that were considered to be food sources (*Oryzopsis*, *Quercus*, *Cyperus*, *Scirpus*, *Chenopodium*, *Juniperus*, *Eriogonum*, *Calyptridium*, *Poa*), McCarthy and Wilke (1983:107) suggested that these indicated a pattern of foraging over long distances or that food was transported to Oro Grande.

Dating

Dating of the Oro Grande site was derived from radiocarbon assays and diagnostic artifacts (Rector 1983b:27-28). Six radiocarbon dates were derived from the upper component of the site: 775 ± 100 (A.D. 1100 to 1300), 825 ± 100 (A.D. 1075 to 1210), 850 ± 100 (A.D. 1050 to 1225), 1,050 ± 100 (A.D. 860 to 1050), 1,095 ± 100 (A.D. 900 to 1040), and 1,130 ± 100 RCYBP (A.D. 840 to 980). At one standard deviation, Rector (1983b:27) suggested a maximum time range for this component between A.D. 840 and 1300, with a minimum time range between A.D. 980 and 1075. The lower component was dated at 5,070 ± 120 RCYBP (3,700 to 4,190 B.C.).

Oro Grande was also dated typologically with temporally sensitive artifacts, including the projectile points and shell beads. The Cottonwood specimens, which constituted the majority of the projectile points from the site, suggested a Late Prehistoric Period occupation (Rector 1983b:29). Given the radiocarbon dates, however, Rector (1983b:30)

suggested that this point type may have been introduced somewhat earlier. The shell and stone ornaments are thought to date between about 500 B.C. to A.D. 1500, although the time span of these ornaments is rather considerable and some may have continued to be used much later in time (Rector 1983b:31).

Interpretations

The excavations at Oro Grande demonstrated that it consisted of two cultural components separated by a considerable period of time (Rector 1983b:24). It was first inhabited about 6,000 years ago, and subsequently between 500 B.C. and A.D. 1500, although most of the human activity probably occurred between A.D. 840 and 1300 (Rector 1983b:31). While it was not possible to determine with any certainty the season of site use at the site, it is likely that it was inhabited predominantly between spring and autumn, with occasional use during the winter (McCarthy and Wilke 1983:108). This interpretation was based on known seasons of collection of particular botanical species (such as Indian rice grass [*Oryzopsis*]) and determination of the season of flowering (McCarthy and Wilke 1983:108). This was supported by the faunal assemblage, the interpretation of which was based largely on the seasonal availability of chuckwalla and bufflehead (Langenwalter et al. 1983:133). The faunal remains demonstrated an emphasis on hares and rabbits (Rector 1983d:142).

The relatively small quantity of debitage indicated the likelihood that stone tool manufacture occurred elsewhere, with the materials subsequently carried to the site (Jesperson 1983:50). This was supported by the fact that almost all of the toolstone at Oro Grande was nonlocal (Rector 1983d:144). The presence of the stone and marine shell ornaments at Oro Grande suggested that the inhabitants participated in "one or more far-reaching exchange systems" (Rector 1983d:144; also see King 1983).

CA-SBR-176 (Deep Creek Site)

Site Description

The Deep Creek site (CA-SBR-176) is located where the west fork of the Mojave River and Deep Creek once intersected prior to desiccation of the area by construction of the Mojave River Forks dam in 1963 (Altschul et al. 1989:23; also see Altschul 1991). It is situated on a slight terrace next to the Mojave River channel. The surrounding vegetation today consists of sparsely distributed desert chaparral. The construction of the dam also altered the topography of the south end of the site, and dirt roads now cut through it (Altschul et al. 1989:23). The site was originally investigated by Smith (1955) and later tested by Altschul et al. (1989), although the description of the site herein addresses the latter study almost exclusively. The site dimensions are approximately 60 by 120 m.

Field Methods

During the investigations by Altschul et al. (1989), a surface collection of the site was conducted, along with the excavation of seven backhoe trenches and two 1 by 2 m. test units. One of the test units was ultimately expanded to a 2 by 3 m. unit in order to expand the exposure of a feature (see below). The test units were excavated in 10-cm. levels (Altschul et al. 1989:32), and although it was not so stated, it is presumed here that all soil was screened through 1/8-in. mesh.

Features

Two features were documented at Deep Creek during the investigations by Altschul et al. (1989). Feature 1 was discovered in TU-2 at 20 to 30 cm. It was a relatively circular concentration of stones and cobbles that had been thermally altered (Altschul et al. 1989:34). While its function was not clear, similar features recorded by Smith (1955)

suggested that it may be either the floor of a house pit or pavement for an outside cooking area (Altschul et al. 1989:37).

The second feature was uncovered in one of the backhoe trenches, near TU-1. It consisted of a rock-lined pit containing a small organic stain and heavy carbon deposit (Altschul et al. 1989:37). No artifacts were associated with this feature, although the rocks contained within the pit were slightly fire-affected. This feature was characterized by Altschul et al. (1989:37) as "an expediently utilized hearth." Although not designated as a feature, Altschul et al. (1989:26) also identified two relatively small grinding slicks on a single massive boulder along the eastern border of the site. Two bedrock grinding slicks were also documented at Deep Creek (Altschul et al. 1989:26).

Material Culture

Lithic artifacts made up the entirety of the assemblage recovered at Deep Creek by Altschul et al. (1989). From the surface collections, backhoe trenches, and excavation units, these included projectile points, cores, debitage, ground stone, and stone beads. The assemblage totaled 427 specimens, of which 381 (89%) was debitage. The predominant material for the debitage was quartzite, followed in order of abundance by chert, basalt, chalcedony, quartz, obsidian, and rhyolite (Altschul et al. 1989:52-55). Projectile points consisted of three Cottonwood Triangular forms, all manufactured from chert (Altschul et al. 1989:57). Cores were represented by 18 specimens, primarily made of quartzite. Some of the flaked stone appeared to have been heat treated.

Of the 21 pieces of ground stone recovered from the Deep Creek site, 11 were derived from the surface collection and 10 from the test pits and backhoe trenches. Manos made up more than half of these items (n = 12), with the remaining artifacts made up of metates (n = 6) and pestles (n = 3) (Altschul et al. 1989:56). Three stone beads recovered from

TU-2 were thought to have been manufactured from steatite or schist (Altschul et al. 1989:59).

Faunal and Botanical Remains

The excavations at the Deep Creek site produced very few faunal remains (n = 306). Of those, only 36 could be identified taxonomically (Altschul et al. 1989:67). The large mammal species represented by these 36 elements included bighorn sheep (*Ovis canadensis*, n = 2) and deer (*Odocoileus*, n = 5), while the medium and small mammals consisted of cottontail rabbit (*Sylvilagus*, n = 7), probable coyote (*Canis latrans*, n = 1), and ground squirrel (*Citellus*, n = 1). Birds (Charadriidae) were represented by two specimens (Altschul et al. 1989:67-70). The remaining elements consisted of unknown small mammal (n = 11), medium mammal (n = 5), and large mammal (n = 2). All but one of the identified faunal remains had evidence of burning, supporting a cultural context for the presence of these remains in the site.

Macroscopic and pollen analyses were conducted on the botanical remains from the Deep Creek site. The pollen results yielded little in the way of identifiable grains, although very small quantities of alder (*Alnus*), oak (*Quercus*), pine (*Pinus*), willow (*Salix*), ambrosia (Ambrosiaceae), and sagebrush (*Artemisia*) were reported (Altschul et al. 1989:73). The macroscopic remains consisted of corn, acorn, ambrosia, possibly squash, and a few unidentifiable fragments (Altschul et al. 1989:74). These results suggested the use of acorns, squash, and stone fruits by the inhabitants of the site (Altschul et al. 1989:77).

Dating

Dating for the Deep Creek site was derived from projectile point typology and obsidian hydration (Bouey 1989; Origer 1989). The projectile points indicated a Late

Prehistoric Period occupation. Obsidian hydration analysis on six debitage specimens produced a mean range between 4.2 and 5.0 microns. Origer (1989:49) maintained that these readings argued for occupation of the site between A.D. 1200 and the late nineteenth century. On the other hand, Origer (1989:48) observed that the stone beads suggested a somewhat earlier occupation, given their stratigraphic position at the base of one of the middens and the discovery of similar beads at nearby sites that dated between 3,000 and 1,650 years ago (Basgall and True 1985; King 1983).

Interpretations

Due to the small artifact and ecofact inventory, Altschul et al. (1989:84-85) were unable to draw any conclusions about the function, season, or length of occupation of the Deep Creek site, although they referred to it as a base camp. However, the presence of a stone floor and rock clusters, the latter of which may have been storage features, suggested relatively long-term occupation. Further, during the earlier investigations by Smith (1955), several house pits were documented, providing support for this conclusion. The diversity of the artifact assemblage argued for a wide range of activities, with hunting and plant processing as major subsistence foci (Altschul et al. 1989:85).

The scant faunal remains hinted that the site occupants focused on cottontail rabbits and deer, "a common pattern throughout southern California" (Altschul et al. 1989:84). This is only surprising in that at most sites that have been studied in this region, jackrabbits (*Lepus*) typically predominate over cottontails (*Sylvilagus*). Despite the presence of rabbits, however, Altschul et al. (1989:84) maintained that the very small quantity of faunal remains precluded any conclusions about seasonality or permanence of occupation. The presence of acorns and stone fruits could indicate a possible fall occupation, except that both can be stored for long periods of time. Limited evidence of

trade was demonstrated by "a rather typical assemblage of 'trade' items" (Altschul et al. 1989:87), in the form of obsidian, marine shell beads, and pottery, the latter two discovered during the earlier investigation of the site (Smith 1955).

CA-SBR-189 (Hinkley Site)

Site Description

Initially recorded by Gerald Smith in 1938, CA-SBR-189 is situated within a large sand dune complex on the north end of the Mojave River (Leonard 1980:19). Its proximity to the town of Hinkley prompted its designation as the Hinkley Site. Much of the area around the site has been subjected to agriculture, natural erosion, trash dumping, vandalism, and construction of a dirt access road that bisects the site. The vandalism has likely resulted in the removal of many artifacts that were probably scattered throughout the site at one time (Leonard 1980:19). At the time of this investigation, the site was bordered by "relatively open, flat, sandy terrain" (Leonard 1980:19).

Field Methods

As part of the investigations undertaken by Leonard (1980), the Hinkley site was surface collected and tested via the excavation of 19 1 by 1 m. units. The units were excavated in 10-cm. levels, and all soil was screened through 1/8-in mesh (Leonard 1980:16). Column and soil samples were taken from selected units.

Features

No features were documented by Leonard (1980) at the Hinkley site. However, the quantity of recovered fire-affected rock (n = 988) suggested that hearths may have once been present at the site (Leonard 1980:30). If so, they have long since been destroyed by various activities that have taken place in recent times.

Material Culture

The artifact inventory from the Hinkley Site included three projectile points, along with knives, hammerstones, cores, manos, metates, reamers, scrapers, chopping tools, modified flakes, debitage, and two fired clay specimens (Leonard 1980:21-26). The combined stone tool category, with the exception of the debitage, totaled 128 specimens. The materials for these tools included metavolcanic, quartz, quartzite, chalcedony, basalt, schist, and chalcedony. The projectile points were tentatively identified as Elko series. The debitage consisted of 387 specimens, most of which were pressure flakes. These were manufactured from various materials as well, including obsidian.

Faunal and Botanical Remains

The faunal remains from the Hinkley Site consisted of 2,206 highly fragmented specimens, few of which were burned (Leonard 1980:26). Of those, 126 were identified taxonomically, the majority of which were jackrabbit (*Lepus*, n = 67). The remaining specimens, most apparently represented by single elements (quantification was somewhat ambiguous), included pronghorn (*Antilocapra americana*), cottontail rabbit (*Sylvilagus*), coyote/dog (probable *Canis latrans*), kit fox (*Vulpes macrotis*), hawk (Falconiformes), ground squirrel (*Spermophilus*), snake (Crotalus), and rodents (*Neotoma*, *Perognathus*, *Thomomys*). No botanical remains were reported by Leonard (1980).

Dating

Dating of the Hinkley Site was derived from three radiocarbon assays from a buried component. These assays resulted in dates of 3,025 ± 75 (1,075 B.C.), 3,210 ± 105 (1,260 B.C.), and 3,295 ± 80 RCYBP (1,345 B.C.) (Leonard 1980:31-32). This placed the occupation of the site within the early part of the Gypsum Period, which was supported by the identification of one of the projectile points as Elko. In the absence of

features, however, it was not made clear in the report what the context, association, or content of these radiocarbon samples were. Given the problems with the radiocarbon samples and the virtual absence of any supporting chronological data, the dating of this site was somewhat ambiguous.

Interpretations

The Hinkley site was interpreted as having a "relatively sedentary occupation" with seasonal use during the late spring or summer (Leonard 1980:31). Milling activities were evident by the number of ground stone artifacts from the site. According to Leonard (1980:29), the projectile points and knives suggested the hunting and butchering of animals. Based on the small number of artifacts and the absence of features, this interpretation is not well supported. According to Leonard (1980:34), the presence of milling tools at a presumed Gypsum Period site is significant in that previous descriptions of sites of this age have denied the presence of such implements (e.g., Warren and Crabtree 1978), and hence that seed collecting and processing activities were not common during this time. Leonard (1980:35) argued that the presence of such tools at Hinkley should be cause to modify previous assumptions about Gypsum Period sites.

CA-SBR-1913 (*Guapiabit*)

Site Description

Guapiabit (CA-SBR-1913) is an ethnohistoric Serrano village situated in the Summit Valley of southwestern San Bernardino County, in the south-central Mojave Desert (Sutton and Schneider 1996:2). The site rests on the northern bank of Horsethief Creek upstream of the convergence of this creek with the Mojave River (Sutton and Schneider 1996:13). CA-SBR-1913 represents a portion of what was originally recorded as CA-

SBR-93/H (Smith 1939). At the time of Smith's study, 142 circular depressions were identified. These circular depressions were a point of interest for the subsequent study by Sutton and Schneider (1996). The site covers an area of about 300 m. east-west by 170 m. north-south. Three major activity loci were identified at the site, those being the habitation zone, a cremation locus, and a possible ceremonial area (see below).

Field Methods

Guapiabit has been the subject of a number of investigations, including a surface collection by the Archaeological Survey Association in 1969, the 1990 excavations by Sutton and Schneider (1996), and mitigation work as the result of construction damage in 1993 and 1994 (Parr 1996). As part of the study conducted by Sutton and Schneider (1996), a surface collection was also conducted, during which diagnostic and formal artifacts were flagged, mapped, and collected (Sutton and Schneider 1996:12).

In addition, in order to define the vertical and horizontal boundaries of the site, four backhoe trenches were excavated. These trenches were two feet wide and five feet deep. Fifty-four 1 by 2 m. excavation units were also placed at the site. These were excavated in 10-cm. levels, and all soil was screened through 1/8-in. mesh, with some soil also passed through 1/16-in. mesh to spot-check for very small items (Sutton and Schneider 1996:12). Column and soil samples were taken from units and features. The subsequent work by Parr (1996) included trenching around the area of construction disturbance, as well as the excavation of three 1 by 2 m. units. The excavation methodology was the same as that conducted by Sutton and Schneider (1996).

Features

Eighteen features were identified at *Guapiabit*. These included eight circular depressions, five hearths, one possible storage pit, and four scatters of fire-affected rock

(FAR). Two of the circular depressions were tested by Sutton and Schneider (1996). One of these two features (Feature 10) was a housepit containing additional features, including two hearths (Features 5 and 8), one of the pits (Feature 11), and one of the FAR scatters (Feature 9) (Sutton and Schneider 1996:15). Three charcoal samples from the two hearths associated with Feature 10 were submitted for radiocarbon analysis (Sutton and Schneider 1996:15-17). Another radiocarbon sample was derived from a hearth (Feature 4) in the center of one of the test units.

Artifacts associated with these hearths included burned ground stone and eight ceramic fragments from Feature 5, and a burned mano, burned ground stone fragment, two ceramic fragments, and a small quantity of debitage from Feature 8. Both features contained small amounts of faunal and botanical remains, although only *Juniperus* sp. was identified to genus. While it could not be conclusively identified as a structure, the characteristics of Feature 10 led Sutton and Schneider (1996:15) to propose that it represented the remnants of a domestic dwelling occupied within the last 400 years.

The possible storage pit was interpreted as storage for juniper seeds (Sutton and Schneider 1996:17). The FAR scatters were interpreted as either hearths, roasting features, or the debris from such features. No radiocarbon samples were taken from any of these features. In addition, Sutton and Schneider (1996:28) reported a cremation consisting of a concentration of burned human bone that had been discovered during an earlier study (Suchey 1990). The remains of this cremation represented two individuals, an adult and a subadult.

Material Culture

The material culture *Guapiabit* study totaled 2,533 artifacts, most of which was debitage. Flaked stone artifacts included 26 projectile points, five bifaces, one jasper

drill, 72 cores, 23 hammerstones, a bipolar hammerstone, a quartzite scraper, six flake tools (all quartzite), four edge-modified flakes (three quartzite, one quartz), and 1,642 pieces of debitage. All of the projectile points were classified as Cottonwood Triangular types (Sutton and Schneider 1996:22). The points and bifaces were manufactured from various materials, including a single obsidian specimen, as well as (in order of frequency) chalcedony, jasper, chert, basalt, rhyolite, and porphyry (Yohe 1996a:65). The cores, hammerstones, and debitage also consisted of a variety of materials, although the predominant material was quartzite, followed distantly by chalcedony, granite, chert, jasper, igneous, and obsidian.

The ground stone assemblage consisted of 30 manos or mano fragments, seven metates or metate fragments, a granite hopper mortar, 11 pestles or pestle fragments, a complete granite bowl, two bowl fragments, 56 fragments of unidentified ground stone, a biconally drilled vesicular basalt item of unknown function, a quartzite shaft straightener, 27 green slate ornament fragments, and three ovate stones. The ground stone artifacts were made predominantly of granite or quartzite, with rhyolite, basalt, and schist represented by one or two specimens each (Sutton and Schneider 1996:19-22).

Other artifacts identified by Sutton and Schneider (1996) included bone artifacts, ceramics, and beads, as well as a few historical items. The bone artifacts consisted of 22 modified fragments (one *Clemmys marmorata* and the rest large mammal), six of which were identified as awls (Sutton and Schneider 1996:25). The ceramic fragments totaled 80 specimens of Tizon Brown Ware and Lower Colorado Buff Ware (Peden and Sutton 1996:77-78). Six beads were also identified, including four made of *Olivella*, one of steatite, and one of glass. Per Bennyhoff and Hughes (1987), the *Olivella* beads were identified as Class D punched, H1b, and B4 Cap (Sutton and Schneider 1996:26).

The material culture from the subsequent work conducted by Parr (1996) was quite small, totaling 185 artifacts. These included a quartzite core, 182 pieces of debitage, a quartzite mano fragment, and a granite metate fragment. Two unmodified quartz crystals and 29 pieces of fire-affected rock were also documented. The debitage consisted primarily of quartzite (n = 103; 56.9%), followed (in order of frequency) by basalt, chalcedony, rhyolite, chert, jasper, and obsidian.

Faunal and Botanical Remains

The faunal remains from *Guapiabit* totaled 4,222 specimens (Yohe 1996b:59). These included 308 jackrabbit (*Lepus californicus*), 15 cottontail rabbit (*Sylvilagus* spp.), 14 brush rabbit (*Sylvilagus bachmani*), 10 golden eagle (*Aquila chrysaetos*), 2,603 rabbit-sized, 1,141 deer-sized, 60 artiodactyl, and 39 rodent-sized, as well as less than 10 fragments each of deer (*Odocoileus hemionus*, n = 6), possible pronghorn (*Antilocapra americana*, n = 1), dog/coyote (*Canis* sp., n = 5), weasel (*Mustela freneta*, n = 1), ground squirrel (*Spermophilus beecheyi*, n = 3), vole (*Microtus* sp., n = 1), wood rat (*Neotoma* sp., n = 3), and western pond turtle (*Clemmys marmorata*, n = 1).

Yohe (1996b:59) observed that the faunal remains from the site represented the largest category of cultural materials, most of which were found in the house depression designated as Feature 10. He also noted that the discovery of additional features, artifact concentrations, and faunal remains within Feature 10 supported Sutton and Schneider's (1996) interpretation that, along with the other unexcavated surface depressions at the site, this feature represented a "living structure" (Yohe 1996b:61). Further, Yohe (1996b) maintained that analysis of the faunal remains indicated that there was likely a subsistence focus on lagomorphs and artiodactyls. Protein residue analysis on 13 ground stone artifacts and 17 flaked stone artifacts produced positive reactions on 10 of these

items, including lagomorph, pronghorn, deer, mouse, rat, cat, and human (M. Newman 1996:71-72).

Sutton and Schneider (1996:28) noted that there was a significant number of burned juniper seeds (*Juniperus* cf. *californica*) recovered at *Guapiabit*. There were also seeds identified as saltbush (*Atriplex* sp.) and amaranth (*Amaranthus* cf. *albus* or *californicus*), but these were thought to be natural occurrences. Pollen analysis identified alder (*Alnus*), juniper (*Juniperus*), pine (*Pinus*), oak (*Quercus*), willow (*Salix*), Cheno-ams, Caryophyllaceae, various Compositae, and other specimens identified to family level (Scott Cummings 1996). The number of pollen specimens from 10 different bulk pollen samples ranged between 100 and 203, although there was no indication of how many of each species was represented (Scott Cummings 1996:75).

Faunal remains from the salvage operation conducted by Parr (1996) were very minimal, and considered to be of recent origin. The botanical remains consisted of juniper seed fragments and unidentified charcoal.

Dating

Seven pieces of obsidian, including one of the projectile points and six small flakes, were submitted for obsidian studies. Three were too small for analysis; the other four had micron values of 1.7, 2.1, 5.8, and 11.8 (Sutton and Schneider 1996:32). While the first two readings are generally temporally concordant with the Cottonwood Triangular projectile point, the others are inconsistent with a late occupation. This may be the result of curation, reuse, or the presence of an earlier occupation that was not detected (Sutton and Schneider 1996:30). Interestingly, there were at least three sources represented in the obsidian; one from the Coso Volcanic Field, one from Obsidian Butte, and one from the Bagdad source in the Bristol Mountains (Jackson 1996:79).

The three charcoal samples from the hearths associated with Feature 10 returned results of 240 ± 70, 260 ± 70, and 360 ± 80 RCYBP (Sutton and Schneider 1996:15-17). Another hearth was radiocarbon dated to 235 ± 55 RCYBP. These dates overlapped within one sigma and were statistically identical (Sutton and Schneider 1996:30). The Tizon Brown Ware ceramics date between A.D. 700 and 1900, and the Lower Colorado Buff Ware ceramics date between A.D. 1500 and post-1900 (Peden and Sutton 1996:77). The radiocarbon and obsidian results, along with the ceramics, Desert series projectile points, and glass trade bead, suggested that the site was occupied after A.D. 1000, "most likely within the last 500 years" (Sutton and Schneider 1996:30).

Interpretations

Guapiabit was interpreted as a small, relatively independent habitation/village site that was part of a larger site complex thought to have been occupied by the Serrano (Sutton and Schneider 1996:33-35). This is supported by historical documentation, such as accounts of Garcés and Zalvidea traveling through the area in the late 1770s and early 1800s and observing a village that fits the description of *Guapiabit* (e.g., Beattie 1955; Coues 1900).

There were three major activity loci identified at *Guapiabit*, the habitation area, the cremation locus (see above), and a possible ceremonial locus. The ceremonial locus, located on the western end of the site, was postulated due to the presence of a presumed cache of incised green slate, a possible eagle burial, and the virtual absence of domestic debris (Sutton and Schneider 1996:34). The habitation area was centered in the northeastern part of the site, where all of the surface depressions (including Feature 10) and most of the artifacts were located. Other activities at the site included awl manufacture, food processing, and flaked stone tool manufacture.

Guapiabit (CA-SBR-1913) was interpreted as "an isolated outlier" to the larger and more complex CA-SBR-93/H site, "perhaps the residence of some particular social unit such as a lineage" (Sutton and Schneider 1996:37). Although it was occupied towards the end of the Late Prehistoric Period, Sutton and Schneider (1996:37-38) argued that CA-SBR-1913 was not substantially occupied during ethnohistoric times, suggesting that the inhabitants either left the area or relocated to the CA-SBR-93/H site subsequent to the Late Prehistoric Period.

There was evidence of trade at the site in the form of nonlocal materials, such as obsidian, shell beads, green slate, and ceramics. CA-SBR-1913 is located along the Mojave Trail, a well-documented prehistoric trade route, which likely facilitated trading activities (Sutton and Schneider 1996:37). The site was thought to have been occupied principally during the winter. This argument was based on three criteria: the substantial nature of the structure, which also contained hearths; the presence of jackrabbits, captured most often in the fall; and the apparent focus of activity around the structure (Sutton and Schneider 1996:34-35).

Red Mountain Archaeological District

The Red Mountain Archaeological District consists of more than 40 known archaeological sites from both prehistoric and historical times (Allen 2003:2). Red Mountain, for which the District is named, is situated between the Rand and Lava mountains, and is a distinctive landmark in the west-central Mojave Desert (Figure 15). Under the direction of Dr. Mark Allen, field classes from California State Polytechnic University, Pomona, have been conducting survey, mapping, and limited test excavations in the District since the spring of 2001 (Allen 2002). The District was placed on the

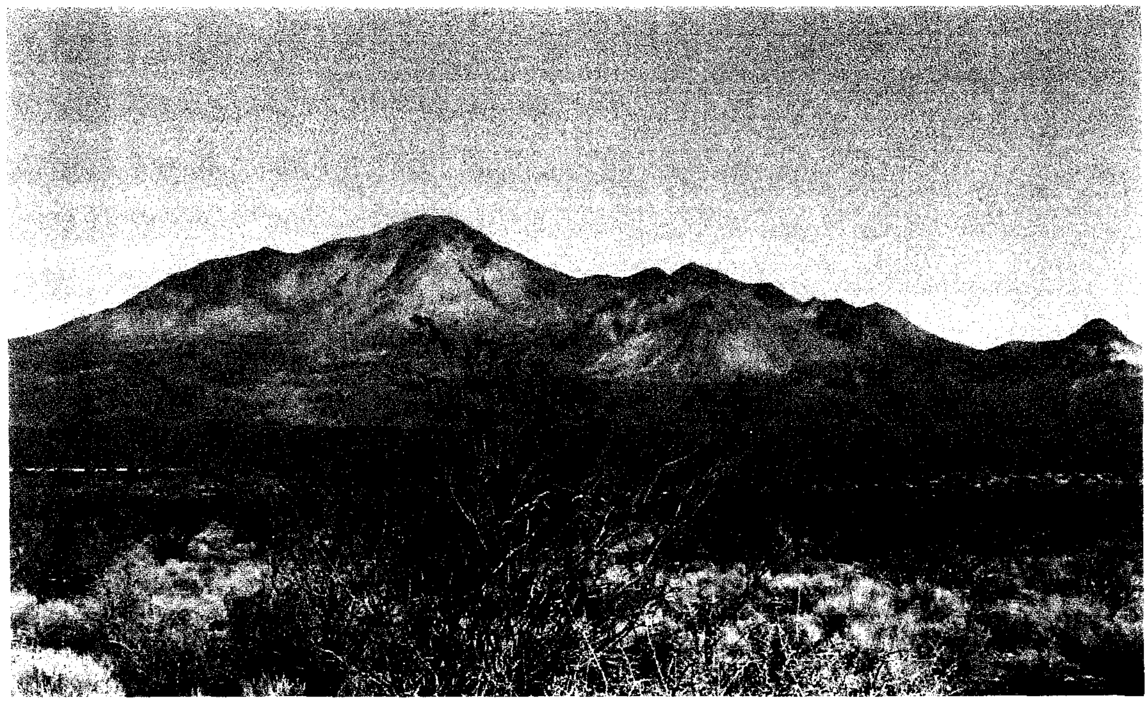

Figure 15. View of Red Mountain from Cuddeback Lake playa, taken in 2003. (Photograph courtesy of Mark Allen.)

National Register of Historic Places in 1981. Although the district has witnessed "fairly serious artifact collecting" for several decades, vehicular access has been restricted since 1978 (Allen 2004:3).

As the formal site report is underway, the discussion herein was gleaned from Allen's interim report to the BLM and a recent conference paper (Allen 2003, 2004). Both of these reports are preliminary summaries, so little quantification of the material culture was available for the purposes of this study; thus, the discussion and interpretations provided below are necessarily brief and the sites are discussed as a group, rather than separately.

Site Descriptions

The BLM report included a summary of five prehistoric sites; the Guzzler Site (CA-SBR-211), the Well Site (CA-SBR-2600), the Hunting Blind Site (CA-SBR-2608), the Ridge Site (CA-SBR-2609), and the Saddle Site (CA-SBR-2614) (Allen 2003:5). No site

dimensions were given, but a general description of the features and artifacts from each of these sites was provided. These five sites are discussed below.

Field Methods

Most of the test units for the prehistoric sites at Red Mountain were 1 by 1 m. in size, excavated in 10-cm. levels. All soils removed from the units were screened through 1/8-in. mesh. Column and soil samples were taken from most of the units.

Features

In general, the prehistoric sites excavated at Red Mountain include several large middens, a hunting blind complex, multiple rock art locales, and concentrations of rock features and milling stones. In addition, there are numerous small lithic scatters and a large quantity of isolated flaked and ground stone implements distributed across the District.

Specifically, the Guzzler Site, located at the north end of the District, has been extensively damaged by construction activities and mining operations. Despite these impacts, portions of the site are in fairly good condition, and a large, charcoal-filled feature was discovered (Allen 2003:4). At the Well Site, several possible hearth features were identified (Allen 2003:4). The Hunting Blind Site contains hunting blinds, a storage facility, and a shallow midden with large quantities of faunal remains and charcoal (Allen 2003:4). The Ridge Site includes a concentration of rock rings that may represent houses (Allen 2003:6), and the Saddle Site contains a large and dark midden (Allen 2003:5).

Material Culture

In addition to the variety of features recorded in the District, an assortment of artifacts was documented as well. At the Guzzler Site, several shell beads, green slate pendant fragments, and ceramics were recovered (Allen 2003:4). Excavations at the Well Site

produced a few obsidian projectile points and other diagnostic artifacts (Allen 2003:4). At the Hunting Blind Site, excavations revealed three small glass trade beads. The Ridge Site contained a significant amount of domestic debris in the form of ground stone artifacts, as well as a Cottonwood Triangular projectile point and a shell bead (Allen 2003:6). Three test units at the Saddle Site yielded a significant amount of lithic materials of both obsidian and nonlocal chert, as well as an intact mano (Allen 2003:6).

Faunal and Botanical Remains

Analyses of the faunal and botanical remains are incomplete, although charcoal was recovered from all five sites. Unidentified faunal remains were reported from two sites, the Hunting Blind Site and the Saddle Site (Allen 2003:5-6).

Botanical samples from all five sites analyzed by Virginia Popper (2004:3) contained uncarbonized seeds, including *Amsinckia*, *Erodium*, *Eriogonum*, *Phacelia*, Asteraceae, and Malvaceae, some of which appeared fresh and were not considered cultural. On the other hand, carbonized seeds consisted of *Amsinckia* (fiddleneck), *Eriogonum* (wild buckwheat), *Erodium* (filaree), *Phacelia* (phacelia), and *Sphaeralcea* (globemallow, desert mallow) (Popper 2004:4). Others that could not be identified to the genus level included Asteraceae (sunflower family), Brassicaceae (mustard), Lamiaceae (mint), Malvaceae (mallow), Poaceae (grass), and Solanaceae (nightshade), *Artemisia* (sagebrush), *Atriplex* (saltbush), *Larrea tridentata* (creosote bush), and Rhamnaceae (buckthorn family) (Popper 2004:4).

Saltbush was the most common botanical remain found at the site, followed by Asteraceae. Both of these species are common ingredients recovered from prehistoric sites in California, typically for use as fuel, medicinal products, fire drills, and/or arrow manufacture (Popper 2004:5). Creosote was also commonly used as fuel. Phacelia,

globemallow, wild buckwheat, and fiddleneck were used as medicines, food, straws, and pipes (Popper 2004:6). Despite their known uses, however, Popper (2004:7) was reluctant to state categorically that they were cultural in nature, as these carbonized seeds could have been charred by natural fires. The one possible exception was at the Saddle Site (CA-SBR-2614), as it contained a midden with a large quantity of groundstone (Popper 2004:1).

Dating

There have been 21 projectile points recovered from the various sites. Of those 21, three were classified as Desert Side-notched, eight as Cottonwoods, two as Rose Spring, and eight others were described as Desert series that could not be further typed (Allen 2004:6). With the exception of the Rose Spring specimens, all of the projectile points indicate a Late Prehistoric Period occupation. This is supported by the recovery of nine ceramic brown ware and orange-colored sherds (Allen 2004:7). While Allen (2004:7) did not provide a classification for the 15 shell beads recovered from his excavations, he proposed that they "mildly suggest a Rose Spring component."

Five radiocarbon samples from four of the sites were submitted to Beta Analytic for analysis. Two of the samples came from the Guzzler Site, and one each from the Ridge, Hunting Blind, and Well sites (Allen 2004:7-8). In that order, the radiocarbon ages are 930 ± 40 RCYBP (A.D. 1020 to 1200), 2,720 ± 40 RCYBP (930 to 810 B.C.), 680 ± 40 RCYBP (A.D. 1270 to 1320 and A.D. 1340 to 1390), 300 ± 40 RCYBP (A.D. 1480 to 1660), and 250 ± 40 RCYBP (A.D. 1550, 1650, 1790, and 1950). Allen (2003:4) argued that these radiocarbon dates supported the evidence provided by the diagnostic artifacts indicating a significant Late Prehistoric Period occupation, but that the District may have been utilized as long ago as 2,000 years.

A total of 53 obsidian specimens from the Red Mountain sites discussed above, as well as a few other sites that are not reported here, was submitted for hydration and sourcing analysis. Of those, 24 (45%) had rim measurements equal to or greater than 6.0 microns, "a conservative approximate indicators of the transition from Gypsum to Rose Spring Periods" (Allen 2004:8). In addition, 20 (38%) of the rim values ranged between 4.5 and 5.9 microns, roughly corresponding to the Rose Spring Period. Seven of the values fell between 2.0 and 4.4 microns, suggestive of the Late Prehistoric Period (Allen 2004:9). Of the obsidian specimens that could be chemically characterized, all were derived from the Coso Volcanic Field, with a few further identified as originating from the Joshua Ridge, Sugarloaf, and West Sugarloaf subsources (Allen 2004:9).

Interpretations

Based on the radiocarbon and hydration results, as well as an admittedly small number of diagnostic artifacts, Allen (2004:6) proposed that the Red Mountain District was occupied during the Gypsum, Rose Spring, and Late Prehistoric periods. In his analysis of the prehistoric land use of the District over time, Allen (2004:9) argued that during the Gypsum Period, sites were relatively short-term and/or seasonal in nature. While there was not a remarkable difference in site use during the Rose Spring Period, sites may have been occupied somewhat longer (Allen 2004:9). A more significant occupation is evident during the Late Prehistoric Period (Allen 2004:10).

Comparing his data from Red Mountain to the model proposed by Sutton (1990, 1991a, 1991b) for the Fremont and Antelope valleys, Allen (2004:10) observed that his analysis generally supports the predictions of Sutton's model (see Chapter 1 for details). The spring on the northeast side of Red Mountain "was evidently used periodically and likely seasonally" (Allen 2004:10). During the transition from the Gypsum to the Rose

Spring Period, it appears that in some cases, the same sites were reoccupied. However, unlike many other sites in the western Mojave Desert, the Red Mountain area continued to be occupied after about 1,000 years ago (Allen 2004:11).

In examining the Bettinger and Baumhoff (1982) model of adaptive strategies (i.e., travelers versus processors), Allen (2004:12) observed that Red Mountain "does seem to reveal evidence of changes in economics and settlement pattern" throughout its occupation span. Allen (2004:12-13) also cited Eerkens' (1999) study in which Eerkens proposed that marginal areas in the central Mojave Desert, and in particular at Fort Irwin, functioned as common pool resource systems, buffer zones, and jointly owned territories among various ethnic groups. As such, Allen (2004:13) argued that there is strong evidence for "marked social boundaries" and "unique cultural patterns" in the Mojave Desert during the Late Prehistoric Period.

CA-SBR-6580 (Siphon Site)

Site Description

The Siphon Site (CA-SBR-6580) is located in the Summit Valley along the southernmost edge of the south-central Mojave Desert, in the foothills of the San Bernardino Mountains, less than a mile from *Guapiabit* (see above; Sutton et al. 1993:1). The elevation of the site is 3,990 ft. The site, named for the Mojave Siphon that was eventually constructed there, had a very dark midden containing multiple features and artifacts. It was discovered during backhoe trenching activities that were intended to locate buried sites along the proposed pipeline route (Sutton et al. 1993:1). The eastern part of the site had been damaged by earlier pipeline construction activities in 1970. The site dimensions were ca. 180 m. east-west by 100 m. north-south (Sutton et al. 1993:4).

Field Methods

Excavations at the Siphon Site consisted of 103 1 by 2 m. test units (197.6 cubic meters), which were excavated in 10-cm. levels (Sutton et al. 1993:4). All of the soil that came from the units was screened through 1/8-in. mesh, and some of that soil was spot-checked for very small artifacts with 1/16-in. mesh. As the site was destined to be destroyed by construction of the siphon, mechanical scraping was conducted after all test units had been excavated in an attempt to discover additional artifacts and features. The scraping went as deep as 1.5 m. in parts of the site (Sutton et al. 1993:4).

Features

Nineteen features were identified at the Siphon Site, including 11 hearths, a cairn, a human cremation, a metate cache, and five concentrations of fire-affected rock (Sutton et al. 1993:9). Charcoal was found in all of the hearths, but only four (Hearths 1, 2, 3, and 6) had sufficient amounts for radiocarbon analysis. Numerous fire-affected rocks were associated with all of the hearths except Hearth 2 (Sutton et al. 1993:10-15).

Artifacts were recovered from Hearth 2 (a single jasper flake), Hearth 5 (a ground stone fragment), Hearth 6 (a core/hammerstone, core/chopper, and core/scraper plane), Hearth 7 (a mano and metate), Hearth 8 (a mano and mano fragment), Hearth 9 (a mano), and Hearth 10 (two manos, a mano fragment, a metate fragment, two unidentified ground stone fragments) (Sutton et al. 1993:10-13). There were very few faunal or botanical remains in the soil samples taken from the hearths (Sutton et al. 1993:10-14). Hearth 6 was located directly above the human cremation, suggesting that this hearth may have been used as part of a mourning ceremony (Sutton et al. 1993:12). While it is possible that the hearth was unrelated to the cremation, its size prompted Sutton et al. (1993:12) to speculate alternatively that it may have represented the remains of a burned structure.

The cairn discovered at the Siphon Site had been partially destroyed by a backhoe during a previous study (no report available). What remained of the cairn feature that was documented by Sutton et al. (1993:15) included 14 rocks, one of which was an intact burned mano. The cache contained at least eight granite metates. Associated with the metates were two cores, a biface, and a pumice abrader (Sutton et al. 1993:16). Charcoal from this feature was identified as chamise (*Adenostoma*). The cremation contained bones that were badly burned and highly fragmented (Sutton et al. 1993:19). At the bottom of the pit that held this cremation were four complete and unburned metates "placed as to form a platform at the bottom of the pit" (Sutton et al. 1993:19). The individual from this cremation was identified as a mature adult of undetermined sex, although some of the skeletal traits were indicative of a male (Yohe 1993a:90).

Five clusters containing fire-affected rocks made up the remaining features from the Siphon Site, all of which were thought to represent dispersed hearths or roasting features. A number of flaked and/or ground stone artifacts was associated with all of these features (Sutton et al. 1993:26).

Material Culture

The artifact assemblage from the Siphon Site consisted of 3,161 specimens, including flaked and ground stone artifacts, bone artifacts, and quartz crystals (Sutton et al. 1993:28-52). The flaked stone specimens included six projectile points, 14 bifaces, one graver, 38 cores, eight bipolar cores, 34 core tools (core/scraper planes, core/unifaces, core/choppers, core/hammerstones), 22 cobble hammerstones, 13 edge-modified flakes, and 2,812 pieces of debitage. Two of the points, one made of chalcedony and one of jasper, were identified as Pinto series. Three were identified as Summit Valley Barbed (all made of chalcedony), a new type designation to describe the multiple specimens "that

do not conform to any existing series or type in southern California" (Sutton et al. 1993:44). The sixth point was identified only as lozenge-shaped.

Of the 14 bifaces, two were complete and 12 were fragments. Six were made of chalcedony, three of quartz, two of obsidian, two of jasper, and one of basalt (Sutton et al. 1993:46). The graver consisted of a piece of modified chalcedony. The materials for the cores and core tools included quartzite (n = 48), chalcedony (n = 12), basalt (n = 6), quartz (n = 3), porphyry (n = 2), jasper (n = 2), rhyolite (n = 2), and one each of felsite, chert, gneiss, granitic, and unknown (Sutton et al. 1993:45-52). The hammerstones (n = 22) were made of quartzite (n = 14), granite (n = 6), jasper (n = 1), and unknown (n = 1). The 13 edge-modified flakes were manufactured from quartzite (n = 9), cryptocrystalline (n = 2), and igneous (n = 2) (Yohe 1993b:73). The 2,812 debitage specimens included quartzite (n = 1,807; 64.3%), chalcedony (n = 247; 8.8%), porphyry (n = 205; 7.3%), chert (n = 172; 6.1%), basalt (n = 150; 5.3%), jasper (n = 80; 2.8%), obsidian (n = 23; 0.8%), and small quantities of other materials.

The ground stone and miscellaneous artifacts from the Siphon Site consisted of 66 manos and mano fragments, 56 metates or metate fragments, nine pestles and pestle fragments (all granitic), a granitic bowl fragment, 14 unidentified ground stone fragments, an ovate schist stone, two abraders, two pipe fragments, two grey slate ornaments, and three slate "pencils" (Sutton et al. 1993:28-43). The predominant material for the manos and metates was overwhelmingly granite, with much smaller quantities of quartzite, sandstone, schist, and breccia. Three bone awls were recovered from Feature 18, identified as a roasting pit (Sutton et al. 1993:24). Five quartz crystals found at the site were likely brought to the site, perhaps for use as power objects (Sutton et al. 1993:52).

Faunal and Botanical Remains

The amount of faunal remains recovered from the Siphon Site was very small (n = 314). Of those, 294 were taxonomically identified, including 23 western pond turtle (*Clemmys marmorata*), two each of jackrabbit (*Lepus californicus*) and pocket gopher (*Thomomys bottae*), and one possible shark tooth (cf. *Carcharodon* sp.). Twelve specimens were identified as lagomorph, 11 specimens as rabbit-sized, 32 as artiodactyl, 156 as large mammal, 52 as unidentified vertebrate, one unidentified reptile, and one unidentified rodent (Yohe 1993c:69-70). In addition, immunological analysis of a soil sample from one of the features identified guinea pig (cf. porcupine, squirrel) and rabbit (Newman 1993b:80-82).

A number of botanical species was identified from the soil samples, including juniper (*Juniperus californica*), amaranth (*Amaranthus* sp.), prickly poppy (*Argemone* sp.), water-hemlock (*Cicuta douglasii*), chamise (*Adenostoma*), and creosote (*Larrea*) (Sutton et al. 1993:26, 52-53). Amaranth is a species known to have been used by the Kawaiisu as food (Zigmond 1981:10). Water-hemlock is a poisonous species that was used medicinally by the Kawaiisu and other groups (Zigmond 1981:20).

Pollen analysis from column samples identified a number of arboreal and nonarboreal species. The arboreal pollen included fir (*Abies*), alder (*Alnus*), hickory/pecan (*Carya*), eucalyptus (*Eucalyptus*), walnut (*Juglans*), juniper (*Juniperus*), pine (*Pinus*), oak (*Quercus*), willow (*Salix*), and elm (*Ulmus*) (Scott Cummings 1993:87). The nonarboreal specimens consisted of Caryophyllaceae (pink family), Cheno-ams (amaranth, pigweed), Compositae (e.g., sagebrush, ragweed, cocklebur, aster, sunflower, dandelion, chicory), Cruciferae (mustard family), *Ephedra* spp., *Eriogonum*, *Erodium*, Gramineae (grass family), Nyctaginaceae, Onagraceae (e.g., *Opuntia*), Polemoniaeae, Rhamnaceae

(*Ceanothus*, *Ribes*), Rosaceae, and Umbelliferae (Scott Cummings 1993:87). As with CASBR-1913, the pollen counts ranged between 100 and 200 specimens, but there was no tabulation of how many specimens there were per species.

Several of the botanical species (e.g., *Eucalyptus*, *Erodium*) were introduced during the historic period and most likely were not associated with prehistoric human activity at the site (Scott Cummings 1993:87). However, some of the other species that were present at the time of occupation (e.g., Cheno-ams, Cruciferae, *Eriogonum*, Gramineae, *Rhus*, *Ribes*) produce seeds, greens, and berries that may well have been used by the site occupants (Scott Cummings 1993:87).

Dating

The following were the radiocarbon results from Hearths 1, 2, 3, and 6, respectively, at the Siphon Site: 3,320 ± 80 RCYBP (3,580 B.P.); 3,435 ± 60 RCYBP (3,700 to 3,725 B.P.); 3,125 ± 60 RCYBP (3,375 B.P.); 3,195 ± 60 RCYBP (3,375 to 3,475 B.P.) (Sutton et al. 1993:57). A radiocarbon assay on bone from the cremation (Feature 20) returned a result of 3,210 ± 50 RCYBP (3,400 B.P.). The radiocarbon results from the cremation and the hearth feature (Hearth 6) above the cremation were statistically identical, providing further evidence that the two features were associated (Yohe 1993c:90). An assay from one of the clusters of fire-affected rock (Feature 18) produced a result of 3,525 ± 60 RCYBP (3,775 to 3,925 B.P.), representing the oldest date from the site (Sutton et al. 1993:27). These results were fairly tightly clustered between 3,125 ± 60 and 3,525 ± 60 RCYBP (1,375 to 1,925 B.C.), strongly indicating a Gypsum Period occupation (Sutton et al. 1993:56).

In addition, 22 obsidian specimens were submitted for sourcing and hydration, including two bifaces and 20 flakes (Sutton et al. 1993:56-57). All of the specimens

originated from the Coso Volcanic Field, except for one piece whose source was unknown (Sutton et al. 1993:56). The micron values clustered relatively tightly and ranged between 3.6 and 6.0 microns, although most of the values fell between 5.1 and 6.0 microns. These values point out some of the problems with obsidian hydration dating, in that the range of rim values is somewhat lower than would be expected for a Gypsum Period site. Since the rate of hydration is sensitive to elevation, this may be due to the position of the site at a higher elevation than most of the other study sites. Pinto series projectile points generally date between about 6,000 and 4,000 years ago.

With the exception of the two Pinto points, the temporal data from the Siphon Site indicate occupation between about 3,600 and 3,400 years B.P. (Sutton et al. 1993:57). This led Sutton et al. (1993:57) to suggest that the Siphon Site dated to the Millingstone Horizon (ca. 7,000 to 3,500 B.P.). The Millingstone Horizon is a concept employed in southern California to describe sites showing extensive use of milling stones and a lack of well-defined projectile points, possibly indicating a general trend away from hunting and toward the processing of plant foods (Wallace 1955). Sutton et al. (1993:64) also noted that the Siphon Site was occupied ca. 600 years earlier than Millingstone Horizon sites in nearby Crowder Canyon (Kowta 1969).

Interpretations

The Siphon Site was interpreted as a single-component Middle/Late Millingstone Horizon base camp occupied between about 3,900 and 3,400 B.P. (Sutton et al. 1993:59). This time frame slightly overlaps with the terminal Pinto Period, which accounts for the Pinto point discovered at the site. Based on the presence of riverine sandy gravel in one of the features on the east side of the site, Sutton et al. (1993:59) suggested that at one time, there was likely an active waterway associated with the site. When it was occupied

about 3,300 years ago, it was situated on a small alluvial fan "above the floodplain of the Mojave River" (Sutton et al. 1993:59). The presence of 19 features (hearths, a cremation, scatters of fire-affected rock) indicated that significant resource processing occurred in at least the eastern part of the site, which was thought to have been closer to the water source (Sutton et al. 1993:59).

The seasonality of the site was addressed largely through the botanical data, as the faunal data were of little value (Sutton et al. 1993:59). The occurrence of amaranth, which is available between August and December, suggested habitation of the site during those months. This was supported by the presence of juniper berries, which are also available in August. This botanical evidence, although admittedly weak, suggested the season of occupation as fall and possibly winter (Sutton et al. 1993:59). The cremation was secondary, indicating that the individual was cremated at a different location and then relocated (Sutton et al. 1993:59). Based on the radiocarbon date from this feature, it is the oldest known cremation in southern California. Obsidian recovered from the site indicated some level of trade (Sutton et al. 1993:63).

Coso Volcanic Field

During the late 1980s and early 1990s, investigations were conducted by Gilreath and Hildebrandt (1997) within the Coso Volcanic Field in Inyo County. Of some 550 sites known in this region, 34 were excavated, including 20 quarries and 14 off-quarry sites. These were separated into site types, those being five different types of quarries, as well as brief encampments, limited habitation encampments, production stations, milling camps, and isolated feature/milling stations (Gilreath and Hildebrandt 1997:5). As a result of this study, 435.4 $m.^3$ of soil were excavated, more than 7,500 artifacts were

documented, and 185,000 pieces of debitage were recovered (Gilreath and Hildebrandt 1997:1).

As Gilreath and Hildebrandt (1997) used different terminology throughout their study to refer to the various time periods represented, for ease and clarity, the following discussion follows those designations and time frames. From earliest to most recent, these designations are: Early (pre-ca. 5,500 B.P.); Little Lake (5,500 to 3,500 B.P.); Early, Middle, and Late Newberry (3,500 to 2,800, 2,800 to 2,300, and 2,300 to 1,275 B.P., respectively); Haiwee (1,275 to 650 B.P.); and Marana (650 to 200 B.P.) (Gilreath and Hildebrandt 1997:64) (also see Table 1).

The primary goal of the project was "to monitor the prehistoric production, use, and exchange of Coso obsidian, and determine the relationship of these activities to other socio-economic developments in the region" (Gilreath and Hildebrandt 1997:7). As such, the focus was on obsidian procurement and use rather than in-depth site descriptions, for which there are numerous reports dating back to 1979 (see Gilreath and Hildebrandt 1997 for references). Thus, the following is a summary of the brief descriptions of the sites provided by Gilreath and Hildebrandt (1997), along with a synopsis of their interpretations regarding the acquisition and production of obsidian by prehistoric populations in this region.

Site Descriptions

All of the sites in the Gilreath and Hildebrandt (1997) study fall within the Coso Volcanic Field, in the southwestern Coso Mountain Range. Volcanic episodes beginning about 1.5 million years ago have left their mark in the form of craters, domes, and debris flows (Gilreath and Hildebrandt 1997:7). Good quality obsidian is extremely abundant in the Coso region and quarry sites dot the landscape.

Field Methods

Each of the 34 sites was surface collected and excavated. In some cases, 1 by 1 m. "selective recovery units" were excavated in arbitrary 10-cm. levels and screened through 1/4-in. mesh. In these instances, no debitage was retained (Gilreath and Hildebrandt 1997:31). In those units where the volume of debitage was being controlled, "control excavation units" were employed, again in 10-cm. levels. These units were screened through 1/4-in. or 1/8-in. mesh, depending on the size of the unit, the former restricted to 1 by 2 m. units and the latter to 1 by 1 m. or 0.5 by 1 m. units (Gilreath and Hildebrandt 1997:31). Backhoe trenches and 3 by 3 m. surface scrapes and were also excavated in some cases.

Features

No specific details of the features from the excavated sites were provided, although the radiocarbon dates were listed by feature context (Gilreath and Hildebrandt 1997:69). According to their Table 12, Gilreath and Hildebrandt (1997:69) recorded at least 20 features from the project sites.

Material Culture

Given the fact that 7,500 artifacts and 185,000 pieces of debitage were recovered from the 34 sites investigated by Gilreath and Hildebrandt (1997), no attempt is made here to provide details on the entire artifact inventory. Rather, the following provides a brief description of the artifact categories provided by Gilreath and Hildebrandt (1997).

Flaked stone artifacts, which made up the greatest percentage of the artifact inventory, consisted of projectile points (n = 172), bifaces/points (n = 40), bifaces (2,912), cores (n = 1,856), drills (n = 2), flake blanks (n = 167), flake tools (684), simple flake tools (n = 649), formed flake tools (n = 35), unifaces (n = 511), and debitage. As

would be expected, the vast majority of these was made of obsidian. Ground stone implements included metates, manos, mortars, and pestles, in significantly lower numbers than flaked stone. The materials for the ground stone artifacts included rhyolite, granite, basalt, sandstone, and dike rock (Gilreath and Hildebrandt 1997:41). Miscellanous artifacts consisted of abraders, anvils, glass and shell beads, a quartz crystal, an incised stone, modified stones, a palette, and pottery sherds (Owens Valley Brown Ware) (Gilreath and Hildebrandt 1997).

Faunal and Botanical Remains

Faunal remains from various components at the Coso Volcanic Field consisted of a total of 309 specimens, most of them (n = 290) derived from Marana Period contexts (Gilreath and Hildebrandt 1997:157). Of those that were identified, five were *Lepus* (three burned), one was large mammal (burned), 114 were small mammal (84 burned), and 189 were considered intrusive or indeterminate (Gilreath and Hildebrandt 1997:157). As preservation was not considered an issue at these sites, it was concluded that the exploitation of game animals was not of primary importance to prehistoric peoples while they were visiting the Coso Volcanic Field, at least not until the Marana Period (Gilreath and Hildebrandt 1997:158).

Most of the identified botanical specimens were derived from the Marana Period, although one came from a Middle Newberry Period context (Gilreath and Hildebrandt 1997:153). One of the Marana specimens consisted of ricegrass, goosefoot, and blazing star seeds, while another contained ricegrass, desert tomato, and small herbaceous seeds. Other specimens lacked both desert tomato and goosefoot. The first sample was interpreted as demonstrating summer occupation, the second as late spring/early summer, and the third as spring/summer (Gilreath and Hildebrandt 1997:155).

Dating

Gilreath and Hildebrandt (1997:69) reported 20 radiocarbon dates from their study. Those dates ranged between modern and 3,600 ± 280 RCYBP, with the majority of the dates (n = 17) ranging between modern and 930 ± 80 RCYBP. As noted above, all of the radiocarbon dates were retrieved from feature contexts, although the features were not described.

Numerous obsidian hydration results provided a range between 1.3 and 18.4 microns, spanning the Early Period through the Marana Period (Gilreath and Hildebrandt (1997:61-68). The projectile point assemblage (n = 172) included types from all of these time periods as well (Gilreath and Hildebrandt 1997:70-71). Three *Olivella* shell beads and 41 Owens Valley Brown Ware pottery sherds made up the remaining temporally diagnostic artifacts (Gilreath and Hildebrandt 1997:87). The shell beads were classified as Types C2 and D1a per Bennyhoff and Hughes (1987:124, 126), tentatively placing them within the Late Middle and Late periods in the Great Basin. The pottery sherds also indicated a late occupation, probably within the last 700 years (Gilreath and Hildebrandt 1997:87).

Interpretations

In their discussion of prehistoric land use changes within the Coso Volcanic Field, Gilreath and Hildebrandt (1997:177-179) observed that during the Early and Little Lake phases, activities were mostly limited to short-term use of quarry deposits, with little evidence of subsistence-related behavior. Lithic procurement strategies within these settlement and subsistence systems would likely have demonstrated high residential mobility, little use of vegetal materials, and a focus on game acquisition (Gilreath and Hildebrandt 1997:178). During the subsequent Early and Middle Newberry periods, lag

quarries were still being exploited and biface manufacture increased. In addition, off-quarry biface production areas witnessed more intensive use and there was little focus on obsidian exchange. While there was a little more variety in the artifact assemblages, the sites tended to remain short-term, with an escalation in obsidian procurement (Gilreath and Hildebrandt 1997:178).

The Late Newberry Period represented a shift away from lag quarries and a trend toward higher frequencies of bifacial cores and larger early-stage bifaces (Gilreath and Hildebrandt 1997:178). The sites from this period also demonstrated an increase in subsistence-related artifacts and an expansion of obsidian exchange. Residential mobility remained high, although seasonal movement was less extensive. Sites are represented by seasonal residential bases that were reoccupied over time, as evidenced by the presence of structures, features, and caches (Gilreath and Hildebrandt 1997:178). During the subsequent Haiwee and Marana periods, use of the Coso Volcanic Field decreased significantly, finally collapsing during the Marana Period (Gilreath and Hildebrandt 1996:179). Mobility was replaced with relatively longer occupations.

One potential explanation for the reduction in obsidian procurement and collapse of the exchange system beginning during the Haiwee Period was the development of the bow and arrow, which would have reduced the demand for such toolstone (Gilreath and Hildebrandt 1997:179). However, as hydration profiles in areas adjacent to the Coso Volcanic Field—as well as two quarries within it (at Joshua Ridge and West Sugarloaf Mountain; Gilreath and Hildebrandt 1997:179)—actually peaked during the Haiwee Period, Gilreath and Hildebrandt (1997:179) addressed this apparent contradiction by concluding that while secondary reduction locales were eliminated, more specific concentrations where high-quality materials could be obtained were being exploited by a

smaller number of people. In the absence of the excavation of more Haiwee Period quarries, this creates the appearance of limited production activity during this time (Gilreath and Hildebrandt 1997:179).

Nevertheless, Gilreath and Hildebrandt (1997:179) argued that by the Marana Period, the obsidian acquisition and exchange system ceased, in favor of seed processing activities. This argument is supported by a general late period shift in settlement and subsistence that "helped fuel the spread of Numic speaking populations throughout much of the Great Basin" (Gilreath and Hildebrandt 1997:179; also see Bettinger and Baumhoff 1982). (For a further discussion of obsidian production and procurement activities in the western Mojave Desert, see Chapter 7.)

Fort Irwin

Since the 1980s, a great deal of research has been conducted at Fort Irwin in the north-central Mojave Desert (e.g., Basgall 2000; Basgall and Hall 1994; Basgall et al. 1988, 2003; Hall and Basgall 1994; Kelly 1985; McGuire and Hall 1988; Warren 1991). While not in the western Mojave Desert, Fort Irwin is included here due to the scope of the investigations there, as well as its proximity to the study area. While the research at Fort Irwin is ongoing, the following synopsis focuses on the work of Basgall and his colleagues, much of which had been completed by the mid-1990s. The discussion is drawn largely from Basgall's (2000) most recently published article that summarizes the results of investigations there since the late 1980s. As more than 400 prehistoric and historical sites had been recorded at the fort as of 1994, no attempt is made herein to discuss the sites in detail; rather, a general overview of the structure and interpretations of these sites is provided as background for the western Mojave Desert.

Of the nearly 400 prehistoric sites recorded at Fort Irwin as of 1994, sites dating to the Lake Mojave, Pinto, Gypsum, Rose Spring, and Late Prehistoric periods have been identified, demonstrating a certain level of continuity over time (Basgall and Hall 1992:6). While using caution in his remarks, this suggested to Basgall (2000:126) that "strong trends in the data" are indicated. Some of these trends include (1) the density of prehistoric sites in the Fort Irwin installation; i.e., site densities range "from less than 0.1 locations/km.^{2} in the Bicycle Lake Basin to 2.2/ km.^{2} in the Avawatz Mountains"; (2) the kinds of settings in which artifact concentrations occur; e.g., predominantly on basin floors near playa margins or on alluvial piedmonts with good drainage; and (3) the dominance of flaked stone artifacts over milling implements (averaging 33.8 tools/ km.^{2}), with ground stone occurring primarily in upland settings on the northern margin of the fort and on the lowlands to the southeast (Basgall 2000:127).

Basgall (2000:132) observed that Gypsum Period projectile points have been recovered from 36 sites (nine isolates have also been documented), a significantly greater concentration of sites with these temporal markers than previous time periods and slightly greater than succeeding periods. This pattern strongly suggests that the Gypsum Period witnessed a notable occupational expansion from the preceding periods (Basgall (2000:132). The Saratoga Springs/Shoshonean (i.e., Rose Spring Period) era is characterized by an increasing reliance on flake cores as well as milling equipment. Faunal assemblages emphasized "high-cost, low-return forms, and . . . a further intensification of subsistence pursuits" (Basgall 2000:132-133).

The research at Fort Irwin suggested to Basgall (2000:133) that the early and middle Holocene witnessed a relatively low level of human activity, "before beginning a gradual but inexorable increase through the Late Holocene." Thus, there appears to be evidence

for increasing exploitation of Fort Irwin late in the chronological sequence, "with a marked decrease in human activity during the Middle Holocene climatic optimum (the so-called Altithermal [Antevs 1948])" (Basgall 2000:133). Subsequent late Holocene archaeological assemblages reflect decreasing residential mobility and restriction of annual ranges (Basgall 2000:135).

Owens Valley

Owens Valley is a long north-south trending physiographic feature in eastern California at the southwest margin of the Great Basin. The southern end of the valley borders the northern margin of the Mojave Desert. While Owens Valley does not fall within the Mojave Desert, the proximity of its southern border to the study area, the presence of a once-large lake, and the extensive excavations that have taken place there (e.g., Byrd and Hale 2003) necessitated at least a broad discussion of how cultural and natural events that occurred there may have had an impact on cultures immediately to the south. The summary that follows is derived from the results of investigations undertaken by Byrd and Hale (2003) as part of the Olancha/Cartago project.

The Olancha/Cartago project began with a large-scale survey conducted in 2001 (Parr et al. 2001:55), at which time 31 prehistoric sites, 20 historical sites, and four sites with both prehistoric and historical components were documented (14 of which were updates on previously recorded sites). Test excavations were conducted at 15 sites, which totaled more than 182 m.^{3} of excavated sediment (Byrd 2003:765). Nine of the tested sites consisted mostly of surface assemblages, with very few cultural remains discovered in the subsurface deposits. Features consisted of milling stations, a surface rock cluster, a surface hearth, and small lithic concentrations. These sites were deemed to have periodic

occupations that were "extensive rather than intensive in nature" (Byrd 2003:766) and at which midden deposits did not accumulate. The six other sites consisted of "in situ cultural deposits of various sizes" (Byrd 2003:771), including two large sites.

The ages of the 15 sites were determined by the use of radiocarbon dating, ceramics, projectile point typology, and shell beads. Obsidian hydration analysis was also performed, but the "varied and disparate results" prompted Byrd (2003:775) to eliminate it from the dating discussion. Six sites yielded a total of 19 radiocarbon samples, with dates ranging between 5,840 ± 40 to 90 ± 40 RCYBP (cal. B.C. 4,730-4,685 to A.D. 1690-1955) (Byrd 2003:775). The projectile points that were classified included Concave Base (n = 1), Great Basin Stemmed (n = 1), Little Lake (n = 3), Pinto (n = 2), Humboldt (n = 8), Elko (n = 3), Rose Spring (n = 20), Cottonwood (n = 3), and Desert Side-notched (n = 8). The most common occupational period was the Newberry Period, followed by the Marana Period. The Little Lake and Haiwee occupations were less frequently represented (Byrd 2003:782).

In terms of site activities, debitage dominates the artifact assemblages at all of the sites, with Coso obsidian the almost exclusive material being used (Byrd 2003:786). Projectile points were the primary tool being produced, along with bifacial and flake tools. Ground stone assemblages showed an increase in size and diversity through time, with higher frequencies of ground stone and greater use of milling features during Marana Period (and later) occupations (Byrd 2003:786-787).

Subsistence activities were evidenced through the faunal and botanical data from the Olancha/Cartago sites. In order of frequency, the most abundant animals were rabbits, rodents, waterfowl, black-tailed deer, and bighorn sheep, although the relative frequencies of these species varied between units and from site to site (Byrd 2003:787).

These variations "suggest that exploitation strategies differed greatly in the short term (at the annual or seasonal scale of procurement" (Byrd 2003:787). Plant remains consisted of macrobotanical samples and pollen analysis. Carbonized seeds were the most common macrobotanical specimens, followed by nuts. The most common were the Poaceae family (e.g., Indian rice grass) and the Chenopodiaceae family, at least during and after the Newberry Period. Pinyon (*Pinus monophylla*) was also recovered from Newberry and Haiwee period components (Byrd 2003:788). Wetland plant resources were dominant in the assemblages until the Marana Period, when shrub species such as Chenopodium began to increase in frequency, indicating "a shift in resource emphasis and longer summer occupation during the Marana/Historic period" (Byrd 2003:788).

Byrd (2003:789) summarized by noting the low diversity of the artifact assemblages, limited range of site activities, and a focus on late stage biface production. Byrd (2003:789) argued that the lithics by themselves demonstrated short-term occupation events, while the ground stone assemblages showed "an adaptive strategy of non-sedentary settlements, but yet reflecting repeated reuse of the same localities." The botanical remains, however, indicated a wider and more diverse range of activities in terms of procurement, processing, and consumption (Byrd 2003:790). Overall, Byrd (2003:790) argued that the evidence from the various sites suggested the presence of small residential camps that were occupied seasonally and reoccupied at least yearly.

Discussion

This chapter provides detailed descriptions for 54 individual sites, as well as a general overview of hundreds of sites collectively for the Coso Volcanic Field, Fort Irwin, and Owens Valley complexes. As noted at the beginning of this chapter, most of these sites

fall within the boundaries of the western Mojave Desert as they are currently defined, with the exception of Fort Irwin, Owens Valley, and a few of the sites described in this chapter that fall close to the border of the western Mojave Desert; thus, their inclusion was deemed relevant to the primary research topic (i.e., the impact of the MCA).

The exclusion of other central Mojave Desert sites, as well as eastern Mojave Desert sites, should not be construed as implying that there were no connections either culturally or environmentally between the eastern, central, and western Mojave Desert. The selection of sites merely reflected the author's desire to focus on the region of interest for this study, that being the western Mojave Desert. The number of sites discussed in this chapter represents the most comprehensive inventory of known prehistoric archaeological sites in the western Mojave Desert in a single venue. As such, it is hoped that this study can be used to facilitate future research into any issue related to the prehistory of this desert region, not just those associated with environmental fluctuations such as the MCA.

Notes

1. Two points need to be made here. First, as the focus of this study is on the time just before, during, and just after the MCA, earlier time periods (i.e., Paleoindian, Lake Mojave, Pinto) are examined only briefly where deemed appropriate. Second, the terms "Gypsum Period" and "Elko Period" are typically used interchangeably in the literature in terms of their timing and characteristics, so for the sake of simplicity and unless otherwise noted, only the term Gypsum Period is employed herein.

2. The terminology for the projectile point types discussed throughout this chapter is taken from Heizer and Baumhoff (1961), Heizer and Clewlow (1968), Lanning (1963), Thomas (1981), and Yohe (1992).

3. I was initially confused about the site designations in Hillebrand (1972), who listed Junction Ranch as CA-INY-1534B and Chapman 2 as CA-INY-1535, which was not how they were subsequently reported by Amy Gilreath (2000) in her analysis of the burials at the Coso Locality sites. After an email correspondence with Amy, who had spent a great deal of time with the collections, my confusion was resolved.

4. As with the site designations, there were many discrepancies in the artifact counts provided by Hillebrand (1972), which contained a number of arithmetic errors. Thus, for clarity in this study, I used the counts for projectile points that were provided by Gilreath (2000), with the exception of Junction Ranch as there have been no further analyses of this site. As a result, the counts reported by Hillebrand for the projectile points, as well as the other artifacts that Gilreath (2000) did not discuss in her NAGPRA report, are considered to be approximate.

5. I am grateful to Sandy Rogers, Archaeology Curator at the Maturango Museum in Ridgecrest, California, for making me aware of this discrepancy and sending copies of the original data sheets to me.

CHAPTER 6

SUMMARY OF STUDY SITES

Introduction

This chapter summarizes the attributes of the study sites discussed in Chapter 5. The first part of the chapter is a summary of the general site descriptions, consisting primarily of the dating techniques used and the functional categories of the sites (also see Appendix A). The rest of the chapter is a comparison of specific aspects of the study sites overall, including flaked and ground stone implements, evidence of trade, summary of the faunal and botanical remains, and a discussion of the ecological approach taken in this study. The interpretations of these data are presented in Chapter 7.

Summary of Site Descriptions

Of the 54 individual sites and three site complexes (Coso Volcanic Field, Fort Irwin, and Owens Valley) discussed in Chapter 5, some were well-dated, some were fairly well-dated, some were poorly dated, and others were undated, making comparisons difficult (see Tables 4 through 12).[1] A further challenge was the reporting standards; that is, there are many inconsistencies in the way site reports were organized, what kinds of data were incorporated into them, and what information was deemed unnecessary to include (such as the raw data in a few cases).

Table 4. Radiocarbon Dates for the Study Sites[a]

Site No.	Site Name	Radiocarbon Age (RCYBP; uncorrected)
CA-INY-372	Rose Spring (Locus 1)	110 ± 50
		280 ± 50
		330 ± 50
		330 ± 60
		590 ± 60
		1,360 ± 70
		1,400 ± 50
		2,070 ± 90
		2,240 ± 145
		2,900 ± 80
		3,240 ± 60
		3,520 ± 80
		3,580 ± 80
		3,900 ± 180
		4,030 ± 100
		4,460 ± 110
		5,460 ± 80
	Rose Spring (Locus 2)	900 ± 60
	Rose Spring (Locus 3)	2,240 ± 100
	Rose Spring (Spring Locus)	2 dates at < 150
CA-INY-444	Ray Cave	1,500 ± 95
		3,390 ± 50
CA-INY-1534A	Chapman 1	320 ± 60
		580 ± 70
		760 ± 60
CA-INY-1534B	Chapman 2	230 ± 60
		470 ± 80
CA-KER-246	(Red Rock Canyon)	3,140 ± 40
CA-KER-250	Bickel Site	650 ± 65
		950 ± 75
		1,050 ± 90
		1,255 ± 110
CA-KER-261	Last Chance Site	640 ± 75
CA-KER-733	--	460 ± 75
CA-KER-875	Koehn Lake (Locus 1)	970 ± 70
		1,180 ± 40
	Koehn Lake (Locus 6)	1,140 ± 50
	Koehn Lake (Locus 10)	1,110 ± 70
		1,240 ± 90
		1,300 ± 60
		1,420 ± 50
		1,430 ± 60
CA-KER-2211	Cantil (Locus 1)	940 ± 80
		940 ± 100
		1,300 ± 100
CA-KER-2218	Cantil	2,490 ± 300
CA-KER-2450	Rosamond	1,110 ± 50
CA-KER-526	Rogers Lake (Unit 7)	3,670 ± 70
		3,770 ± 70
CA-KER-533	Rogers Lake (Unit 1)	1,890 ± 80
CA-KER-1180	Rogers Lake (Unit 1)	180 ± 130
	Rogers Lake (Unit 4)	690 ± 50
CA-KER-4619	Cross Mountain	370 ± 60, 460 ± 60

Table 4. Radiocarbon Dates for the Study Sites (continued)[a]

Site No.	Site Name	Radiocarbon Age (RCYBP; uncorrected)
CA-KER-5043	Coffee Break	880 ± 50
		2,430 ± 80
		2,490 ± 60
CA-KER-6106	Freeman Spring	1,110 ± 40
		1,110 ± 50
		1,130 ± 60
CA-SBR-72	Oro Grande	775 ± 100
		825 ± 100
		850 ± 100
		1,050 ± 100
		1,095 ± 100
		1,130 ± 100
		5,070 ± 120
CA-SBR-189	Hinkley Site	3,025 ± 75
		3,210 ± 105
		3,295 ± 80
CA-SBR-1913	*Guapiabit*	235 ± 55
		240 ± 70
		260 ± 70
		360 ± 80
CA-SBR-6580	Siphon Site	3,125 ± 60
		3,195 ± 60
		3,210 ± 50
		3,320 ± 80
		3,435 ± 60
		3,525 ± 60
Red Mtn Complex		
CA-SBR-211	Guzzler Site	930 ± 40, 2,720 ± 40
CA-SBR-2600	Well Site	250 ± 40
CA-SBR-2608	Hunting Blind Site	300 ± 40
CA-SBR-2609	Ridge Site	680 ± 40
Coso Volcanic Field		
CA-INY-1816	--	160 ± 70
CA-INY-1824	--	2,450 ± 90
CA-INY-1906	--	110 ± 70
		110 ± 70
CA-INY-1907	--	3,080 ± 70
CA-INY-2103	--	370 ± 70
CA-INY-3004/5	--	110 ± 60, 860 ± 65
CA-INY-4243	--	130 ± 80
CA-INY-4267	--	101.6% ± 0.6%
CA-INY-4322/H	--	99.1% ± 0.7%
CA-INY-4325	--	930 ± 80
CA-INY-4329	--	140 ± 50
		580 ± 60
		290 ± 50
		310 ± 50
		360 ± 50
		530 ± 60
CA-INY-4330	--	600 ± 50
		3,600 ± 280

[a] See text for references.

Table 5. Obsidian Hydration Results for the Study Sites[a]

Site No.	Site Name	Mean Rind Measurements
CA-INY-372	Rose Spring (Unit X-1)	2.8, 4.1, 4.4, 4.4, 4.5, 4.5, 5.3, 5.3, 5.4, 5.8, 5.8, 5.8, 5.9, 5.9, 6.1, 6.2, 6.2, 6.2, 6.2, 6.3, 6.3, 6.4, 6.5, 6.6, 6.8, 6.9, 7.0, 7.0, 7.0, 7.0, 7.0, 7.0, 7.0, 7.1, 7.1, 7.1, 7.1, 7.1, 7.1, 7.1, 7.1, 7.2, 7.2, 7.2, 7.2, 7.2, 7.3, 7.5, 8.0, 8.0, 8.0, 8.1, 8.1, 8.2, 8.5, 8.6, 8.7, 8.7, 8.8, 9.0, 9.1, 9.3, 9.3, 10.6
	Rose Spring (Unit XX-7)	5.2, 5.5/6.0, 5.6, 5.6/6.3, 5.7, 5.9/5.4, 6.4, 6.4, 6.4, 6.5, 6.6, 6.7, 7.0, 7.2, 7.3, 7.6, 7.7, 7.8, 7.8, 8.0, 8.1, 8.1, 8.2, 8.3, 8.3, 8.3/7.7, 8.4, 9.0
CA-INY-444	Ray Cave	3.03, 3.53, 4.0, 4.2, 4.54, 5.05
CA-INY-1534A	Chapman Rockshelter 1	1.5, 1.6, 1.6, 1.8, 2.1, 2.2, 2.3, 2.4, 2.4, 2.5, 2.5, 2.6, 2.6, 2.6, 2.6, 2.7, 2.7, 3.0, 3.0, 3.0, 3.1, 3.2, 3.4, 3.5, 3.5, 3.5, 3.7, 3.7, 3.7, 3.7, 3.9, 4.0, 4.1, 4.3, 4.5, 4.5, 4.6, 4.9, 5.2, 5.3, 5.5, 6.2, 6.2, 6.5, 8.1, 9.8, 14.1
CA-INY-1534B	Chapman Rockshelter 2	1.1, 1.2, 1.6, 1.8, 1.9, 2.0, 2.0, 2.0, 2.2, 2.2, 2.4, 2.5, 2.5, 2.5, 2.6, 2.9, 3.0, 3.0, 3.0, 3.0, 3.2, 3.2, 3.2, 3.2, 3.2, 3.4, 3.4, 3.5, 3.5, 3.7, 3.8, 3.8, 3.9, 3.9, 4.3, 4.8, 5.1, 5.2, 5.3, 5.4, 5.7, 5.7, 6.0, 6.5, 6.7, 6.9, 12.9
CA-INY-1535	Junction Ranch	1.6, 1.7, 2.0, 2.1, 2.3, 2.4, 2.5, 2.5, 2.6, 2.6, 2.8, 2.8, 2.9, 3.0, 3.1, 3.2, 3.2, 3.3, 3.3, 3.3, 3.4, 3.4, 3.4, 3.5, 3.5, 3.5, 3.6, 3.6, 3.6, 3.7, 3.7, 3.7, 3.9, 3.9, 4.0, 4.0, 4.0, 4.0, 4.0, 4.1, 4.1, 4.1, 4.1, 4.1, 4.2, 4.2, 4.3, 4.4, 4.5, 4.8, 5.0, 5.0, 5.2, 5.2, 5.3, 5.3, 5.4, 5.4, 5.6, 8.0, 9.3, 9.4, 9.4, 10.7
CA-INY-2284	Coso Junction Ranch (Unit T3/1 NW)	2.9, 3.5, 3.6/2.6, 3.7, 3.7, 4.0, 4.0, 4.0/4.6, 4.1, 4.1, 4.1, 4.1, 4.2, 4.4/5.8, 4.5/6.8, 4.8, 4.8/5.4, 5.0, 5.0/4.4, 5.0/5.9, 5.0/5.9, 5.2, 5.3, 5.3/5.8, 5.4, 5.4, 5.5, 5.6, 5.7, 5.7, 5.7, 5.7, 5.8, 5.8, 5.8, 5.8, 5.9, 5.9, 5.9, 6.0, 6.1, 6.1, 6.1, 6.1, 6.1, 6.1, 6.1, 6.2, 6.2, 6.2, 6.2, 6.2, 6.2/4.2, 6.3, 6.3, 6.3, 6.3, 6.3, 6.3, 6.4, 6.4, 6.4, 6.4, 6.4/6.9, 6.5, 6.5, 6.5/4.6, 6.6, 6.8, 6.8, 6.9, 6.9/6.3, 7.1, 7.3, 7.4, 7.4, 7.9, 8.1
	Coso Junction Ranch (Unit T 3/11 SW)	3.0, 4.0/4.6, 4.1/5.0, 4.2, 4.4, 4.6/6.2, 4.7, 4.7/6.2, 4.8, 4.8/5.3, 4.9, 4.9, 5.3, 5.3, 5.4, 5.4, 5.5, 5.5, 5.5, 5.8, 5.9, 6.2/6.9, 6.4, 6.5, 6.7, 6.9, 6.9, 7.0/5.5, 7.5
	Coso Junction Ranch (Features)	3.3/4.9, 4.3, 4.5, 4.8, 4.9/5.7, 5.4/6.0, 5.8/6.2, 6.0, 6.0, 6.0/6.4, 6.0/6.9, 6.1, 6.3/5.3, 6.4, 7.3, 7.4/7.2, 7.4/7.7, 8.9, 9.9, 11.3
CA-KER-246	(Red Rock Canyon)	5.9, 7.1, 7.3, 7.3, 7.5, 7.5, 7.5, 7.6, 7.6/10.6, 7.7, 7.7, 8.6, 16.4
CA-KER-250	Bickel Site	3.5, 3.6, 3.8, 3.8, 3.8, 3.9, 4.0, 4.0, 4.0, 4.0, 4.0, 4.0, 4.1, 4.1, 4.1, 4.2, 4.3, 4.3, 4.4, 4.4, 4.5, 4.5, 4.5, 4.5, 4.7, 4.8, 5.1, 5.3, 5.4, 5.4, 5.6, 5.8, 6.6, 8.1/3.4
CA-KER-733	--	2.8/3.3, 3.0, 3.9, 4.3
CA-KER-875	Koehn Lake (Locus 1)	4.0, 4.8, 4.8, 4.9, 5.0, 5.0, 5.2, 5.2, 5.3, 5.4
	Koehn Lake (Locus 10)	4.0, 4.4, 4.4, 4.5, 4.8, 4.8, 4.9, 5.0, 5.0, 5.0, 5.2, 5.5, 6.4/13.0
CA-KER-1998	Oak Creek Canyon	2.2, 2.8, 3.3, 3.7, 3.7, 3.7, 3.8, 5.2
CA-KER-2211	Cantil	1.1, 1.4, 1.4, 1.6, 1.8, 2.1, 2.5, 2.6, 2.6, 2.7, 2.8, 3.0, 3.2, 3.6, 3.7, 3.7, 4.1, 4.1, 4.5, 5.5/4.8, 6.3, 12.0/5.3
CA-KER-2209	Cantil	2.7
CA-KER-2210	Cantil	3.3, 3.3, 5.2

Table 5. Obsidian Hydration Results for the Study Sites (continued)[a]

Site No.	Site Name	Mean Rind Measurements
CA-KER-2212	Cantil	3.7, 18.6, 20.0, 20.8
CA-KER-2215	Cantil	4.5, 5.6
CA-KER-5043	Coffee Break Site (surf.)	4.7
	Coffee Break Site (TU-1)	5.0
	Coffee Break Site (TU-2)	3.8, 4.0, 4.0, 4.6, 4.6, 4.7, 4.9, 5.5, 8.1, 8.9, 11.3, 11.6
	Coffee Break Site (TU-3)	3.4, 3.8, 4.3, 4.6, 9.0+
	Coffee Break Site (TU-4)	3.1, 4.1, 4.2
	Coffee Break Site (TU-5)	5.7
CA-KER-6106	Freeman Spring (TU-1)	3.90, 4.06, 4.07, 4.28, 4.77, 5.52, 5.82, 5.90, 5.92, 6.50, 6.92, 6.95
	Freeman Spring (TU-4)	3.01, 3.75, 3.98, 4.37, 4.37, 4.44, 4.46, 4.49, 4.66, 4.97, 4.98, 5.06, 5.27, 5.52, 6.35, 7.27, 7.87, 8.58, 9.37, 9.78, 9.79, 9.95, 10.09, 10.64, 11.01
	Freeman Spring (TU-5)	3.95, 4.16, 4.17, 4.82
CA-KER-6188	Terese Site	4.0, 4.3, 4.7, 5.0, 5.8, 6.0, 10.3, 10.9
CA-KER-520	Rosamond	5.0
CA-KER-2567	Rosamond	2.9, 9.2/4.1
CA-KER-2569	Rosamond	2.6, 7.4, 8.4, 9.0, 14.1
CA-KER-2450	Rosamond	3.4, 3.6, 4.4
CA-KER-2765	Rosamond	7.4, 8.2, 9.1, 11.8
CA-KER-2769	Rosamond	3.3, 4.3, 4.3, 4.4, 4.6, 4.6, 4.7, 4.7, 4.7, 4.8, 5.3, 5.5, 6.2/4.4/4.7, 7.5/4.4, 8.8/7.3/4.4, 8.9
CA-KER-526	Rogers Lake (Unit 2)	9.5, 9.5, 9.5, 9.5, 9.6, 9.8
	Rogers Lake (Unit 9)	8.6, 8.7, 8.7, 8.7, 8.7, 8.7
	Rogers Lake (Unit 7)	13.1, 13.1, 13.2, 13.2, 13.4, 13.5
	Rogers Lake (Unit 10)	7.4, 7.4, 7.4, 7.4, 7.5, 7.5, 7.5, 7.5, 7.5, 7.5, 7.5, 7.5, 7.5, 7.6, 7.6, 7.8, 7.8, 7.8
	Rogers Lake (Unit 17)	7.4, 7.5, 7.5, 7.6, 7.8, 7.8
CA-KER-3377	Rogers Lake (Unit 1)	3.6, 3.6, 3.7, 3.8, 3.8, 3.8, 4.7, 4.8, 4.8, 4.8, 4.8, 4.8
	Rogers Lake (Unit 3)	4.5, 4.5, 4.7, 4.8, 4.8, 4.9
CA-SBR-176	Deep Creek Site	4.2, 4.2, 4.3, 4.8, 4.9, 5.0
CA-SBR-1913	*Guapiabit*	1.7, 2.1, 5.8, 11.8
CA-SBR-6580	Siphon Site	3.6, 3.8, 4.2, 4.3, 4.8, 4.8, 4.9, 5.1, 5.2, 5.2, 5.4, 5.5, 5.5, 5.6, 5.7, 5.7, 5.8, 5.8, 5.9, 5.9, 6.0, 7.7
Red Mtn District		
CA-SBR-211	Guzzler Site	4.4, 5.2, 5.7, 6.0, 6.1, 6.1, 6.2, 6.2, 6.3, 6.3, 6.3, 6.3, 6.4, 7.7
CA-SBR-2600	Well Site	4.5, 5.5, 5.8, 5.9, 6.0, 7.3, 7.5, 7.5, 7.5, 9.3, 9.5, 9.5, 10.8
CA-SBR-2608	Hunting Blind Site	1.6, 1.8, 3.0, 5.3
CA-SBR-2609	Ridge Site	3.7, 4.2, 5.3, 5.7
CA-SBR-2614	Saddle Site	3.0, 5.0, 5.0, 5.2, 5.4
Coso Volcanic Field	All site components (means)	1.3, 1.5, 2.2, 3.1, 3.7, 4.3, 4.7, 5.1, 5.5, 5.7, 5.7, 5.8, 5.8, 5.8, 5.9, 6.3, 6.3, 6.3, 6.3, 6.4, 6.5, 6.5, 6.5, 6.6, 6.6, 6.7, 6.9, 6.9, 7.0, 7.0, 7.0, 7.2, 7.2, 7.5, 7.6, 8.5, 8.5, 8.5, 8.6, 8.7, 8.7, 8.8, 8.8, 9.5, 9.9, 10.4, 10.6, 10.6, 10.8, 11.1, 11.2, 11.3, 11.5, 11.5, 11.5, 11.7, 11.8, 11.8, 11.9, 12.0, 12.0, 12.5, 13.0, 13.6, 15.8, 18.4

[a] See text for references. Where stated in the site report, all of the obsidian was chemically characterized to the Coso Volcanic Field, with the exception of two specimens from CA-KER-1913, one of which was derived from Obsidian Butte and the other from the Bristol Mountains (Sutton and Schneider 1996:29).

Table 6. Age Assignment Estimate for Obsidian Rim Values[a]

Rim Value Range (in microns)	Period Designation
1.0 to 4.0	Late Prehistoric
4.0 to 7.0	Rose Spring
7.0 to 10.0	Gypsum

[a] As the focus of this study is on the time subsequent to the Pinto Period, only the latter three periods are listed here. It should be noted that these are only general time frames and not to be taken as absolute (adapted from Gilreath and Hildebrandt 1997; refer to Note 2 at the end of this chapter).

Table 7. Projectile Point Types from Selected Study Sites[a]

Site	Elko/ Gypsum	Rose Spring	Desert Side-notched	Cottonwood	Total
Coso Locality Sites	18	65	13	16	112
CA-INY-372 (Rose Spring)[b]	33	143	12	39	227
CA-KER-246 (Red Rock Cyn)	1	--	--	--	1
CA-KER-250 (Bickel)	1	11	1	1	14
CA-KER-733	--	--	--	3	3
CA-KER-875 (Koehn Lake)	--	22	1	12	35
CA-KER-1180 (Rogers Lake)	--	--	1	--	1
CA-KER-1998 (Oak Creek)	--	1	1	1	3
CA-KER-2211 (Cantil)	--	15	7	8	30
Cantil sites (all sites)	2	--	1	1	4
CA-KER-5043 (Coffee Break)	--	4	--	--	4
CA-KER-6106 (Freeman Spring)	--	14	--	--	14
Rosamond sites (all sites)	--	20	--	1	21
CA-SBR-72 (Oro Grande)	1	1	--	68	70
CA-SBR-176 (Deep Creek)	--	--	--	3	3
CA-SBR-189 (Hinkley)	3[c]	--	--	--	3
CA-SBR-1913 (*Guapiabit*)	--	--	--	26	26
Red Mountain (all sites[d])	--	2	3	8	13
Coso Volcanic Field (all sites)[e]	41	27	2	10	80
Total	100	325	42	197	664

[a] Sites containing projectile points that were not included in this table were those where quantification was unclear. The Elko/Gypsum and Cottonwood categories include all subtypes; the Rose Spring category includes Eastgate and Rosegate varieties. The material type for these points is overwhelmingly Coso obsidian (> 80%).

[b] From Locus 1 and an earlier collection reported in Lanning (1963) (see Yohe 1992:173).

[c] Tentatively identified as Elko (Leonard 1980:29).

[d] Includes sites not discussed in the study, as analyses of some of these sites were not available to the author at the time of this study. Quantification comes from Allen (2004), which also listed eight points described as Desert series that could not be further classified.

[e] Excludes those points where classification was uncertain; the Rose Spring column includes those points identified as Saratoga Spring (Gilreath and Hildebrandt 1997:71).

Table 8. Gypsum Period Study Sites

Site	Basic Description	Evidence for Age Assignment[a]
CA-KER-246 (Red Rock Cyn)	lithic reduction site	point typology (1 EL); 3,140 ± 40 RCYBP; OH = 5.9 to 16.4μ
CA-KER-526 (Rogers Lake)[b]	large base camp	3,670 ± 70 and 3,770 ± 70 RCYBP; OH = 7.4 to 13.5μ
CA-KER-2209 (Cantil)[b]	short-term habitation site, possible hare focus	point typology (1 CT); OH = 2.7μ
CA-KER-2214 (Cantil)	small multifunctional camp	point typology (1 GC, 1 EE)
CA-KER-2218 (Cantil)[b]	small, temporary special purpose camp	2,490 ± 300 RCYBP
CA-SBR-189 (Hinkley)[b]	seasonal site	point typology (3 EL); 3,025 ± 75 and 3,295 ± 80 RCYBP
CA-SBR-6580 (Siphon)	Middle/Late Millingstone Horizon base camp	six dates between 3,125 ± 60 and 3,525 ± 60 RCYBP; OH = 3.6 to 7.7μ

[a] Projectile point designations: EL = Elko; CT = Cottonwood; GC = Gypsum Cave; EE = Elko Eared. OH = obsidian hydration rim values; ranges reflect the means of the rim values.
[b] See Chapter 5 for more detailed explanations of and caveats for the age assignments for these sites.

Table 9. Rose Spring Period Study Sites

Site	Basic Description	Evidence for Age Assignment[a]
CA-KER-250 (Bickel)	small rabbit (hare) drive site	point typology (11 RG, 1 each of DSN, CT, EC); four dates between 650 ± 65 and 1,255 ± 110 RCYBP; OH = 3.5 to 8.1μ
CA-KER-533 (Rogers Lake)	temporary encampment; forager residential base or field camp	1,890 ± 80 RCYBP
CA-KER-875 (Koehn Lake)	large village	point typology (vast majority are RS); eight dates between 970 ± 70 and 1,430 ± 60 RCYBP; OH = 4.0 to 6.4μ
CA-KER-2215 (Cantil)	small, temporary camp	OH = 4.5, 5.6μ
CA-KER-2450 (Rosamond)	temporary camp for processing hares	point typology (1 RS); 1,110 ± 50 RCYBP; OH = 3.4, 3.6, 4.4μ
CA-KER-2567 (Rosamond)	small habitation site or temporary camp	point typology (5 RS); OH = 2.9 (on a RS point), 2.9, 4.1, 9.2μ
CA-KER-2768/H (Rosamond)	lithic quarry/reduction site	point typology (1 RS)
CA-KER-2769 (Rosamond)	lithic quarry/reduction site	point typology (11 RS), OH = 3.3 to 8.9μ
CA-KER-6106 (Freeman Spring)	seasonal habitation site with focus on hares	point typology (14 RS); 1,110 ± 40, 1,110 ± 50, 1,130 ± 60 RCYBP; OH = 3.0 to 11.0μ

[a] Projectile point designations: RG = Rosegate; DSN = Desert Side-notched; CT = Cottonwood; EC = Elko Corner-notched; RS = Rose Spring. OH = obsidian hydration rim values; ranges reflect the means of the rim values.

Table 10. Late Prehistoric Period Study Sites

Site	Basic Description	Evidence for Age Assignment[a]
CA-KER-261 (Last Chance)	small rabbit (hare) drive site	640 ± 75 RCYBP
CA-KER-520 (Rosamond)	temporary camp with focus on lithic reduction	point typology (1 CT); OH = 5.0μ
CA-KER-733	special activity site for processing hares	point typology (3 CT); 460 ± 75 RCYBP; OH = 2.8 to 4.3μ
CA-KER-1180 (Rogers Lake)	short-term encampment; forager residential base or field camp	point typology (1 DSN); 690 ± 50 and 180 ± 130 RCYBP
CA-KER-2210 (Cantil)	two small camps, possible hare focus	point typology (1 DSN); OH = 3.3, 3.3, 5.2μ
CA-KER-3377 (Rogers Lake)	short-term encampment; forager residential base or field camp	3.6 to 4.9μ
CA-SBR-176 (Deep Creek)	base camp	point typology (3 CT); OH = 4.2 to 5.0μ
CA-SBR-1913 (*Guapiabit*)	ethnohistoric Serrano village, subsistence focus on hares	point typology (26 CT); 235 ± 55, 240 ± 70, 260 ± 70, and 360 ± 80 RCYBP; OH = 1.7, 2.1, 5.8, 11.8μ

[a] Projectile point designations: CT = Cottonwood Triangular; DSN = Desert Side-notched. OH = obsidian hydration rim measurements; ranges reflect the means of the rim values.

Dating was accomplished in a variety of ways for the data set in Chapter 5, including radiocarbon assays, obsidian hydration analyses, and/or projectile point and shell bead typologies.[2] In addition, the distributions of radiocarbon dates and obsidian rim measurements for selected sites and for the study area overall are shown in Figures 16 through 28. The Pinto Period sites (CA-KER-2569 and -2765) were included the archaeological data set because they were originally investigated as part of a site complex (Sutton 1993b). For this summary, however, they are excluded (except where noted) as only those sites that date between the Gypsum and Late Prehistoric periods or that are undated are discussed.

It should be noted that while some of the chronological data are less than ideal for placement of a particular site into a particular time period, they can still be relatively reasonably placed (e.g., a single Rose Spring point provides evidence for a Rose Spring

Table 11. Multiple Component Study Sites

Site	Basic Description[a]	Evidence for Age Assignment[b]
CA-INY-372 (Rose Spring)	large village (or large, long-term habitation site) (GY, RS, LP)	point typology (predominantly RS); multiple radiocarbon dates; OH range = 2.8 to 10.6µ
CA-INY-444 (Ray Cave)	rockshelter (GY, RS, LP)	point typology[c]; 1,500 ± 95 and 3,390 ± 50 RCYBP; OH = 3.0 to 5.0µ
CA-INY-1534A (Chapman 1)	rockshelter (GY, RS, LP)	point typology[c]; 320 ± 60, 580 ± 70, and 760 ± 60 RCYBP; OH = 1.5 to 14.1
CA-INY-1534B (Chapman 2)	rockshelter (GY, RS, LP)	point typology[c]; 230 ± 60 and 470 ± 80 RCYBP; OH = 1.1 to 12.9µ
CA-INY-1535 (Junction Ranch)	seasonal site; cluster of house rings (GY, RS, LP)	point typology[c]; OH = 1.6 to 10.7µ
CA-INY-2284 (Coso Junction)	large village (GY, RS, LP)	point typology (unknown number, but mostly RG); OH = 2.9 to 11.3µ
CA-KER-1998 (Oak Creek Cyn)	large site with focus on hare exploitation (RS, LP)	point typology (1 RS, 2 DS); OH = 2.2 to 5.2µ
CA-KER-2211 (Cantil)	large site with a focus on hare exploitation (RS, LP)	point typology (8 CT, 7 DSN, 15 RS, 1 HU); 940 ± 80, 940 ± 100; and 1,300 ± 100 RCYBP; OH = 1.1 to 6.3µ
CA-KER-4619 (Cross Mtn)	large habitation site with cemetery (RS, LP)	point typology (unknown number of RS, DS), 460 ± 60 and 370 ± 60 RCYBP
CA-KER-5043 (Coffee Break)	small, seasonal habitation site (GY, RS)	point typology (4 RS, 1 HU); 880 ± 50, 2,490 ± 60, 2,430 ± 80 RCYBP; OH = 3.1 to 11.6µ
CA-KER-6188 (Terese)	relatively small habitation site, possibly short-term (GY, RS)	OH = 4.0 to 10.9µ
CA-SBR-72 (Oro Grande)	seasonal occupation site (GY, RS, LP)	point typology (96% DS; 1 ea. of RS, EE, HU); Upper component: six dates between 775 ± 100 and 1,130 ± 100 RCYBP. Lower component: 5,070 ± 120 RCYBP

[a] GY = Gypsum Period; RS = Rose Spring Period; LP = Late Prehistoric Period.
[b] Projectile point designations: DS = Desert series; DSN = Desert Side-notched; CT = Cottonwood Triangular; RS = Rose Spring; RG = Rosegate; EE = Elko Eared; HU = Humboldt. OH = obsidian hydration rim measurements; ranges reflect the means of the rim values.
[c] Together, these sites included Desert Side-notched (n = 15), Cottonwood Triangular (n = 12), Cottonwood Leaf-shaped (n = 5), Rose Spring (n = 63), Eastgate (n = 2), Elko Corner-notched (n = 2), and Pinto (n = 1).

Period occupation). While the validity of this approach may be subject to disagreement, I did not want to call a site undated if it had any information (such as a single projectile point) to place it in a temporal context.

The sites listed in Tables 8 through 12 can be broken down into four basic functional categories, including small temporary or special purpose and/or seasonal camps (n = 23;

Table 12. Undated Study Sites

Site	Basic Description	Comments
CA-KER-519 (Rosamond)	lithic reduction site, some domestic activity	possible hearth, one small mammal bone, no botanical remains
CA-KER-1765 (Rogers Lake)	short-term encampment for cooking activities; forager residential base/field camp	a few small mammal bones, no botanical remains
CA-KER-2212 (Cantil)	small lithic workshop	no features, no faunal or botanical remains
CA-KER-2489 (Rosamond)	quarrying/lithic reduction site, milling activities	bedrock mortars, linear rock feature, a few small mammal bones, no botanical remains
CA-KER-2546 (Rosamond)	short-term camp for lithic reduction activities	no features, a few small mammal bones, no botanical remains
CA-KER-2570 (Rosamond)	lithic reduction site	no features, 151 small bone fragments, no botanical remains
CA-KER-2608 (Rosamond)	lithic reduction site	no features, one lagomorph bone, no botanical remains
CA-KER-2762 (Rosamond)	quarry/lithic reduction site	no features, no faunal or botanical remains
CA-KER-2763 (Rosamond)	lithic reduction workshop	no features, no faunal or botanical remains
CA-KER-2767 (Rosamond)	lithic reduction site	no features, no faunal or botanical remains
CA-KER-3379 (Rogers Lake)	short-term encampment for cooking activities; forager residential base/field camp	two small mammal bones, small amount of wood charcoal

this category includes rockshelters); large village, habitation, occupation, or base camps (n = 10); lithic quarry/reduction sites (n = 12); and rabbit (hare) drive sites (n = 2). These terms were seldom operationalized in the original site reports that were included in this study, so any attempt to do so here is fraught with potential bias, as it is likely that no two archaeologists would define them the same way. Borrowing from Gardner (2002), however, the following provides general definitions for the site functions listed above.

Small, temporary or special purpose camps and/or seasonal camps are those that are typically utilized only at certain times of the year, perhaps when resources unique to that

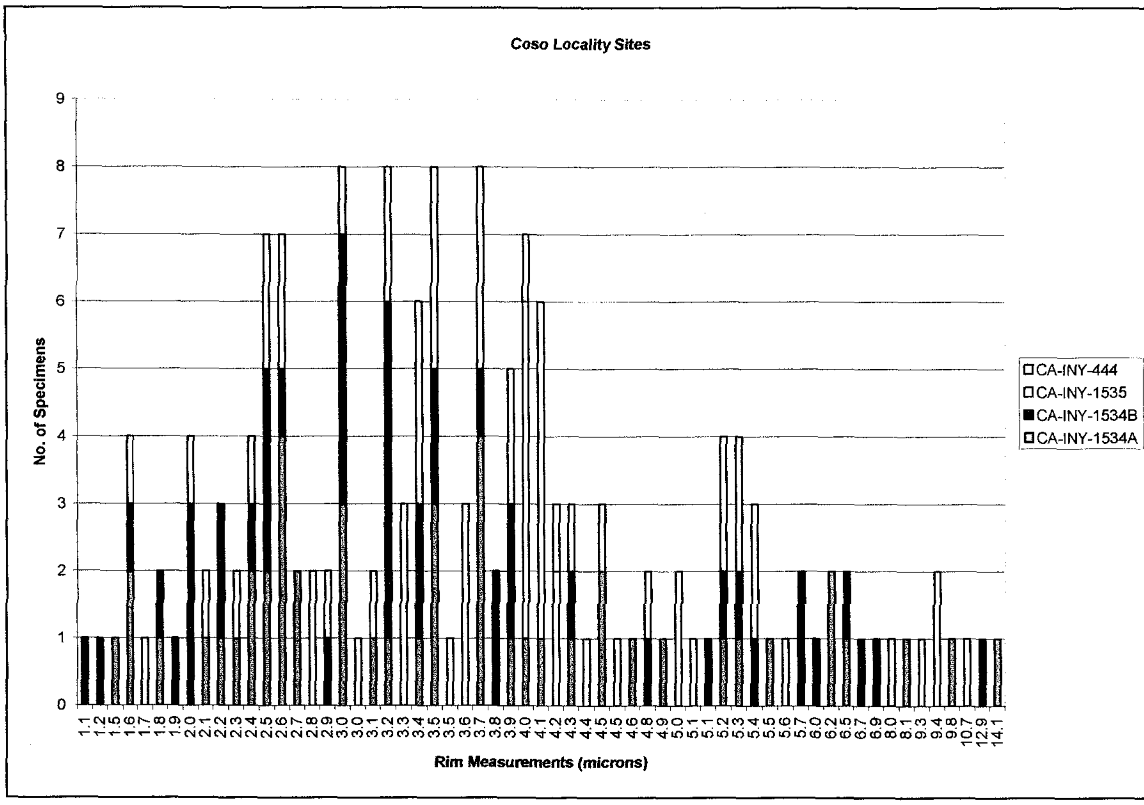

Figure 16. Distribution of obsidian rim measurements for the Coso Locality sites.

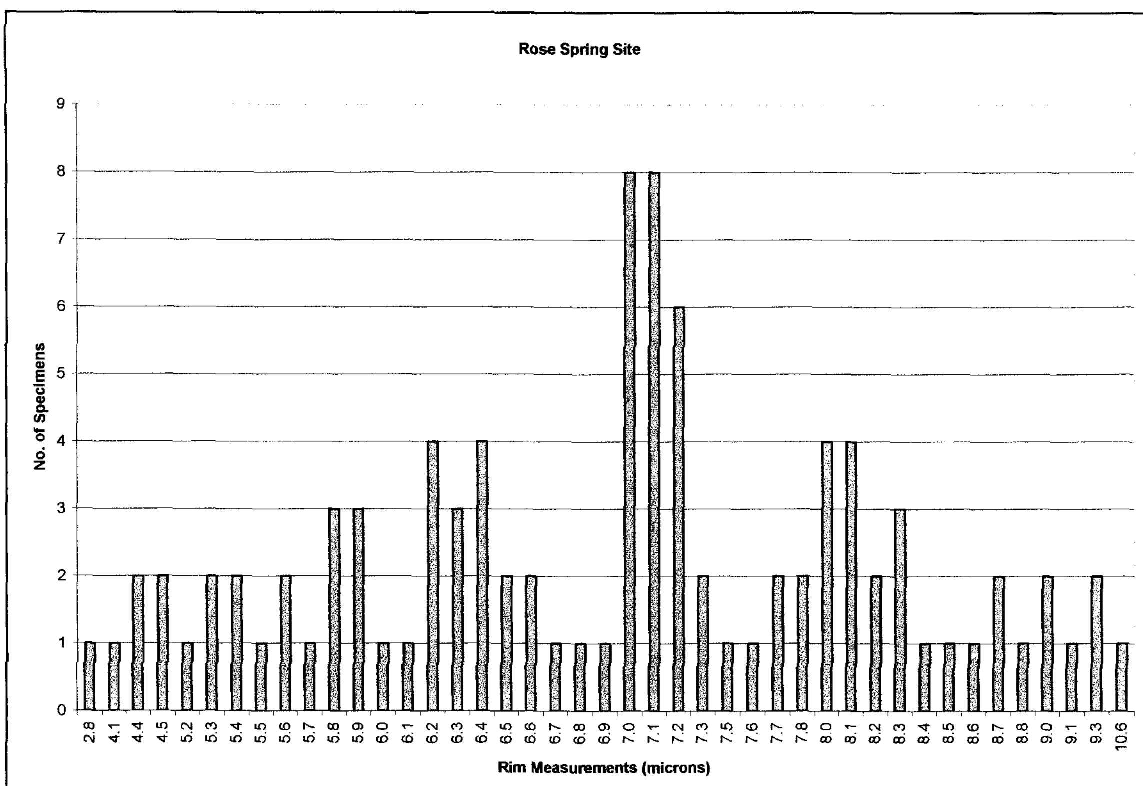

Figure 17. Distribution of obsidian rim measurements for the Rose Spring site (CA-INY-372).

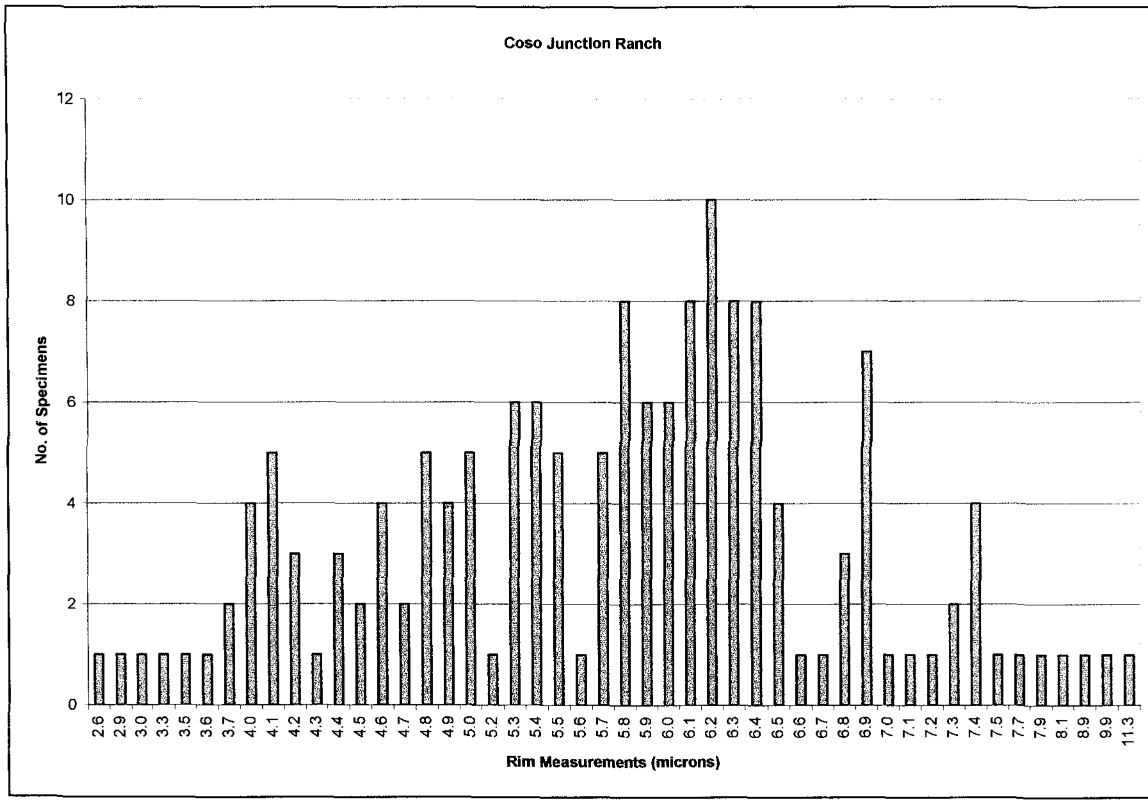

Figure 18. Distribution of obsidian rim measurements for the Coso Junction Ranch site (CA-INY-2284).

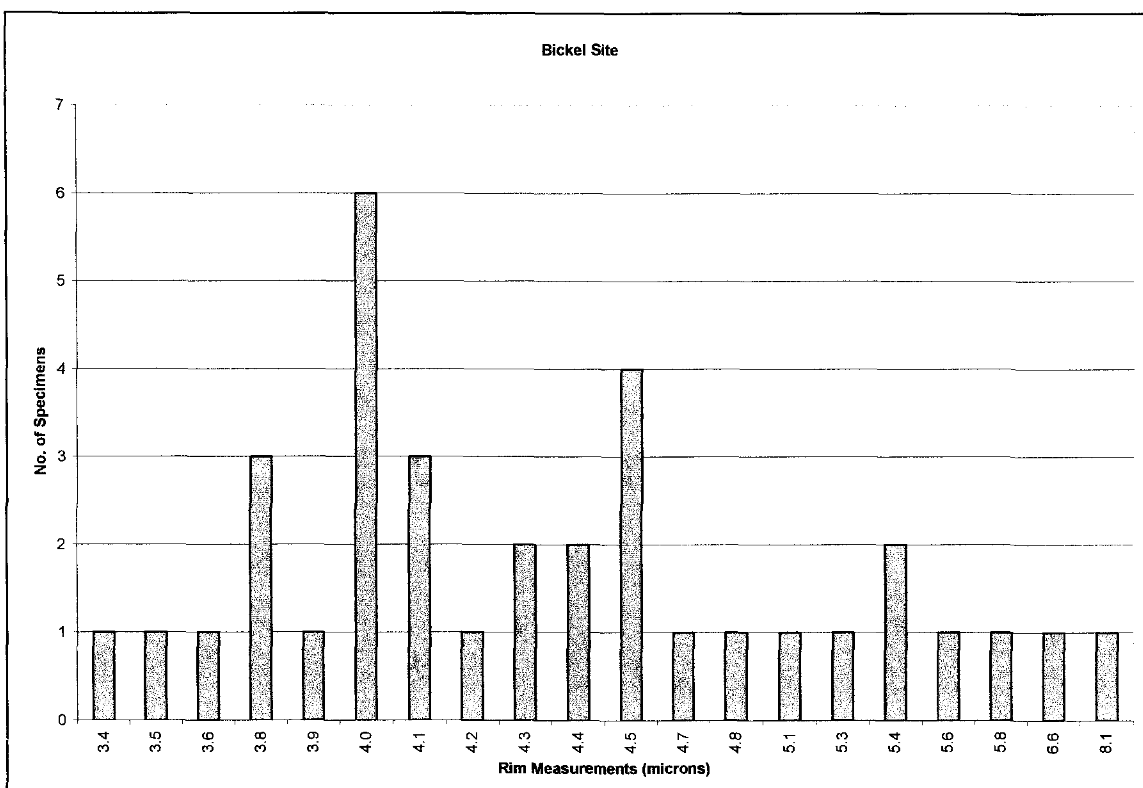

Figure 19. Distribution of obsidian rim measurements for the Bickel site (CA-KER-250).

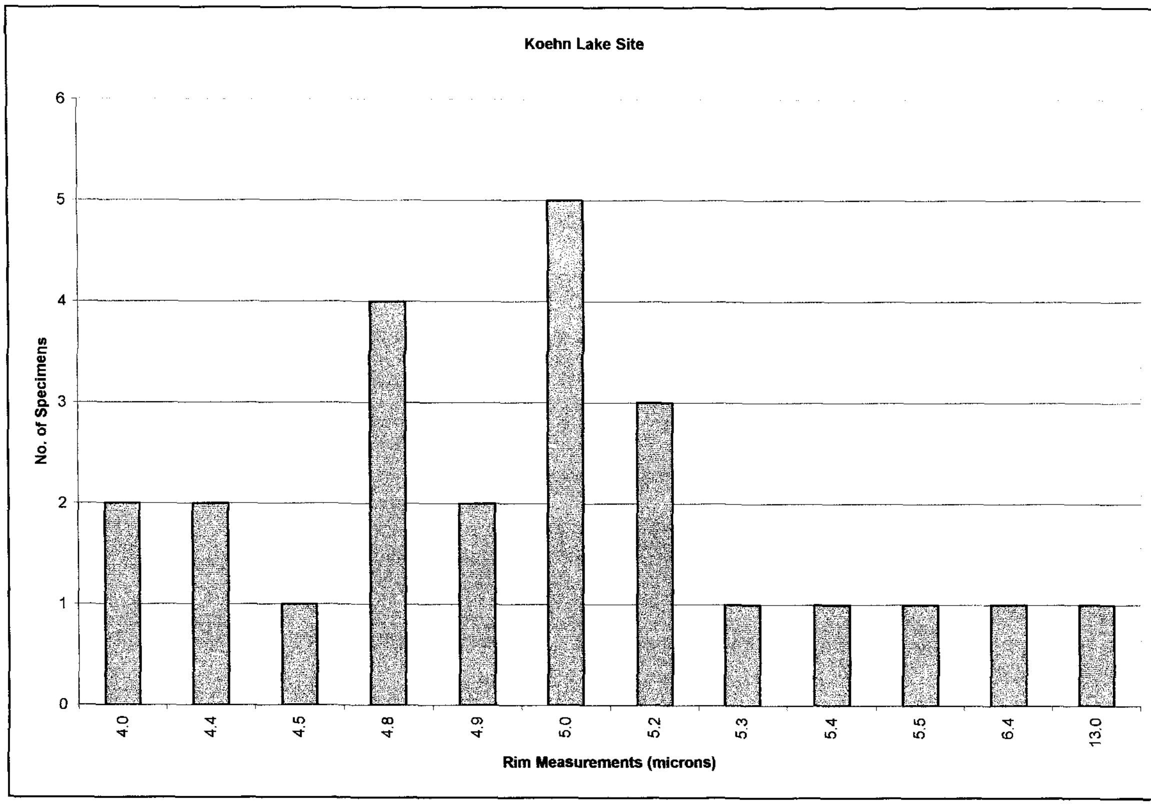

Figure 20. Distribution of obsidian rim measurements for the Koehn Lake site (CA-KER-875).

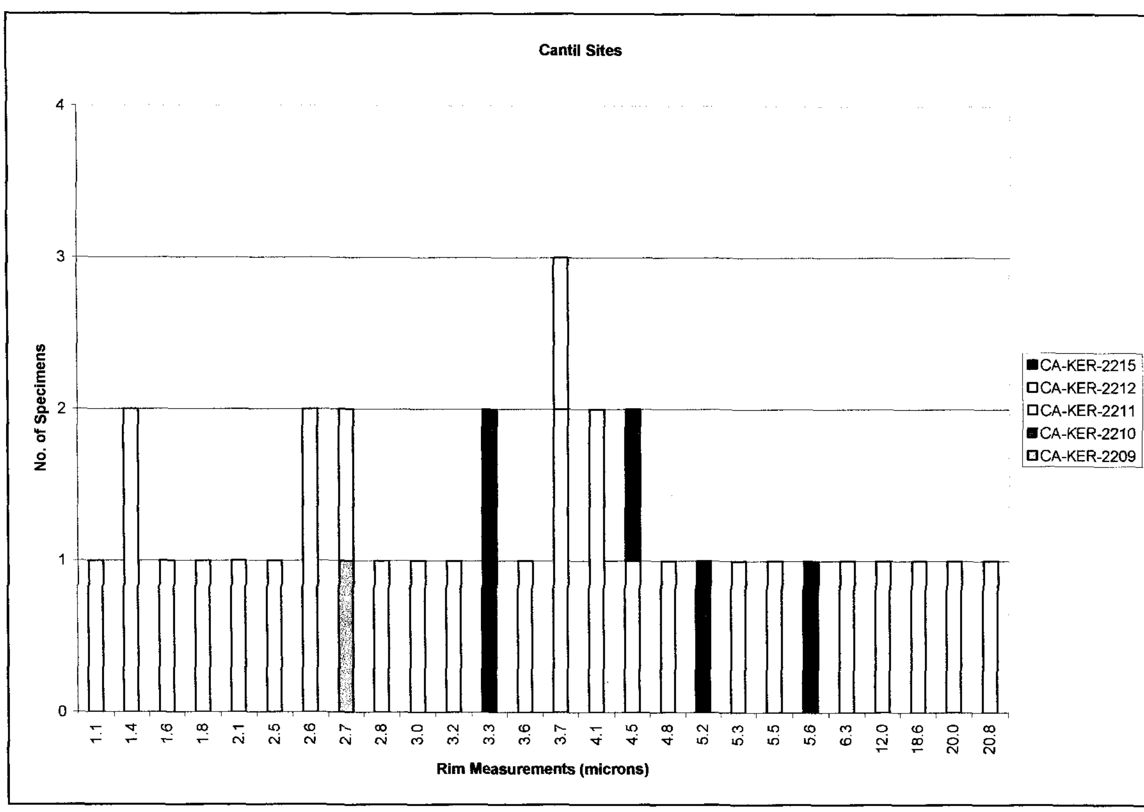

Figure 21. Distribution of obsidian rim measurements for the Cantil sites.

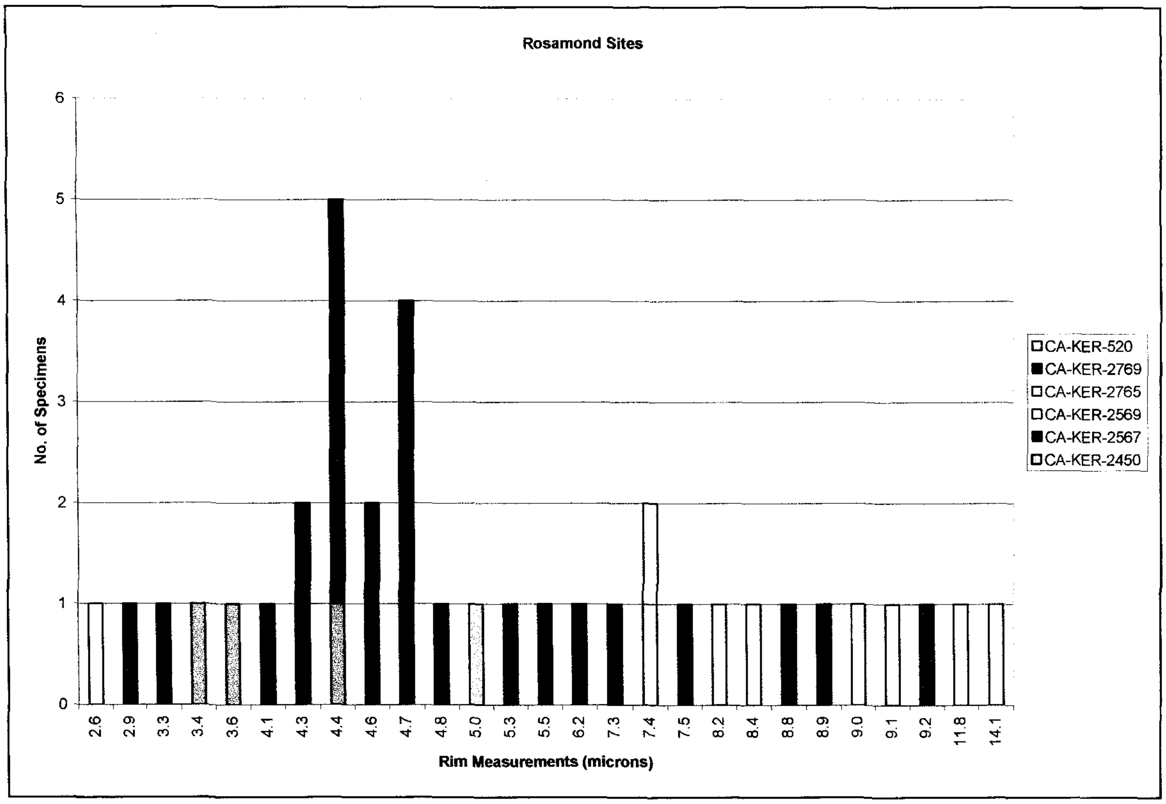

Figure 22. Distribution of obsidian rim measurements for the Rosamond sites.

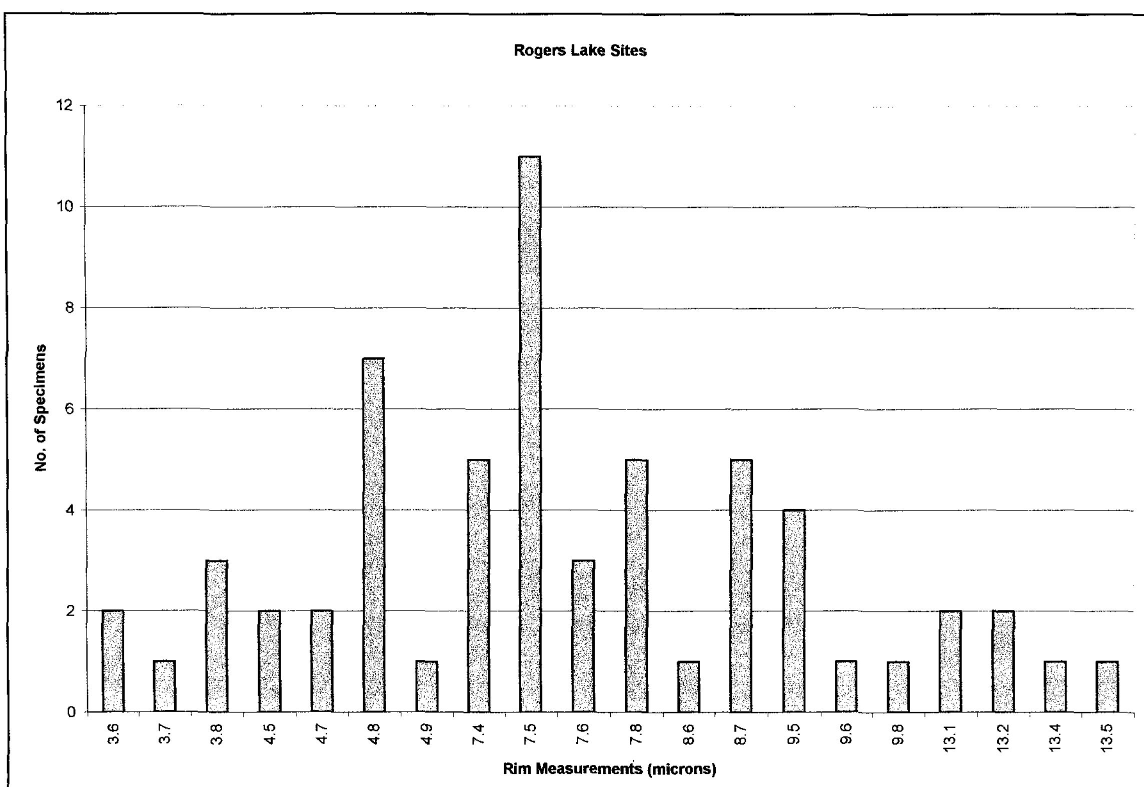

Fig. 23. Distribution of obsidian rim measurements for the Rogers Lake sites (CA-KER-526 and -3377).

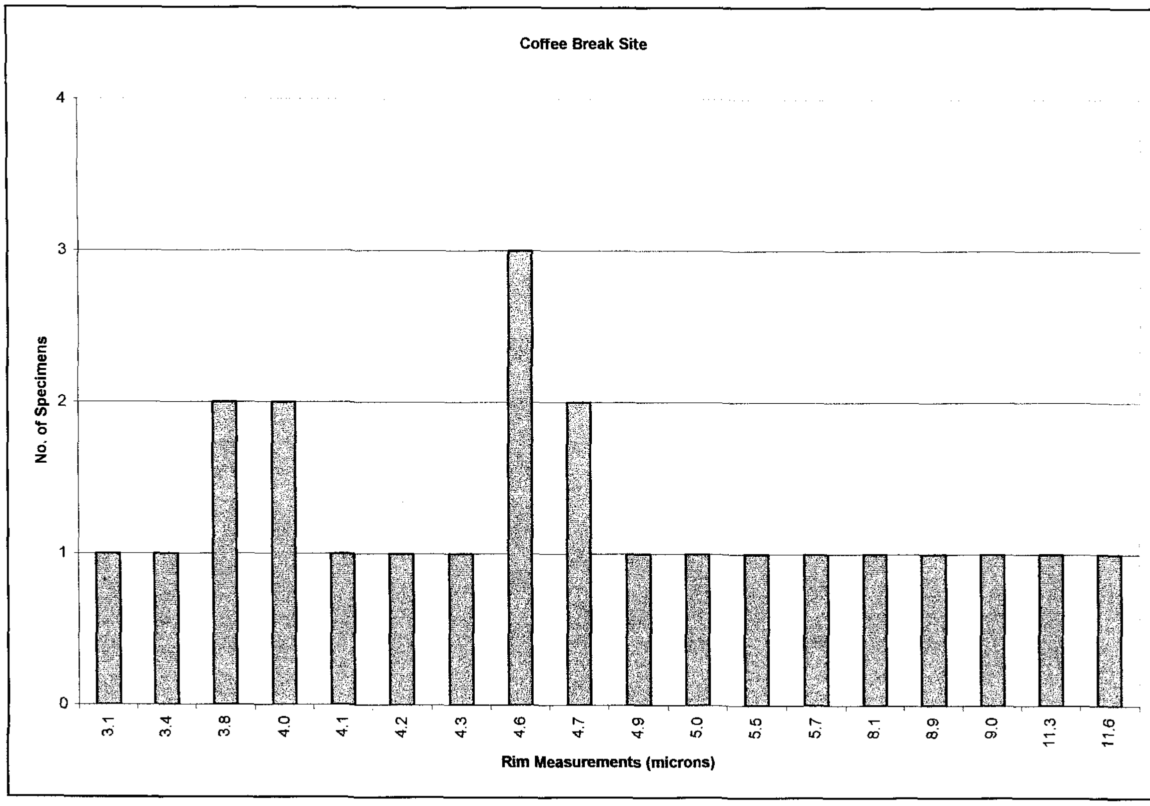

Figure 24. Distribution of obsidian rim measurements for the Coffee Break site (CA-KER-5043).

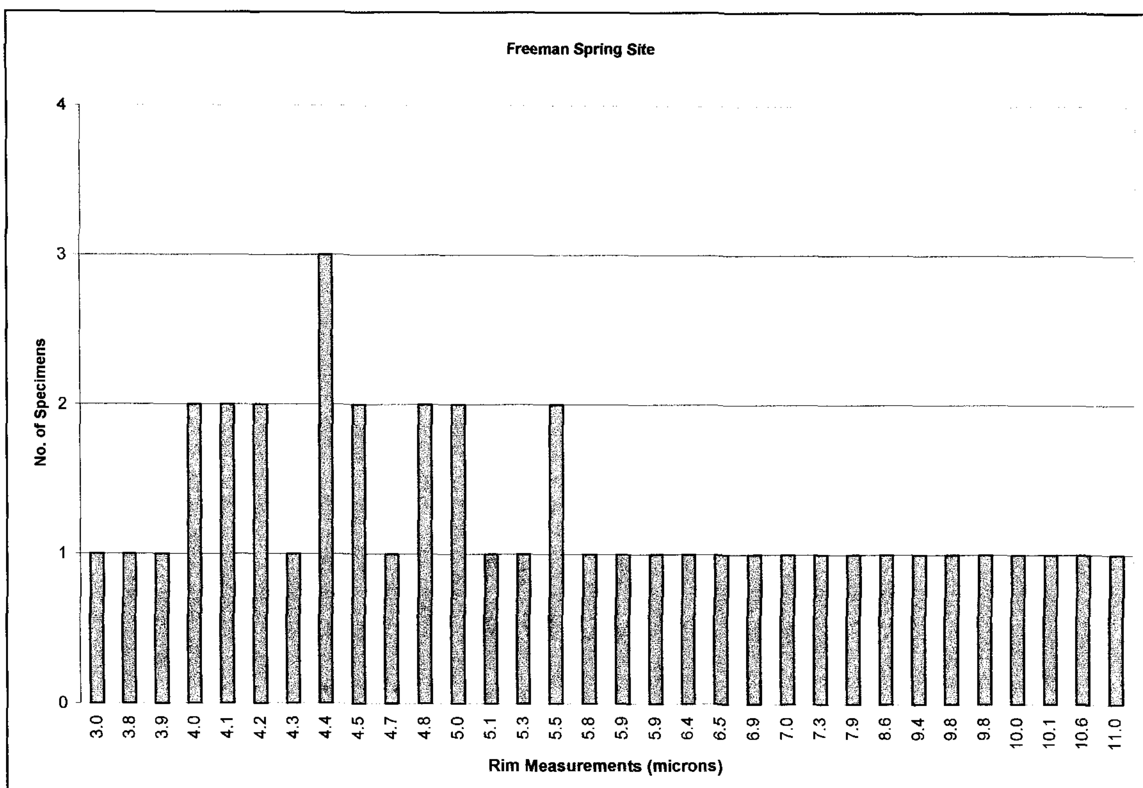

Figure 25. Distribution of obsidian rim measurements for the Freeman Spring site (CA- KER-6106). The rim measurements for this site were rounded to the closest tenth.

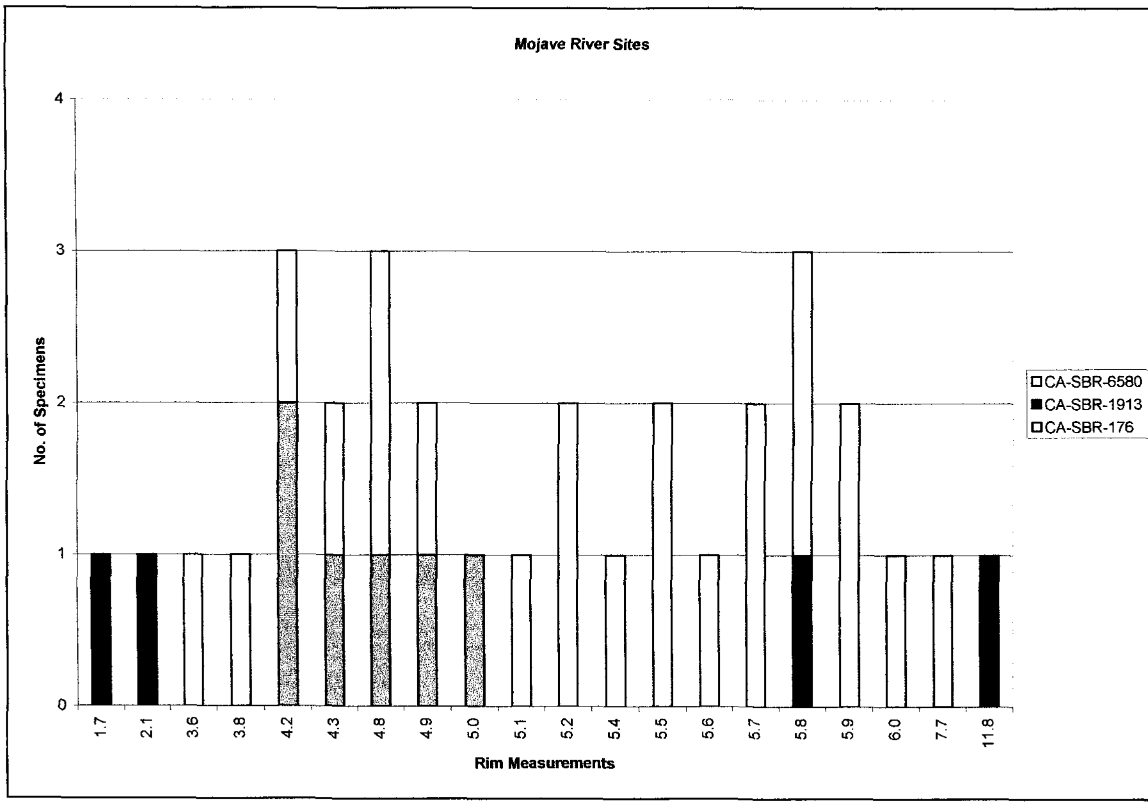

Figure 26. Distribution of obsidian rim measurements for the Mojave River sites.

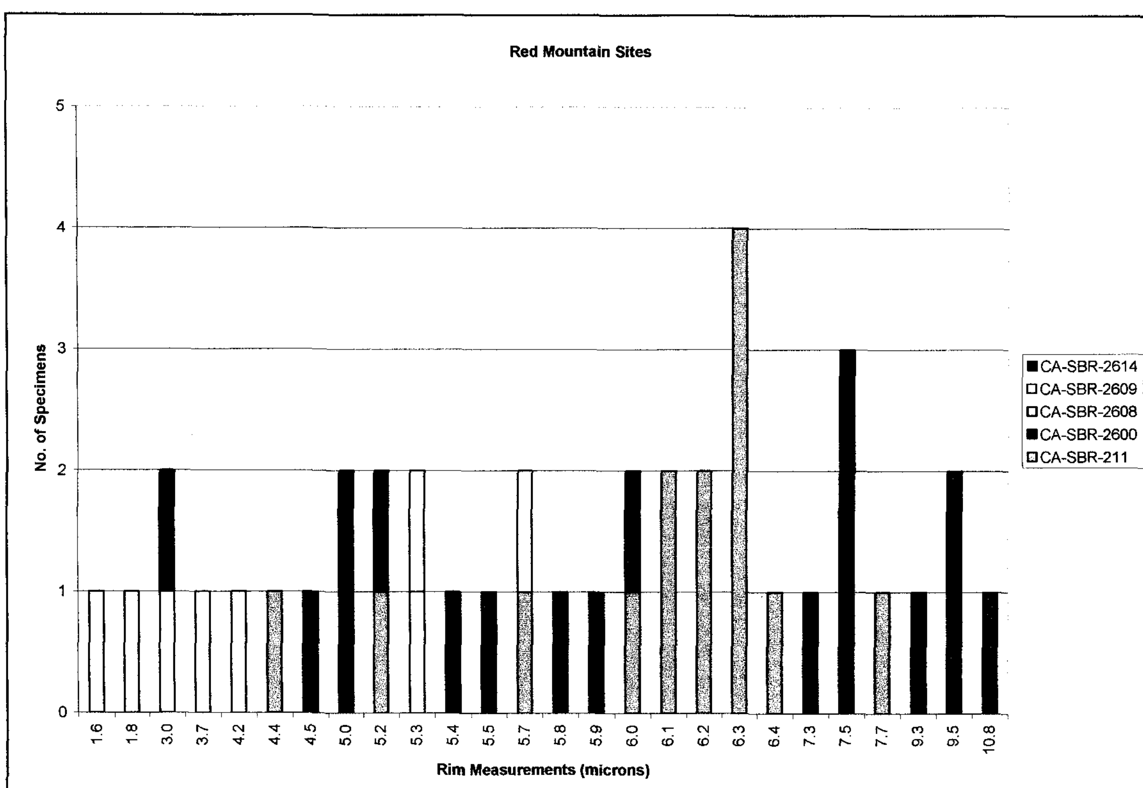

Figure 27. Distribution of obsidian rim measurements for the Red Mountain sites.

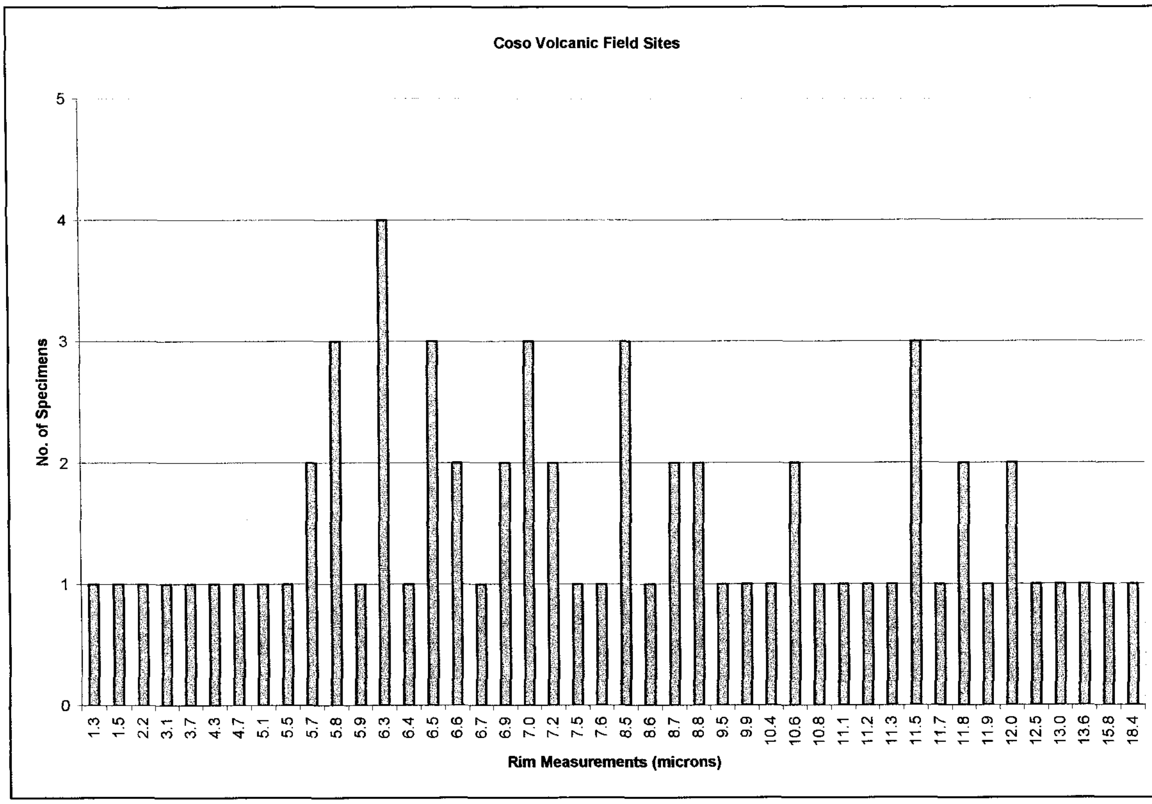

Figure 28. Distribution of obsidian rim measurements for the Coso Volcanic Field sites.

area are available. Such sites may be used to process resources prior to transport to more permanent locations. As a result, there would be less diversity and quantity of artifacts and ecofacts (including faunal and botanical remains), with seasonal resources being most common. Structures, if any, would be minimal and temporary. Rockshelters are a specialized type of small site that may be for residential use (depending on the size of the rockshelter; e.g., Hillebrand 1972), for specialized activities (e.g., Hudson et al. 1979), or for storage (e.g., Schneider 2000).

A large village, habitation, occupation, or base camp is indicative of permanent habitation at which the inhabitants live year-round for an extended period of time ("extended" suggesting more than a single season). Various activities would take place, which would be demonstrated by a large diversity and quantity of artifacts and ecofacts. While population size does not necessarily dictate whether a site would be used on a

permanent basis, generally speaking the population would likely be of considerable size, translating to perhaps as many as 45 to 50 people for hunter-gatherer groups. Hearths, structures, burials, cremations, and/or other types of features would likely be common aspects of such sites.

Lithic quarry/reduction sites and rabbit drive sites are fairly self-explanatory. Lithic quarry/reduction sites are those locations where people would travel to obtain quality toolstone and begin the process of reducing the material to a more manageable size and bulk in order to facilitate transport to the habitation locale. Rabbit drive sites are typically viewed as short-term, seasonal sites where lagomorph (usually jackrabbit) remains are predominant, to the near exclusion of other resources (e.g., McGuire et al. 1982). The quantity of lagomorph remains is usually interpreted to indicate that communal rabbit drives were occurring. Generally, the only features found at such sites are hearths (presumably to cook the rabbits) and flaked stone tools (presumably to capture and/or process them).

As identified in the original site reports, the seven Gypsum Period sites listed in Table 8 are relatively diverse in terms of their function, including two base camps, four small temporary or short-term sites (two considered to be special purpose, one seasonal, and one multifunctional), and a lithic reduction site. Of the nine sites with Rose Spring Period components, one was considered to be a large village and five were classified as small temporary or seasonal sites, two of which were thought to be focused on hare processing (Table 9). The remaining three sites were identified as lithic quarry/reduction sites and a small rabbit drive site. Late Prehistoric Period sites listed in Table 10 fall into three basic categories; village/base camps (n = 2), temporary, short-term, or special activity camps (n = 5), and a rabbit drive site.

The 12 multiple component sites listed in Table 11 include five large village or habitation sites, four seasonal and/or short-term sites, and three rockshelters. These multiple component sites consist of seven that have Gypsum, Rose Spring, and Late Prehistoric period components, three that have Rose Spring and Late Prehistoric period components, and two that have Gypsum and Rose Spring period components. It is interesting to note that of the 12 multiple component sites, all have a Rose Spring Period component, and of those 12, 10 also have Late Prehistoric period components. None of the nine multiple component sites that contained Gypsum components (see Table 11) seem to have had a significant Gypsum Period occupation.

Perhaps the most intriguing sites in terms of the interpretations offered in Chapter 7 are those that are undated (see Table 12). Nine of the 11 sites that fall into this category were characterized exclusively or primarily as rhyolite lithic reduction or quarry sites, while two were described as short-term encampments for cooking activities. Virtually no features and very few faunal or botanical remains were found at any of these sites. This is to be expected at lithic reduction sites where the main task would be the working of toolstone. It is also not unexpected that dating would be a problem in the absence of obsidian toolstone or associated radiocarbon samples.

Potential Biases and Patterns in the Dating Criteria

There are several potential biases in the way the dating criteria from the study sites were analyzed in this study. First, the criteria were not derived from a random sample. As such, there is a disproportionate number of obsidian rim measurements and radiocarbon dates from particular sites (e.g., the Rose Spring site [CA-INY-372]; Yohe 1992) and particular localities (e.g., the Coso Volcanic Field; Gilreath and Hildebrandt

1997); thus, they may not be representative of the entire study area. Second, later sites are more likely to occur on or near the surface, while older sites typically occur below the surface; thus, later sites are more visible, which is often why they are chosen for excavation projects, creating further bias in the sample of sites. Generally speaking, there is also less material for radiocarbon dating in older sites, which could lead to sites being designated as undated (in the absence of any dating criteria) or incorrectly dated (in the absence of materials suitable for radiometric analysis; for example, sites could be incorrectly dated based on typological criteria alone).

Having pointed out these various potential biases, and with those caveats in mind, some patterns appear to emerge in the distributions of obsidian rim measurements and radiocarbon dates shown in Figures 29 through 32. Using Table 6 as a general guideline, Figure 29 demonstrates that 52.4% of the 843 rim measurements shown in Table 5 fall within the range between 4.0 and 6.9 microns (n = 442; roughly Rose Spring Period), with 21.3% falling between the range of 1.0 and 3.9 microns (n = 180; roughly Late Prehistoric Period) and 20.2% between 7.0 and 9.9 microns (n = 170; roughly Gypsum Period). Between 10.0 and 29.0 microns, there is a total of 51 rim measurements (6.0%), with two of the ranges having no readings (17.0 to 17.9 and 19.0 to 19.9 microns) and six having four or less readings. Figure 29 also shows a steady increase in the number of rim readings between 7.9 and 4.0 microns, or roughly from the end of the Gypsum Period to the end of the Rose Spring Period. Beyond any inferences regarding site age and environment, this distribution of obsidian rim measurements could also have implications regarding political access to obsidian (see Chapter 7 for further discussion).

A review of Figures 30, 31, and 32 also shows some interesting patterns. In order to “tease out” potential patterns in the radiocarbon dates, these three graphs were generated

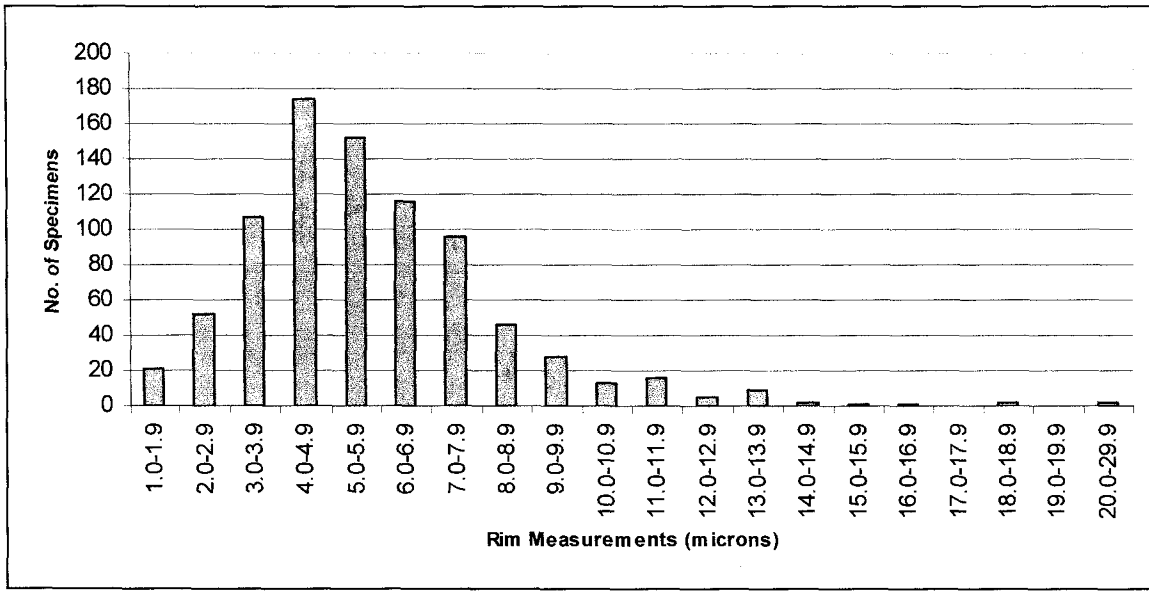

Figure 29. Distribution of all obsidian rim measurements (n = 843) in Table 5.

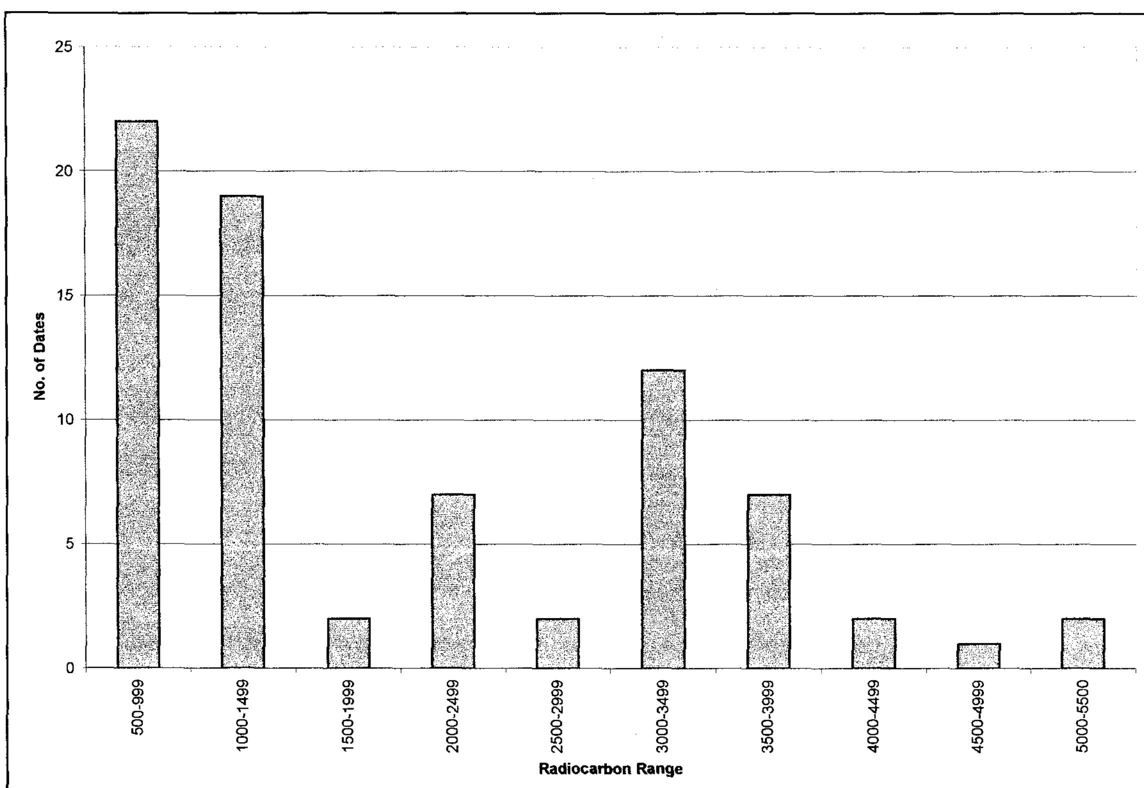

Figure 30. Distribution of 71 radiocarbon dates from Table 4 in 500-year intervals, excluding those that postdate 500 RCYBP.

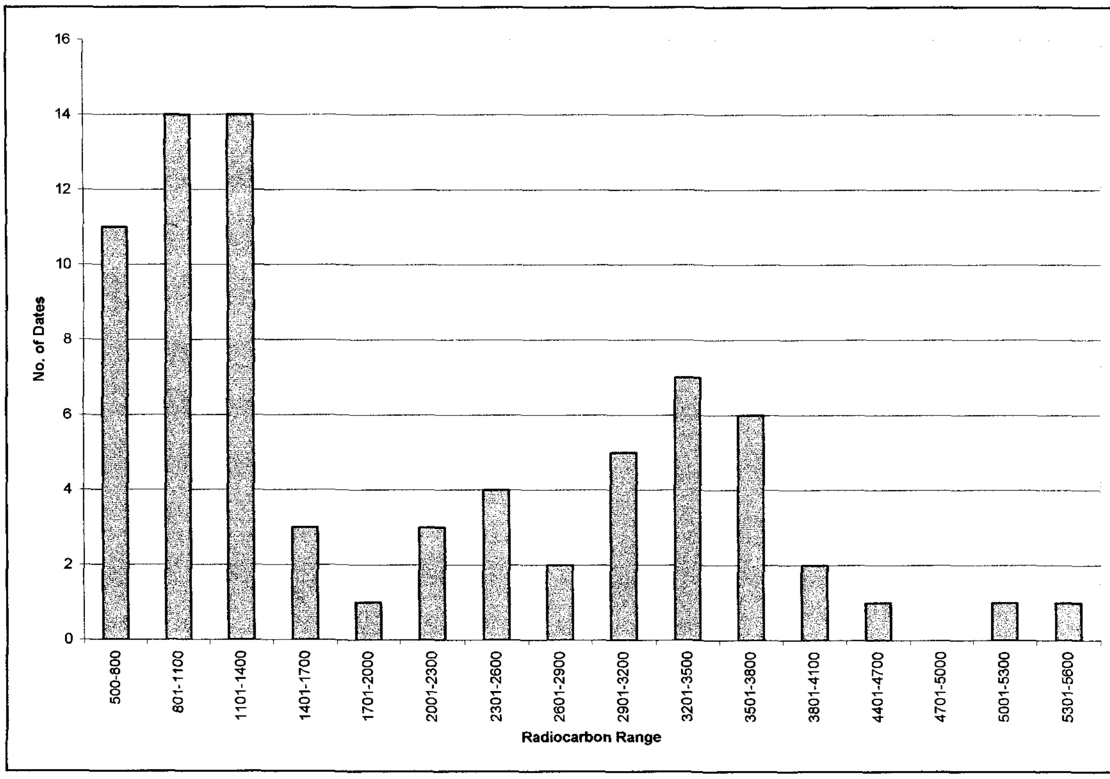

Figure 31. Distribution of 71 radiocarbon dates from Table 4 in 300-year intervals, excluding those that postdate 500 RCYBP.

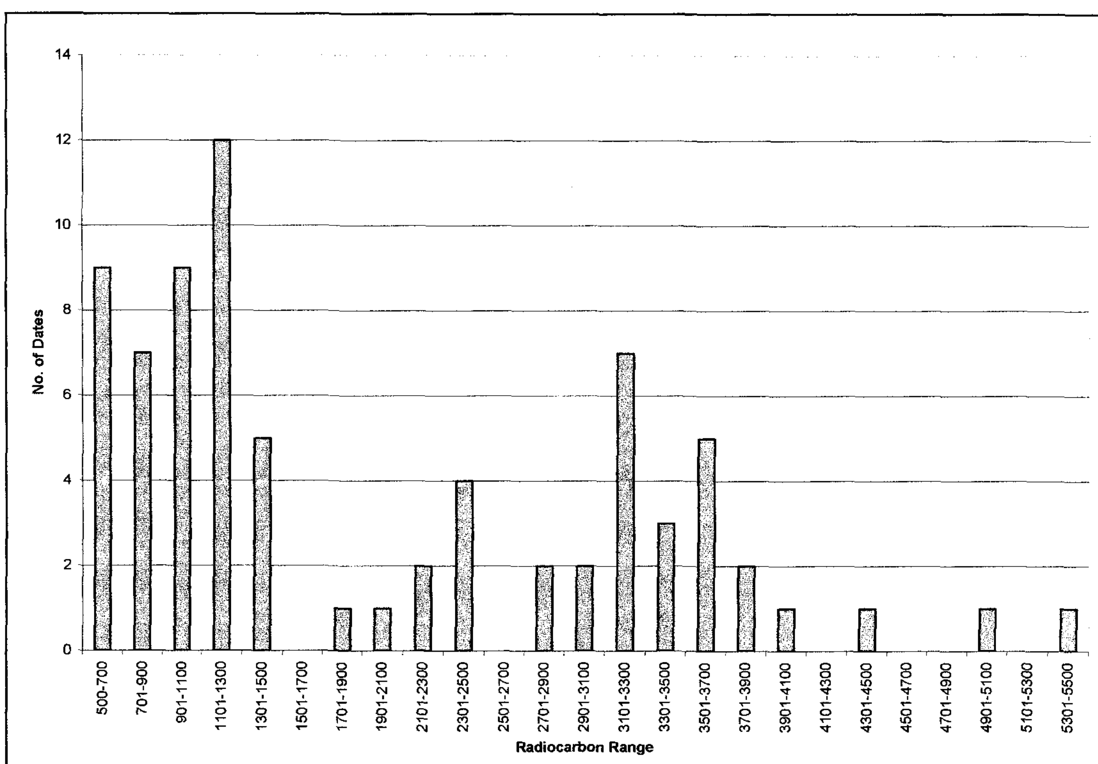

Figure 32. Distribution of 71 radiocarbon dates from Table 4 in 200-year intervals, excluding those that postdate 500 RCYBP.

to illustrate the distribution of radiocarbon dates in 500-year, 300-year, and 200-year arbitrary intervals. It should be pointed out that in Figure 30, the first column contains nine dates that fall within the Late Prehistoric Period and 11 dates that fall within the Rose Spring Period. Keeping that in mind, what these graphs demonstrate is that regardless of how the time parameters are set up, the densest occupations among the study sites was during the Rose Spring Period. There are also surges in site density at various times during the Gypsum Period (see Figures 30 through 32), although they never reach the level of density of the Rose Spring sites.

By breaking down the dates into increments of 200 years (Figure 32), the pattern becomes clearer. It is apparent that site occupations—or at least site densities—began to decline between the ranges of 1,100 and 1,300 RCYBP and 701 and 900 RCYBP, or roughly from the beginning to the end of the MCA. This would be expected if populations were gradually declining due to environmental deterioration. Further, if there was a climatic amelioration at the end of the MCA, the fact that there is a slight increase in radiocarbon dates between 500 and 700 RCYBP is not too surprising. The surges in Figure 32 between 3,101 and 3,300 and between 3,501 and 3,700, which would be the beginning of the Gypsum Period, are also not surprising given the relatively more mesic conditions that likely existed at that time (see Chapters 1 and 4). The decrease in radiocarbon dates between 3,301 and 3,500 could simply be a sampling bias. The Gypsum Period surges could also be biased by the fact that about a third of the radiocarbon dates of that age were derived from the Rose Spring site, and those early dates are suspect as to their cultural context (see Chapter 5).

As Figures 30 through 32 are skewed due to the fact that some sites have multiple radiocarbon dates, Figure 33 was generated to look only at the number of dated

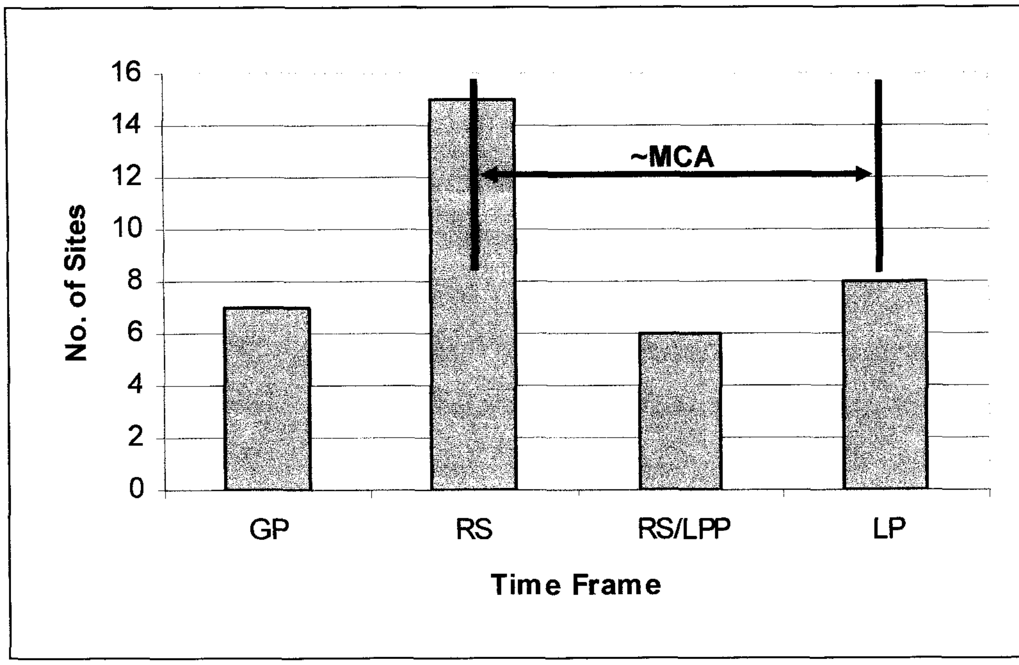

Figure 33. Number of dated archaeological assemblages (sites) per time period. GP = Gypsum Period; RS = Rose Spring Period; RS/LPP = Rose Spring/Late Prehistoric Period; LP = Late Prehistoric Period. The thick vertical lines encompass the approximate time frame for the MCA.

archaeological assemblages (i.e., sites) per time period (based on radiocarbon dates and/or obsidian hydration rim measurements) rather than the total number of radiocarbon dates for each site by time period. Thus, the pattern of dated components becomes a little clearer.[3]

In reviewing Tables 8 through 11, there are seven Gypsum-aged sites, nine Rose Spring-aged sites, eight Late Prehistoric-aged sites, and 12 multiple component sites. Of the multiple component sites, however, six (CA-INY-372, -444, -2284; CA-KER-2211, -5043, -6188) are considered to be predominantly Rose Spring in age and are placed in Figure 33 as such. Additionally, at least four of those six sites, as well as five of the Rose Spring-aged sites (CA-KER-250, -533, -875, -2450, -6106), fall within the first half of the Rose Spring Period. As the Rose Spring Period is argued to have been considerably more mesic during the first half than the second half, this temporal distribution of sites supports that argument.

In terms of the Late Prehistoric Period sites in Figure 33, at least two of them (CA-KER-733 and CA-SBR-1913) were occupied toward the end of that period, at a time when there was likely a climatic amelioration, which would account for the "spike" in the graph during the Late Prehistoric Period. Furthermore, even if the Red Mountain and Coso Volcanic Field sites shown in Table 4 are included, the pattern remains much the same, except that there are several more later Late Prehistoric Period sites.

Flaked and Ground Stone Implements

While some of the study site reports did not provide quantification for the toolstone used to manufacture flaked and ground stone implements, the vast majority of flaked stone items (including formed tools and debitage) was obsidian (> 80%), numbering in the tens of thousands at a few sites. A different picture emerged at nine of the undated sites in Table 10, however. All but one of these sites contained rhyolite almost exclusively in their flaked stone assemblages. The exceptions were CA-KER-1765, -3379, and -2212, at which the toolstone consisted primarily of quartz, chert, and chalcedony (Sutton 1991b; Byrd et al. 1994). The predominance of rhyolite at these nine sites may indicate that they were not occupied at the height of the obsidian procurement and production system during the Rose Spring Period (see Chapter 7).

In terms of the ground stone assemblages, Leonard (1980:29) argued that the presence of milling tools at the Gypsum-aged Hinkley site refuted the notion that sites of this age would not contain such implements, as seed collecting and processing are not thought to have been significant activities at that time (e.g., Warren and Crabtree 1978). Leonard's (1980) proposal is somewhat supported at Fort Irwin, where Basgall et al. (1988) and Hall and Basgall (1994) reported ground stone tools at a number of Gypsum

Period sites, although not in great abundance. The increasing frequency of milling implements during the Rose Spring Period suggests a change in plant availability, which may well be related to the MCA.

Differences in ground stone assemblages in the Fremont Valley show a potential change in technology related to such tools between the Rose Spring and Late Prehistoric periods. For example, the ground stone artifacts from Koehn Lake (CA-KER-875) consist of a large number of fragmented and burned manos, indicating an extended use-life for these implements during the Rose Spring Period, first as manos and then as cooking stones (Sutton 1990:4). At the nearby multicomponent Cantil site (CA-KER-2211), complete and unburned manos are much more common, suggesting their sole use as milling equipment (Sutton 1990:6). This may represent a change in the resource inventory and/or a modification of the processing technology (Sutton 1990:7; also see Chapter 7 for further discussion).

Evidence of Trade

Evidence for trade among the study sites was derived from obsidian, marine shell ornaments, green slate, and pottery. Obsidian was present at all but a few of the study sites. All but two of the obsidian specimens from the study sites came from the Coso Volcanic Field a few miles south of Owens Lake. The other two sources of obsidian from the study sites include Obsidian Butte near the southern shore of the Salton Sea in Imperial County and Bristol Mountains northeast of the Twentynine Palms Marine Corps Base. With an area the size of the western Mojave Desert, the acquisition of obsidian would often require either long-distance trade (perhaps via middlemen; see Chapter 4) or extended travel for direct access. The distance to the source of the obsidian, as well as

the possibility of territorial rights to particular sources by different groups of people, would likely dictate the method for acquisition of obsidian (see Chapter 7 for further discussion of obsidian).

Shell beads and ornaments, predominantly *Olivella* but also including *Haliotis* and *Tivela*, were documented at three of the Gypsum Period sites (CA-SBR-6580, CA-KER-526, CA-KER-2218), three of the Rose Spring Period sites (CA-KER-250, CA-KER-875, CA-KER-6106), three of the Late Prehistoric Period sites (CA-KER-733, CA-SBR-176, CA-SBR-1913), and all of the multiple component sites. Shell beads have also been recovered at the Red Mountain Archaeological District and the Coso Volcanic Field. Marine shell beads are assumed to be traded from people along the Pacific coast, particularly the Chumash.

Green slate (often incised) occurs in small numbers at Mojave Desert sites (Sutton and Schneider 1996:22). Green slate was present at seven of the study sites (CA-INY-372, CA-KER-875, CA-KER-2211, CA-KER-2215, CA-KER-2546, CA-SBR-211 [Red Mountain], CA-SBR-1913). Incised slate was also identified at CA-SBR-72, although no color was specified (Rector 1983c). There were less than five ornaments of green slate at all but one of the study sites, the exception being CA-SBR-1913, at which 27 specimens were recovered. As it is a nonlocal material for much of the Mojave Desert, it is thought to represent evidence of trade (e.g., Sutton and Schneider 1996:38). Four of the sites at which green slate occurred were multiple component sites (CA-INY-372, CA-KER-2211, CA-SBR-72, CA-SBR-211), two were Rose Spring sites (CA-KER-875, CA-KER-2215), one was a Late Prehistoric site (CA-SBR-1913), and one was undated (CA-KER-2546).

While the source of this green slate is not known, it may derive from the Slate Range northeast of the Fremont Valley (Sutton and Schneider 1996:22) or Riverside County to

the south (Simpson et al. 1972:18; Rector 1983c:64). As the Slate Range falls within the ethnographic territorial boundaries of the Kawaiisu (Zigmond 1986:399), if that is indeed the source of the green slate from the study sites, it is likely that the Kawaiisu controlled that source. The temporal significance of green slate is also unknown.

Pottery was discovered at nine of the study sites (CA-INY-372, CA-KER-526, -875, -1180, -2211, -4619, CA-SBR-176, -211, -1913; also at the Coso Volcanic Field and Coso Locality sites). These were variously identified as Owens Valley Brown Ware, Tizon Brown Ware, Lower Colorado Buff Ware, Topoc Buff, and brown ware. Four of the sites containing pottery had multiple components (CA-INY-372, CA-KER-2211, CA-KER-4619, CA-SBR-211), three were Late Prehistoric Period sites (CA-KER-1180, CA-SBR-176, CA-SBR-1913), one was a Rose Spring Period site (CA-KER-875), and one was a Gypsum Period site (CA-KER-526).

The Lower Colorado Buff Ware is presumed to have come from the Colorado River region to the east or the northern Coachella Valley in southeast California (Sutton and Schneider 1996:37), while the Tizon Brown Ware is thought to have originated in the uplands of San Diego County and/or western Arizona (Lyneis 1988:146). Due to terminological difficulties, Lyneis (1988:151) suggested that pottery similar to Tizon Brown Ware that is found in the Mojave Desert be redefined as Mojave Brown Ware, which she described as a dark paddle-and-anvil type of pottery.

Wallace (1988a:98) noted that Owens Valley Brown Ware most likely appeared in California no earlier than about 1,000 years ago and entered into the Sierra Nevada region from the east. Eerkens (2003:2) observed that while precise timing of the introduction of pottery in the Owens Valley is unknown, it appears that pottery manufacturing was very limited prior to about 700 years ago, and that a "modest level of

pot production" was in place by about 500 years ago (also see Eerkens 2004). Using Instrumental Neutron Activation Analysis (INAA), Eerkens et al. (2002:215) argued that in the Mojave Desert, the clays used to produce pots of various types were "either local in origin or derived from areas to the east or south."

Summary of Faunal Remains

While faunal remains were relatively abundant at many of the study sites, few sites contained botanical remains (or if they did, they were not reported). This was another challenge in interpreting the potential effects of the MCA on the prehistoric inhabitants of this region. Moreover, it should be noted here that the presence of faunal remains does not necessarily indicate that they were culturally derived; that is, they could be natural occurrences at some sites (and in some cases likely are). However, unless it was clearly stated in a site report that some or all of the faunal remains were considered noncultural, they were treated as if they were cultural in the analysis below (unless otherwise stated). Below is a summary and comparison of the faunal and botanical assemblages from the study sites, which are discussed by component (also see Appendix A).

Faunal Remains from Gypsum Period Components

Most of the faunal and botanical evidence from Gypsum Period components of the study sites came from CA-KER-526 (Byrd et al. 1994; Hudson 1994) and CA-SBR-6580 (the Siphon Site; Sutton et al. 1993). Of the more than 1,800 terrestrial specimens identified to the family, genus, or species level at CA-KER-526, the most abundant were jackrabbit (*Lepus californicus*) and Leporidae. Other species identified to the family level or below had less than 10 specimens each, including pocket gopher (*Thomomys bottae*), woodrat (*Neotoma* sp.), badger (*Taxidea taxus*), cottontail rabbit (*Sylvilagus* sp.),

and kangaroo rat (*Dipodomys* sp.). There were also small numbers of reptiles, amphibians, and birds (Hudson 1994:Table 51). The faunal remains from CA-SBR-6580 were sparse (n = 294), but consisted of jackrabbit (*L. californicus*), pocket gopher (*T. bottae*), artiodactyl, western pond turtle (*Clemmys marmorata*), and a number of specimens identified as lagomorph or rabbit-sized (Yohe 1993b:69-70).

At the Hinkley site (CA-SBR-189), jackrabbit (*L. californicus*), pronghorn (*Antilocapra americana*), ground squirrel (*Spermophilus* sp.), cottontail rabbit (*Sylvilagus* sp.), and rodents (*Neotoma* sp., *Perognathus* sp., *Thomomys* sp.) were recovered, although the cultural context and quantification of these remains were ambiguous. At CA-KER-2218, the faunal remains identified to genus and species consisted of *Lepus californicus*, *Sylvilagus aududonii*, and *Urocyon*. The faunal remains from CA-KER-246, -2209, and -2214 consisted of a few small mammal remains, including *Lepus* sp. and rabbit-sized, none of which was considered cultural. In comparison, at Gypsum-aged sites in the central Mojave Desert, mountain sheep, other artiodactyls, tortoise, lagomorph, and various rodents have been recovered (e.g., Hall and Basgall 1994; McGuire and Hall 1988).

Faunal Remains from Rose Spring Period Components

Whether it is a question of better preservation, larger sample size, and/or other factors, during the subsequent Rose Spring Period there appears to be a striking increase in sites containing a variety of faunal and botanical remains. Eight of the nine Rose Spring sites with identified faunal remains contained *Lepus californicus*, *Lepus* sp., and/or lagomorph elements, usually in large quantities (hundreds to many thousands).

Cottontail rabbit (*Sylvilagus audubonii*) is a less common faunal element from the Rose Spring sites included in this study, with six sites containing this species in far fewer

frequencies than that of *Lepus* sp. (usually less than 100 specimens at sites where quantification was provided). Other identified faunal species that have been recovered from Rose Spring Period sites (mostly from the Koehn Lake site), usually in small numbers, include fox (*Urocyon cinereoargenteus*), badger (*Taxidea taxus*), desert tortoise (*Gopherus agassizii*), horned lizard (*Phrynosoma* cf. *platyrhinos*), snake (*Crotalus* sp., *Lampropeltis* sp.), and a variety of rodents.

Faunal Remains from Late Prehistoric Period Components

Of the eight study sites that contained Late Prehistoric Period components, six contained *Lepus* remains, with the largest number derived from CA-KER-733 (Sutton and Everson 1992). In addition to *Lepus* remains, cottontail rabbit (*Sylvilagus audubonii*) specimens have been recovered in very small quantities. Interestingly, at CA-SBR-1913, 10 specimens of golden eagle (*Aquila chrysaetos*) were recovered, which prompted Yohe (1996:61) to suggest that the Serrano conducted an eagle killing ritual as part of their annual mourning ceremony at this site (also see Strong 1929; Drucker 1937; Sutton and Schneider 1996). Small quantities of bighorn sheep (*Ovis canadensis*), deer (*Odocoileus* sp.), pronghorn (*Antilocapra americana*), coyote (*Canis latrans*), and desert tortoise (*Gopherus agassizii*), as well as a variety of lizards, birds, rodents, and unidentified artiodactyls have also been identified from the Late Prehistoric Period study site faunal assemblages. A majority of the pronghorn and deer specimens was derived from Late Prehistoric Period components.

Faunal Remains from Multiple Component Sites

Of the 12 multiple component sites, all but two contained lagomorph remains. Once again, *Lepus* is the predominant species, representing roughly between 150 and 6,400 specimens in the faunal assemblages at sites where quantification was provided.

Sylvilagus elements continue to be represented as well, with seven sites containing such remains, although in very small amounts (between one and 106 specimens). Elements identified as Leporidae and rabbit-sized remain abundant, ranging between 156 and almost 22,000 specimens (the latter quantity derived solely from CA-KER-2211 [Sutton 1991b]). As noted above, seven of the sites in the multiple component category have Gypsum, Rose Spring, and Late Prehistoric period components, while two have Gypsum and Rose Spring components only, and three have Rose Spring and Late Prehistoric components only (see Table 11).

Other species recovered from multiple component sites, typically in small quantities, consist of pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), deer (*Odocoileus hemionus*), bobcat (*Lynx* sp.), badger (*Taxidea taxus*), fox (*Vulpes macrotis*, *Urocyon cinereoargenteus*), coyote (*Canis latrans*), porcupine (*Erethizon dorsatum*), squirrel (*Ammospermophilus* sp., *Spermophilus* sp.), desert tortoise (*Gopherus agassizii*), western pond turtle (*Clemmys marmorata*), tui chub (*Gila bicolor*), minnow (Cyprinidae), various rodents (*Dipodomys* sp., *Perognathus* sp., *Neotoma* sp., *Microtis* sp.), birds (*Corvus* sp., *Falco* sp.), snakes (*Crotalus* sp., *Lampropeltis* sp.), and lizards (*Phrynosoma platyrhinos*, *Uta* sp.).

Comparison of Faunal Remains from Selected Site Components

A comparison of the faunal remains from 14 of the 47 individual sites listed in Tables 8 through 12 is presented in Table 13 (also see Chapter 7). Only selected mammalian species were included in the table; thus, carnivores such as bobcats, coyotes, and foxes are excluded, as such animals are not typically viewed as subsistence resources. As there were so few reptiles, amphibians, and birds among the study sites, they are presented as "all taxa," and reptiles were combined with amphibians. Rodents were combined as "all

Table 13. Comparison of Vertebrate Faunal Remains from Selected Site Components[a]

	Gypsum		Rose Spring		Rose Spring/ Late Prehistoric		Late Prehistoric	
	NISP[b]	%[c]	NISP	%	NISP	%	NISP	%
Artiodactyla	33	0.63	35	0.20	22	0.07	95	1.47
Bighorn sheep/sheep	--	--	--	--	7	0.02	--	--
Deer/deer-sized	--	--	--	--	226	0.70	1,148	17.7
Pronghorn	--	--	--	--	--	--	11	0.17
Jackrabbit	963	18.4	2,302	12.4	6,686	20.5	1,630	25.2
Cottontail/brush	35	0.67	114	0.62	127	0.40	45	0.70
Lagomorph/Leporid	821	15.7	296	1.60	5	0.01	333	5.14
Rabbit-sized	11	0.21	--	--	23,509	72.0	2,603	40.2
Rodents (all taxa)	88	1.70	186	1.00	1,488	4.56	125	1.93
Birds (all taxa)	14	0.27	3	0.01	66	0.20	17	0.26
Reptiles/amphibians	67	1.30	20	0.11	512	1.57	11	0.17
Small mammal	2,856	54.5	14,728	79.6	--	--	147	2.27
Small/med. mammal	--	--	304	1.64	--	--	--	--
Medium mammal	174	3.32	264	1.43	--	--	113	1.74
Large mammal	176	3.36	251	1.36	--	--	203	3.13
Total	5,238	--	18,503	--	32,648	--	6,481	--

[a] Table includes 14 study sites; Gypsum Period components (CA-KER-526, CA-KER-2218, and CA-SBR-6580); Rose Spring Period components (CA-KER-250, -533, -2567, -2450, and -6106); Rose Spring/Late Prehistoric period components (CA-KER-1998 and -2211); Late Prehistoric Period components (CA-KER-261, CA-KER-733, CA-KER-2210, and CA-SBR-1913). It should be noted that the majority of the faunal remains from the Gypsum Period components come from a single site, CA-KER-526. The faunal remains from CA-KER-6106 represent a sample of 11,564 from a total of 20,317 specimens (Williams 2004).
[b] Number of identified specimens of selected taxa. Most of the small mammal remains were thought to be jackrabbit by the original investigators.
[c] Percent of NISP of selected taxa (within components).

taxa" for the sake of simplicity and because they were frequently taxonomically classified only as rodents. It should be noted that at all but two of the sites, number of identified specimens (NISP) was used as the measure of quantification, which tends to overestimate the actual abundance of a particular species (e.g., Marshall and Pilgram 1993).

The selection of sites for this table was determined based on whether (1) sufficient faunal remains were reported for the site; (2) the remains were adequately and appropriately quantified for comparative purposes; and (3) the site could be assigned to a time period. For the first criterion, 20 sites were excluded due to the absence (or virtual absence) of faunal remains. For the second criterion, 11 sites were excluded either

because inadequate or no quantification was provided (e.g., all of the Coso Locality sites, CA-INY-372, CA-KER-875), quantification was based solely on absence or presence (e.g., CA-INY-2284), or the measurement of quantification was MNI (minimum number of individuals) rather than NISP (e.g., CA-SBR-72).

In addition, the table excludes the Red Mountain District, as faunal remains have not yet been quantified at any of the sites; the Coso Volcanic Field, because faunal specimens were so rare and because the time periods employed by Gilreath and Hildebrandt (1997) were not always directly comparable; and Fort Irwin because it is out of the study area. Finally, of the two sites with both Gypsum and Rose Spring period components (CA-KER-5043 and CA-KER-6188), the latter had no quantification of faunal remains at the time of this study, leaving only a single site from that category with quantified remains. As that site had only 51 taxonomically identified specimens from a total of 2,829, it was deemed unnecessary to include a column for this one site.

Even considering that NISP can sometimes be misleading, a review of Table 13 shows that the combined lagomorph specimens (jackrabbit, cottontail rabbit, brush rabbit, lagomorph/Leporidae, rabbit-sized) indicate a dramatic rise in the exploitation of lagomorphs (particularly jackrabbits) between the Gypsum and Rose Spring/Late Prehistoric Period components, with a sharp decline in the Late Prehistoric Period components. Combined with the assumption that many of the small and medium mammal specimens from a number of study sites may represent jackrabbits—such as the argument made by McGuire et al. (1982) at the Bickel site where almost 5,000 small mammal remains were recovered—a strong case can be made that lagomorphs were less important resources during the Gypsum Period, became incredibly important by the Rose Spring/Late Prehistoric Period, and then began to decline in importance sometime during

the Late Prehistoric Period. Conversely, the argument could also be made that the importance of jackrabbits did not decrease, only the number of jackrabbits available for exploitation, perhaps as the result of changing climatic conditions (see Chapter 7 for further discussion of jackrabbits). Rodents showed a similar trend to that of jackrabbits, although their numbers were much smaller and some of the remains may not have represented cultural activity.

Artiodactyls demonstrate a different trend. Looking at the categories in Table 13 individually, Artiodactyla specimens are fairly evenly represented in the Gypsum, Rose Spring, and Rose Spring/Late Prehistoric period components, and then increase in the Late Prehistoric Period components. Bighorn sheep/sheep specimens appear only in the Rose Spring/Late Prehistoric components, and appear in only one site (CA-KER-2211). Pronghorn fragments are found only in Late Prehistoric Period components, with 10 of the 11 specimens deriving from a single site (CA-KER-733). The deer/deer-sized fragments show a somewhat stronger trend, in that they do not appear at all in the Gypsum and Rose Spring period components, and then increase more than fivefold between the Rose Spring/Late Prehistoric and Late Prehistoric components.

Figure 34 illustrates the distribution of all of the faunal remains listed in Table 13, and Figure 35 illustrates the distribution of artiodactyls and lagomorphs only (by NISP). Following Table 13, the "artiodactyl" category in Figure 34 includes the Artiodactyla, bighorn sheep/sheep, deer/deer-sized, pronghorn, and large mammal specimens (the latter of which most likely represents artiodactyls); the "lagomorph" category includes the jackrabbit, cottontail/brush rabbit, and lagomorph/Leporidae specimens; the "other mammals" category includes the rabbit-sized, rodents, small mammal, small/medium

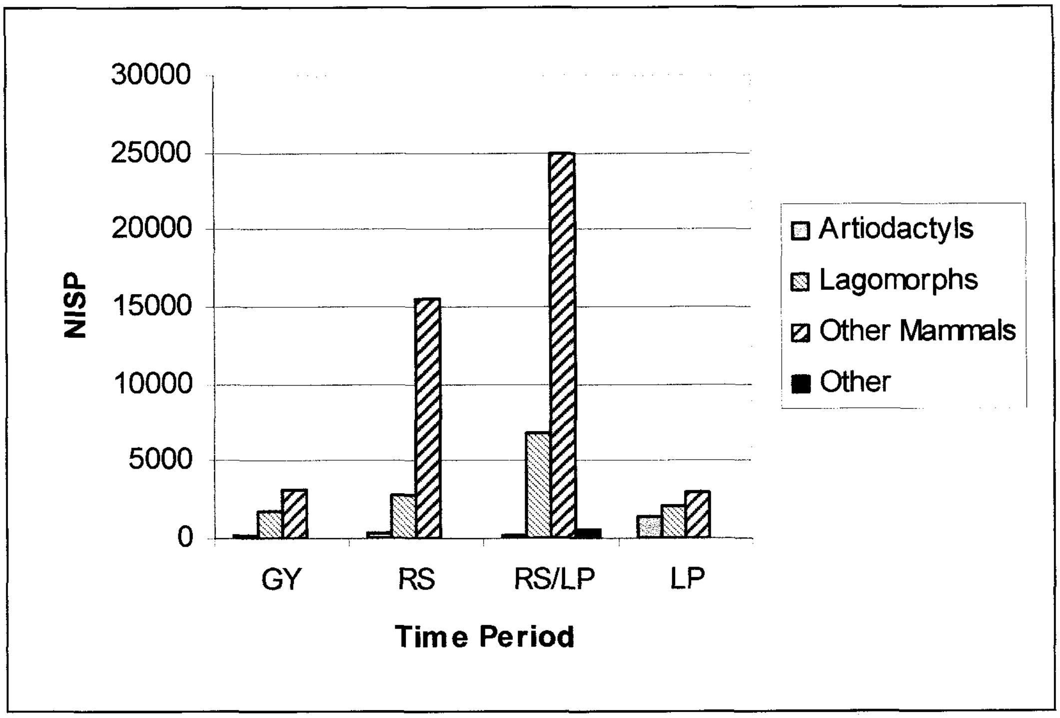

Figure 34. NISP through time of artiodactyl, lagomorph, other mammal, and other specimens tabulated in Table 13 (see text for explanation of taxonomic categories). GY = Gypsum; RS = Rose Spring; RS/LP = Rose Spring/Late Prehistoric; LP = Late Prehistoric.

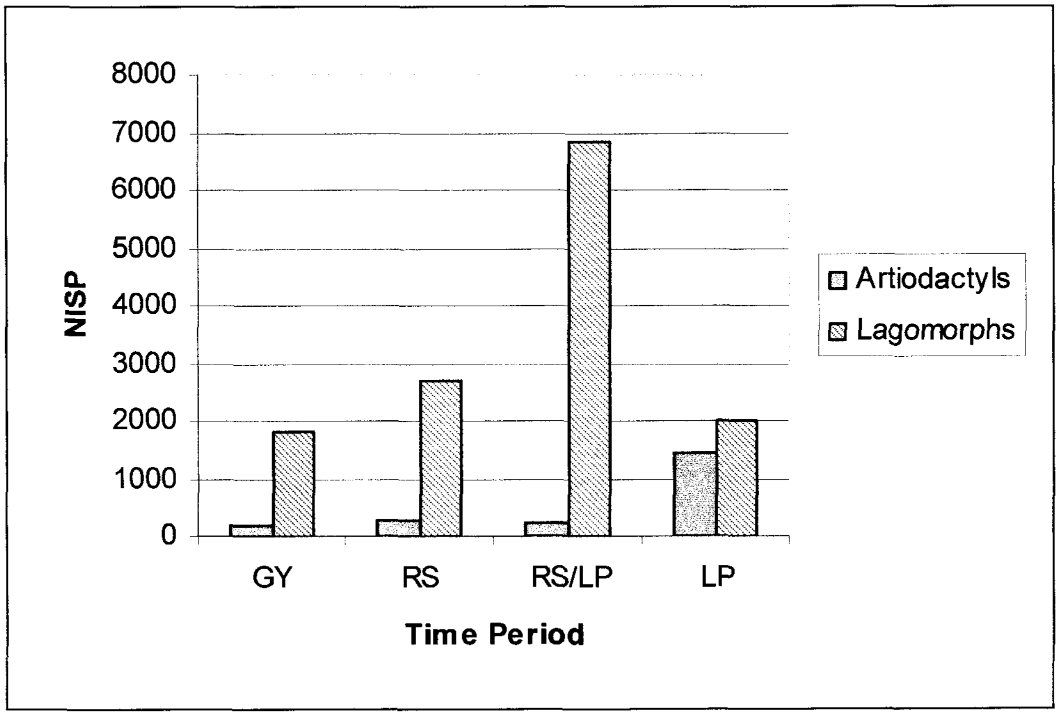

Figure 35. NISP through time of artiodactyl and lagomorph specimens tabulated in Table 13 (see text for explanation of taxonomic categories). GY = Gypsum; RS = Rose Spring; RS/LP = Rose Spring/Late Prehistoric; LP = Late Prehistoric.

mammal, and medium mammal specimens; and the "other" category includes the bird and reptile/amphibian specimens.

It should be reiterated here that NISP can often be inflated, and the "other mammals" category is probably misleading. Nevertheless, if we look only at the distribution of artiodactyls and lagomorphs through time, there is a steady increase in lagomorphs from the Gypsum Period through the Rose Spring/Late Prehistoric Period, followed by a decrease back to roughly what it was during the Gypsum Period. This pattern is even more obvious in Figure 35, which demonstrates that the peak of lagomorph use was during the Rose Spring/Late Prehistoric Period.

There are some potential biases in this comparison. First, the bulk of the faunal remains in the combined Rose Spring/Late Prehistoric period components was derived from a single site (CA-KER-2211; Sutton 1991b). Second, although the faunal analyses for Rose Spring (Yohe 1992) and Koehn Lake (Sutton 1990) have not been completed, both are known to consist of more than 100,000 elements, the majority of which are probably lagomorphs (as appears to be demonstrated by the ongoing faunal analyses of these two sites); however, they also contain many species that were found in other study sites. Although it is possible that a different subsistence picture may emerge when the faunal data from the Rose Spring and Koehn Lake sites become available, from what is currently known about the faunal remains from these two sites, it is more likely that they will support the existing data.

Another consideration in this analysis of the faunal remains is the question of bone identifiability. Due to the extreme fragmentation of many of the elements in the study site faunal assemblages, the number of identified specimens (NISP) among the total number of specimens (NSP) was often quite low. This is related to many factors,

including site formation processes (e.g., Schiffer 1987), differential breakage (e.g., Grayson 1991), and processing technique (e.g., Valdez 2000; Yohe 1996b). Such factors can introduce significant bias into the analysis of faunal assemblages from archaeological contexts.

As the majority of the faunal remains in this study was deemed to be culturally derived, one of the issues to be addressed is whether we can distinguish processing techniques by examining the ratio between NSP and NISP (e.g., Grayson 1991). Table 14 shows the results of that examination (the lower the NSP/NISP ratio, the higher the rate of identification). The results of Table 14 demonstrate that CA-KER-1998, CA-KER-2211, and CA-SBR-1913 had the highest rates of identification (ratio less than 2.0), while CA-KER-5043, CA-KER-2450, CA-SBR-176, and CA-SBR-189 had the lowest rates of identification (ratio greater than or equal to 17.0). One of the potential implications of these results is that different processing techniques were being used among these selected study sites; in other words, the sites with high identification rates suggest that less processing occurred, while sites with low identification rates indicate much greater processing.

This difference in the degree of processing may relate to site function, duration of site occupation, nutritional requirements, and/or other factors. For site function or duration of site occupation, for example, if the site is a quarry locale with the acquisition of quality toolstone the main priority, heavy processing of food items at that location would not usually be necessary or even desired. In the example of nutritional requirements, if the extraction of bone marrow is the goal, by necessity the bones must be pulverized (e.g., Binford 1981). Conversely, if the goal is the overall meat "package," roasting or other techniques less destructive to the bones might be preferable. Yohe (1996b:62) noted that

Table 14. NSP/NISP for Selected Faunal Assemblages in the Study Area[a]

Site	NSP	NISP	NSP/NISP
CA-INY-372 (Rose Spring)[b]	1,900	164	11.6
CA-KER-250 (Bickel)[c]	6,211	972	6.4
CA-KER-261 (Last Chance)	176	26	6.8
CA-KER-526 (Rogers Lake)	14,374	1,902	7.6
CA-KER-733	8,649	1353	6.4
CA-KER-1998 (Oak Creek)	1,627	1515	1.1
CA-KER-2210 (Cantil)	143	27	5.3
CA-KER-2211 (Cantil)	31,198	31,181	1.0
CA-KER-2218 (Cantil)	205	36	5.7
CA-KER-5043 (Coffee Break)	2,829	54	52.4
CA-KER-6106 (Freeman Spring)[b]	11,564	1,854	6.2
CA-KER-2450 (Rosamond)	305	14	21.8
CA-KER-2567 (Rosamond)	413	84	4.9
CA-KER-2569 (Rosamond)	62	29	2.1
CA-KER-2570 (Rosamond)	151	41	3.7
CA-SBR-176 (Deep Creek)	306	18	17.0
CA-SBR-189 (Hinkley)	2,206	126	17.5
CA-SBR-1913 (*Guapiabit*)	4,222	4,211	1.0
CA-SBR-6580 (Siphon)	314	83	3.8

[a] NSP = total number of specimens; NISP = total number of identified specimens. Some sites with faunal remains were eliminated because they were either not quantified or used a different quantification method (i.e.., MNI, presence/absence, weight). Others were eliminated if they had less than 10 specimens. All other faunal remains identified to at least the order level are included in this table. Those specimens identified only as small, medium, or large mammal are not included; the specimens identified as rabbit-sized, rodent-sized, deer-sized, etc., are included as they were considered to be identified to order level (for the purposes of this study, not necessarily by the original investigators). Therefore, the NISP for CA-KER-2211 includes the majority of remains that were identified as rabbit-sized.

[b] The NSP for these two sites is based on a sample of the total assemblage for each site. Particularly for the Rose Spring site, the results could be misleading as the sample was derived from one of the smaller loci of the site, and no additional faunal analysis had been conducted at the time of this study.

[c] The remaining approximately 5,000 faunal elements were considered to represent mostly lagomorphs, but could not be definitively identified.

the Serrano were known to boil large mammal bones for the purpose of extracting bone grease, protein, and marrow. Breaking the bones into smaller pieces would have facilitated this process and maximized nutrient extraction (Yohe 1996b:62).

The fragmentation of many of the bones from the study sites could also be the result of grinding these animals with milling equipment (Yohe 1996b:63). For example, Henrikson et al. (1998) noted the presence of phyllopods (freshwater crustaceans) in the northern Great Basin and the Mojave Desert, although archaeological and ethnographic evidence is meager regarding the use of these resources as food items. The lack of

archaeological evidence of these resources is at least partly due to the unlikelihood of their preservation and/or their collection through 1/8-in. mesh (Henrikson et al. 1998:76). Alternatively, phyllopods could have been consumed whole or heavily processed with ground stone implements for drying and storage. Henrikson et al. (1998:82) observed that this was partially borne out in their study through the use of protein residue analysis, which tested positive for *Lepidurus* (tadpole shrimp) on some of their ground stone artifacts from a number of sites in the northern Great Basin.

In terms of the condition of rodent remains in the study area, while there is some archaeological and ethnographic evidence that rodents may have been a relatively significant component of the diets of native peoples in the Mojave Desert, they are difficult to adequately quantify due to their usually substantial fragmentation, often precluding differentiation between species. It may be that rodents were consumed whole or were so highly processed that their dietary contribution is obscured. There may have even been a preference for certain rodents over others, although the problem of species identification would suppress that potential preference.

Large mammal bone is also vulnerable to heavy processing (e.g., Binford 1978). Among the Nunamiut of the Arctic, for example, it was not unusual to crack sheep and caribou bones to remove the bone juice and marrow, to the point that they would be "pulverized beyond recognition" (Binford 1978:163-164). Thus, the scarcity of artiodactyl remains in the faunal assemblages of the study sites may be more apparent than real in the archaeological record of the western Mojave Desert; in other words, they may simply have been so heavily processed that they are no longer recognizable. It is likely, in fact, that many of the fragments from the study sites that were identified only as large mammal are artiodactyl remains.

This level of processing may be more essential in a marginal environment, such as the Arctic or the Mojave Desert, where people would want to get the most out of their resources, particularly during times of environmental stress. Nevertheless, since the vast majority of the faunal remains (nearly 80%) were identified as jackrabbit, lagomorph/ Leporidae, rabbit-sized, or cottontail/brush rabbit (see Table 13), it is not likely that the apparent focus on lagomorphs at many of the study sites is due merely to chance or processing technique. Therefore, the issue of identifiability of the faunal remains in this study does not seem to greatly affect the outcome of this analysis to any substantial degree.

Summary of Botanical Remains

Despite the number of archaeological investigations conducted in the western Mojave Desert, botanical remains are rarely encountered in any significant quantities. This is likely due, at least in part, to poor preservation of such remains. To compound the problem, of the study sites that contained botanical remains, few of the site reports provided detailed descriptions or analyses of these remains. The following is a discussion of the available data on botanical remains from selected study sites (also see Appendix A and Chapter 7).

Botanical Remains from Gypsum Period Components

Botanical remains (mostly in the form of pollen) from the Siphon site (CA-SBR-6580) were quite diverse, although several were not considered to be associated with human occupation of the site. Some of the remains that were considered part of the site activities included juniper (*Juniperus californica*), amaranth (*Amaranthus* sp.), prickly poppy (*Argemone* sp.), water-hemlock (*Cicuta douglasii*), chamise (*Adenostoma* sp.),

creosote (*Larrea* sp.), fir (*Abies* sp.), alder (*Alnus* sp.), hickory/pecan (*Carya* sp.), walnut (*Juglans* sp.), pine (*Pinus* sp.), oak (*Quercus* sp.), willow (*Salix* sp.), elm (*Ulmus* sp.), wild buckwheat (*Eriogonum* sp.), Cheno-ams, Cruciferae (mustard family), and Gramineae (Scott Cummings 1993:87; Sutton et al. 1993).

From the small Gypsum Period component of the Rose Spring site (CA-INY-372; Yohe 1992), the pollen record demonstrated the presence of high-spine Asteraceae, Cheno-ams, sagebrush (*Artemisia* sp.), and low-spine Asteraceae. Pine and juniper pollens were also represented, but were likely deposited at the site via long-distance wind transport (Scott Cummings 2000; Yohe and Scott Cummings 2000). The remaining botanical remains from Rose Spring are discussed below.

The pollen analysis at CA-KER-526 demonstrated the presence of a number of species, including pine (*Pinus* sp.), Cupressaceae (including juniper), ash (*Faxinus* sp.), oak (*Quercus* sp.), wolfberry (*Lycium* sp.), Mormon tea (*Ephedra* sp.), bursage/ragweed (*Ambrosia* sp.), buckwheat (*Eriogonum* sp.), sunflower family (Compositae), grass family (Gramineae), Cheno-ams, and pea/bean family (Leguminosae) (Smith and Anderson 1994:129). Although some of these specimens may not represent cultural activity, exploitation of the sunflower family and the Cheno-ams has been documented ethnographically (Smith and Anderson 1994:128).

While CA-KER-246 contained cheese brush (*Hymenoclea salsola*), Joshua tree (*Yucca brevifolia*), fiddleneck (*Amsinckia*), rabbit brush (*Chrysothamnus*), cactus (e.g., *Opuntia*), Indian rice grass (*Achnatherum hymenoides*), buckwheat (*Eriogonum*), and saltbush (*Atriplex*), they all appeared to be intrusive and thus unrelated to prehistoric occupation of the site (Harvey and Gardner 2002:53-54). No botanical remains were recovered from any of the other Gypsum Period study sites.

Botanical Remains from Rose Spring Period Components

Of the nine Rose Spring Period site components, six contained botanical remains, in very low quantities. Juniper (*Juniperus* sp.) was recovered from CA-KER-2567 (n = 1) and CA-KER-875 (unknown quantity), while pine (*Pinus sabineana*; n = 12) was found at CA-KER-250. One yucca (*Yucca* sp.) specimen came from CA-KER-6106. At CA-KER-533, two specimens of what was referred to as "saltbush type" (Klug and Popper 1994:128) was recovered. Burned resin from CA-KER-2450 was tentatively identified as mesquite.

Botanical Remains from Late Prehistoric Period Components

Four of the Late Prehistoric Period sites had botanical remains (CA-KER-261, CA-KER-733, CA-SBR-176, and CA-SBR-1913). At CA-KER-261, one fragment of burned creosote (*Larrea tridentata*) was recovered (McGuire et al. 1982), while burned juniper (*Juniperus* sp.) berries and a single burned juniper seed were retrieved at CA-KER-733 (Sutton 1984). The juniper specimens were thought to have represented firewood rather than food (Sutton 1984:44).

At Deep Creek (CA-SBR-176; Altschul et al. 1989), pollen analyses yielded very small quantities of alder (*Alnus* sp.), oak (*Quercus* sp.), pine (*Pinus* sp.), willow (*Salix* sp.), sagebrush (*Artemisia* sp.), and ambrosia (Ambrosiaceae). The remains of corn, acorn, ambrosia, and possibly squash were documented during the macroscopic analysis (Altschul et al. 1989:74). The pollen analysis from *Guapiabit* (CA-SBR-1913; Sutton and Schneider 1996) identified alder, juniper, pine, oak, willow, Cheno-ams, Caryophyllaceae, and various Compositae (Scott Cummings 1996). The macrobotanical assemblage included remains of juniper (*Juniperus* sp.), saltbush (*Atriplex* sp.), and amaranth (*Amaranthus* sp.), the latter two thought to be intrusive.

Botanical Remains from Multiple Component Sites

Botanical evidence from the multiple component Rose Spring/Late Prehistoric Period components comes from 11 of the 12 sites in this category, although the remains were not always quantified adequately for the purposes of this study. From the Coso Locality sites collectively, species represented include soap plant (*Chenopodium californicum*), pinyon hulls, grass seed, and Joshua seeds (Hillebrand 1972:78-79). The Oak Creek Canyon site (CA-KER-1998) contained horehound (*Marrubium vulgare*), red-stem filaree (*Erodium cicutarium*), buckwheat (*Eriogonum* sp.), and juniper (*Juniperus* cf. *californica*) (Sutton and Everson 1992:48, 58). The filaree and horehound are introduced species and were not considered to be part of the prehistoric site occupation.

From CA-KER-2211, juniper seeds primarily associated with the structure (see Chapter 5) were recovered, although juniper was scattered throughout the midden (Sutton 1991b). Juniper seeds were also identified at Cross Mountain (CA-KER-4619), but it was unclear whether these specimens were associated with human occupation of the site (Gardner et al. 1996, 1997). At the Oro Grande site (CA-SBR-72; Rector et al. 1983), the greatest quantities of botanical remains were identified as Indian rice grass (*Oryzopsis* cf. *hymenoides*), filaree (*Erodium* cf. *cicutarium*), California poppy (*Eschscholzia californica*), and juniper (*Juniperus californica*), but also included small quantities of St. John's wort (*Hypericum* sp.), sedge/nut grass (*Cyperus* sp.), locoweed (*Astragalus* sp.), goosefoot (*Chenopodium* cf. *album*), Poaceae (*Festuca* sp., *Avena* sp., *Crypsis* sp.), bulrush (*Scirpus microcarpus*), buckwheat (*Eriogonum* sp.), and oak (*Quercus* cf. *lobata*).

The pollen analysis from the Rose Spring site (CA-INY-372) revealed the presence of Asteraceae (e.g., rabbit brush [*Chrysothamnus* spp.], desert aster [*Aster* sp.]), pin-cushion [*Chaenactis santolinoides*], Cheno-ams (e.g., saltbush [*Atriplex* sp.], hop-sage [*Grayia*

spinosa]), alder (*Alnus* sp), mesquite (*Prosopis* sp.), oak (*Quercus* sp.), creosote (*Larrea* sp.), Mormon tea (*Ephedra* sp.), cactus (*Opuntia* sp.), pine (*Pinus* sp.), juniper (*Juniperus* sp.), and various grasses (*Poaceae*) (Yohe and Scott Cummings 2000; Scott Cummings 2000). Despite the variety of species present in the pollen samples, however, some were considered to be natural pollen rain and not related to the site occupation (Yohe and Scott Cummings 2000:6).

At Coso Junction Ranch (CA-INY-2284), botanical remains consisted of mallow (*Malva* sp.), fiddleneck (*Amsinckia* sp.), wild buckwheat (*Eriogonum* sp.), wire grass (*Juncus* sp.), beard tongue (*Penstemon* sp.), Asteraceae (sunflower family), Brassicaceae (mustard family), Chenopodiaceae (goosefoot family), Laminaceae (mint family), Poaceae (grass family), and Solanaceae (nightshade family) (Gumerman 1985). Three species were identified at the Coffee Break Site (CA-KER-5043), including Asteraceae, saltbush (*Atriplex* sp.), and creosote (*Larrea tridentata*). Most of these remains were derived from a feature identified an ash pit that returned radiocarbon dates indicating a possible Gypsum Period occupation (Gardner 2002:66) and are likely unrelated to the predominant Rose Spring Period occupation of the site.

<u>Comparison of Botanical Remains from Selected Site Components</u>

It should be noted that much of the botanical evidence was derived from sites at the extreme southeast margin of the study area (CA-SBR-72, -176, -6580, and -1913); as a matter of fact, they are technically outside the boundaries of the western Mojave Desert. As such, while it is tempting to extrapolate the diversity of botanical remains from these four sites to the rest of the western Mojave Desert, it is important to note that all four are in close proximity to two mountain ranges (the San Gabriel and San Bernardino ranges) and adjacent to the Mojave River. As a result of this difference in environmental zones,

the botanical evidence from these sites may not be entirely relevant to the rest of the study area. In other words, these four sites are the least "desert" of the desert sites discussed here.

With that caveat, some potential trends can be seen in Table 15. For example, juniper and pine never fall out of the record entirely between the Gypsum and Late Prehistoric period components, although their abundance between components was not always made clear in the site reports. Some species in Table 15 only appear within a single column, including: fir, elm, prickly poppy, water-hemlock, hickory/pecan, and walnut from Gypsum Period components; mallow, wire grass, yucca, cactus, mesquite, and fiddleneck from Rose Spring Period components; and California poppy, Indian rice grass, soap plant, St. John's wort, sedge/nut grass, fescue, and bulrush from combined Rose Spring/Late Prehistoric period components. Whether these apparent trends are culturally significant or a function of sample bias is unclear (see Chapter 7 for further discussion of the botanical evidence from the study sites).

An Ecological Approach for the Data Set

Although the faunal assemblages from the study sites provide some basis for comparison and analysis within an ecological framework, the botanical assemblages are sorely lacking for such interpretations. Even the faunal remains are somewhat problematic in that heavy processing seems to have been quite common, thereby creating difficulties in taxonomic identifications. Nevertheless, an attempt is made here to relate the subsistence data from the study sites to an ecological approach, as discussed in Chapter 1. As those data were determined to be inadequate for a true behavioral ecological (BE) approach, the following is not strictly based on BE; however, some of the

Table 15. Botanical Species from Selected Site Components[a]

	GY	RS	RS/LP	LP	GY/RS/LP
Macrobotanical					
Juniper	+	+	+	+	+
Pine	–	–	+	+	+
Amaranth	+	–	–	+	–
Prickly poppy	+	–	–	–	+
California poppy	–	–	+	–	+
Water-hemlock	+	–	–	–	–
Mallow	–	+	–	–	+
Chamise	+	–	–	–	–
Creosote	+	–	–	+	–
Wild buckwheat	+	+	+	+	+
Wire grass	–	+	–	–	+
Saltbush	+	+	–	+	–
Indian rice grass	+	+	+	–	+
Yucca	+	+	–	–	–
Fiddleneck	–	+	–	–	–
Soap plant	–	–	–	–	+
St. John's wort	–	–	–	–	+
Sedge/nut grass	–	–	–	–	+
Fescue	–	–	–	–	+
Bulrush	–	–	–	–	+
Pollen					
Juniper	+	–	–	+	+
Pine	+	–	–	+	+
Fir	+	–	–	–	–
Alder	+	–	–	+	+
Oak	+	–	–	+	+
Elm	+	–	–	–	–
Willow	+	–	–	+	–
Amaranth	+	–	–	–	–
Creosote	–	–	–	–	+
Sagebrush	+	–	–	+	–
Saltbush	+	–	–	–	–
Hickory/pecan	+	–	–	–	–
Walnut	+	–	–	–	–
Cactus	+	–	–	–	+
Mesquite	–	–	–	–	–
Mormon tea	+	–	–	–	–

[a]Present (+) or absent (–). Component designations: GY = Gypsum; RS = Rose Spring; RS/LP = Rose Spring/Late Prehistoric; LP = Late Prehistoric; GY/RS/LP = Gypsum/Rose Spring/Late Prehistoric. Table includes only those specimens that were identified to genus and/or species (see text for Latin names). It excludes the two multicomponent Gypsum/Rose Spring sites as only one (CA-KER-5043) had any botanical remains, and those were very minimal. The botanical data in this table were derived from the Coso Locality sites, CA-INY-372, CA-INY-2284, CA-KER-526, CA-KER-733, CA-KER-1998, CA-KER-2211, CA-SBR-72, CA-SBR-176, CA-SBR-1913, and CA-SBR-6580. The vast majority of the macrobotanical specimens was charred, with the exception of the Amaranth, water hemlock, and yucca. None of the sites in the Rose Spring and Rose Spring/Late Prehistoric categories had pollen analyses performed.

concepts of BE were borrowed and placed in a cultural ecological context in order to address some of the patterns observed in the faunal and botanical data.

In models of diet breadth, hunter-gatherers must deal with issues such as resource abundance, the amount of energy produced per resource, the amount of energy needed to acquire the energy from that item, and the amount of time needed to acquire that energy once the resource has been selected (Bettinger 1991:84). Thus, the key is to choose the resource with "the highest rate of return per unit of extraction time" (Bettinger 1991:85). In the event of the scarcity of preferred resources, however, it may be necessary to exploit less preferred resources as well. In that case, it is assumed that the combination of resources that includes those of highest and second highest rates of return would be exploited, with the most preferred resource always being exploited even when that item is rarely encountered (Bettinger 1991:85; also see Hawkes and O'Connell 1992; Kelly 1995; Zeanah et al. 1995). As Bettinger (1991:87) noted, the abundance of a resource is not relevant to whether it is included in the diet; rather, it "depends entirely upon the abundance of all more highly ranked resources relative to their energetic yield."

Moreover, resources with high rates of return will always be preferred over those with lower return rates regardless of their abundance; in other words, they will never drop out of the diet (Hawkes and O'Connell 1992). For example, Kelly (1995:87) pointed out that mice have probably never been preferred resources for hunter-gatherers because despite their sheer abundance over larger animals, their return rate is so low that it is not efficient to exploit them. Therefore, the availability of higher ranked resources will result in the elimination of low-ranked resources from the diet, even if they are more abundant (Hawkes et al. 1982; Kelly 1995:87).

In prey models, prey body size is of primary concern (Byers et al. 2005:129; also see Simms 1987). Prey body size is the most obvious characteristic in terms of ranking; that is, large animals almost always have higher return rates. Thus, when large game animals are available, they will always be hunted, while smaller game will often be ignored (Byers et al. 2005:129). In short, "foraging theory predicts that diet breadth should expand and the efficiency of resource exploitation should decline as the encounter rates of high-ranked prey types decrease" (Broughton 1999:11). This situation can be the result of a number of factors, including resource depression as the result of environmental change.

Among the study sites, while their remains are scarce, artiodactyls—thought to have been a high-ranked resource during the Gypsum Period (e.g., Yohe and Sutton 1999)—never totally drop out of the subsistence regime. Conversely, lagomorphs (combining the columns for jackrabbit, cottontail/brush rabbit, Lagomorph/Leporidae, and rabbit-sized), which may have been ranked lower than artiodactyls, increase somewhat between the Gypsum and Rose Spring period components, increase dramatically between the Rose Spring and Rose Spring/Late Prehistoric period components, and then decrease just as dramatically in the Late Prehistoric Period components (this remains true even if the rabbit-sized category is eliminated from the count). This may indicate that artiodactyls became so rarely encountered toward the end of the Rose Spring Period that lagomorphs—presumed to have been the resource with the second highest rate of return—began to be heavily exploited. Artiodactyls increase in NISP slightly during the Late Prehistoric Period, at which time lagomorphs take a steep decline (see Table 13). This would be expected if the availability of artiodactyls increased, as it is assumed that it was the higher ranked resource, resulting in less frequent exploitation of the secondary resource.

In their study of grasshoppers at Lakeside Cave in northwestern Utah, Madsen and Schmitt (1998:446; also see Madsen and Kirkman 1988; Jones and Madsen 1989) generated a prey model that at first glance seems to contradict the principles of this model. While agreeing with the principle that higher ranked prey types will be included in the diet whenever possible, they noted that the abundance of higher ranked types may decrease to the point where it is more efficacious to obtain prey types with lower return rates (Madsen and Schmitt 1998:446). On this basis, their version of the prey model suggests that mass collection of particular resources may be more efficient. According to Madsen and Schmitt (1998:446), mass collecting violates a number of assumptions of the prey model; that a prey type is either always taken or always ignored upon encounter, that searching and handling are separate activities, and that prey encounter is sequential. In mass collecting, however, if an array of resources (e.g., a swarm of grasshoppers) is considered an individual prey item, the model is not violated (Madsen and Schmitt 1998:446). When mass collecting becomes the goal, then, those resources would theoretically become higher ranked prey types (Madsen and Schmitt 1998:447).

Although Madsen and Schmitt (1998) were using grasshoppers as the analytical unit in their study, their notion of the mass collection feature of the prey model could also be applied to the study area in terms of the relative abundance and ranking of artiodactyls and lagomorphs. As noted above, body size is often used by archaeologists as a measure of return rate and ranking of particular prey. Obviously, a single lagomorph is much smaller in size than even the smallest artiodactyl; however, if lagomorphs are caught en masse, their combined body size could easily dwarf that of an artiodactyl. As such, lagomorphs could be considered a resource "patch." As Madsen and Schmitt (1998:448) noted, when a group (or a patch) is the intended target, "it is the biomass of that part of

the group caught simultaneously in the net, weir or snare set that is the comparative unit, not the body size of individual components."

The mass collection of lagomorphs (or any single resource) runs counter to the notion that faunal assemblages dominated by large mammals are indicative of a higher level of predation efficiency than those assemblages with smaller mammals (e.g., Grayson 1991; Broughton 1994a; Broughton and Grayson 1993). In situations where mass collecting takes place, faunal assemblages would contain predominantly smaller animals and, in fact, such scenarios "may well involve more *efficient* predation" (Madsen and Schmitt 1998:448; emphasis in original). In some cases, the hunting of high ranked large game may even have been secondary to the mass collection of lower ranked lagomorphs, depending on the abundance of the latter.

This certainly seems to be the case at several of the study sites, including CA-KER-250 (McGuire et al. 1982); CA-KER-526 (Byrd et al. 1994), CA-KER-733 (Sutton 1984), CA-KER-6106 (Williams 2004), CA-KER-2211 (Sutton 1991b). It is probably also true for CA-INY-372 (Rose Spring; Yohe 1992) and CA-KER-875 (Koehn Lake; Sutton 1990; 1991a), although the faunal analyses are incomplete for these two sites. In other words, during times of abundant lagomorph availability, aboriginal populations may have focused on "patches" of lagomorphs, significantly increasing their rank and return rate over that of large mammals (see Madsen and Schmitt 1998:451).

Technology is another aspect of the cultural ecological approach, as technological changes can affect the success of the search and pursuit of game (Hames and Vickers 1982:368-369). Two factors are involved in technological change; first, new technology must be more efficient if it is to replace the old one, and second, new technology is often adopted due to depletion of a particular resource or to more effectively exploit previously

unused resources (Hames and Vickers 1982:369). This could account for the florescence of the bow and arrow in the study area. As artiodactyl populations decreased at the end of the Gypsum Period, it may have become necessary to maximize efforts to hunt them through the use of a technology that was more efficient than spears or atlatls and darts. As such, the way technology influences diet breadth "depends on the distribution of game types and how technology articulates with each type" (Hames and Vickers 1982:370).

In terms of the botanical resources from the study sites, Simms (1987:16-17) proposed a similar scenario for various plants, wherein he argued that in the Great Basin pine nuts were highly ranked resources and would be expected to be taken in lieu of most other plant resources. Further, he maintained that pine nuts may have been even more valuable than energy models would dictate due to their storability (Simms 1987:79; also see Rhode and Madsen [1998] for a discussion of pine nut usage and foraging theory at Danger Cave). He further observed that the collection of low-ranked seeds "may be as much or more a function of banking for the winter as it is an expansion of the diet for immediate needs" (Simms 1987:79). This has the additional effect of "temporarily enduring a lesser daily return rate during parts of the year to prepare for the winter" (Simms 1987:83; underline in original). Regardless of the ranking of botanical resources, however, Simms (1987:83) noted that low ranked seeds would only be taken when animal resources were very low.

For the study sites, the generally small quantities of seeds suggest that they were unimportant (and thus perhaps low ranked) resources. There are a number of problems with this assumption, however. The first is that botanical remains rarely preserve unless they have been carbonized, so they would not be available to collect from archaeological contexts if they were not cooked in some way. The second is that even if they do

preserve, botanical remains are often either overlooked and/or considered noncultural by archaeological investigators. Third, and possibly most important, the fact that so few botanical remains were recovered from most of the study sites is contrary to the evidence for milling activities in the form of ground stone tools that were abundant at a number of sites, particularly manos and metates (see Chapter 7).

It is much more likely that various plant resources went into and out of the diets of the prehistoric inhabitants of the western Mojave Desert, but those resources are largely invisible in the archaeological record. Such presumably low-ranked resources may have been considered "back-up" foods to more highly ranked resources (see Zeanah et al. 1995:318). This may be especially true during times of dietary stress, such as environmental fluctuations when high-ranked resources may have become scarce.

Comments

This chapter provided a detailed summary of the western Mojave Desert study sites discussed in detail in Chapter 5. This summary included discussions regarding site age, chronological considerations, site function, various artifact categories, evidence of trade, and faunal and botanical remains. In addition, an ecological approach was taken as a way of interpreting some of the information in the data set. In the following chapter, the implications of these data are provided.

Notes

1. The Coso Volcanic Field, Red Mountain, and Fort Irwin complexes are not included in Tables 8 through 12. For the Coso Volcanic Field (CVF), this is because only the Gilreath and Hildebrandt (1997) volume was used to draw upon discussions of these

sites (for the sake of simplicity), in which they offered their interpretations of the 34 excavated sites in their study rather than detailed site descriptions. Red Mountain is excluded because the full report is still in progress so details of the sites were not provided in the preliminary report (Allen 2003, 2004). The Fort Irwin complex of sites is excluded in the tables because it is not in the study area. Nevertheless, despite their exclusion from the tables, the radiocarbon dates and obsidian hydration rim values for the CVF and Red Mountain sites are provided in Tables 4 and 5, and relevant aspects of all three site complexes are discussed in this chapter and in Chapter 7.

2. Most of the study sites did not include calendar calibrations for the obsidian rim measurements. In my discussions with various authors, the reason usually stated is the problems with the calibration formulae, including the variety of factors that can affect the hydration rate of obsidian (such as effective hydration temperature; see Basgall 1990). Depending on the hydration rate that is employed, rim readings can produce ages that vary significantly (e.g., see Gardner 2002; Yohe 1992).

With that caveat in mind, the purpose of including Table 6 here is to provide rough age assignments for obsidian rim measurement ranges based primarily on the chronology in Gilreath and Hildebrandt (1997:64), as all but two of the obsidian specimens from the study sites were derived from the Coso Volcanic Field. Thus, this table should be viewed only as a general guideline rather than as absolute time frames.

In addition, marine shell beads (primarily *Olivella* sp.) are typically dated using the chronologies of Bennyhoff and Hughes (1987) for California and the western Great Basin and/or King (1990) for the California coast and the Channel Islands. The use of either of these two sources can be problematic for dating sites in the Mojave Desert, as neither of the chronologies relates specifically to this region. As such, shell beads are not included

in the dating criteria shown in Tables 8 through 12, although they are discussed in some detail in Chapter 5 for sites where shell beads were recovered.

3. Because many of the radiocarbon dates in the study area were uncorrected and/or uncalibrated, Figures 30, 31, and 32 are based on the raw radiocarbon dates from the study sites. Thus, in the absence of corrected and calibrated dates, the MCA time line could not be accurately depicted in those figures as it is shown in Figure 33.

CHAPTER 7

THE POTENTIAL IMPACT OF THE MCA IN THE WESTERN MOJAVE DESERT

It wouldn't be any fun if the solution to every problem were obvious.

Attributed to noted ethnographer Isabel Kelly
(as cited in Thomas 1998:24).

Introduction

Chapters 5 and 6 provided details about the archaeological data sets from which to determine the potential effects of the Medieval Climatic Anomaly (MCA) on human populations in the western Mojave Desert. Based on these data sets, the following is a discussion of a number of issues related to changes in subsistence, subsistence-related technology, settlement and population density, and the Numic expansion in the western Mojave Desert during the late Holocene, in order to explore whether such changes may have been related to the MCA. In the following chapter, these issues are then evaluated in relation to the research questions and data expectations outlined in Chapter 2. Figures 36 through 39 depict the general locations of the archaeological sites and site complexes that are discussed in this chapter, in order by time period.

Table 16 is a list of the study sites with radiocarbon dated components that date before (pre-1,200 B.P.), during (1,200 to 650 B.P.), and after (post-650 B.P.) the MCA, excluding sites that were dated solely by less precise means (i.e., obsidian hydration and/or artifact typology) and those with modern dates only. Although there appears to be a relatively

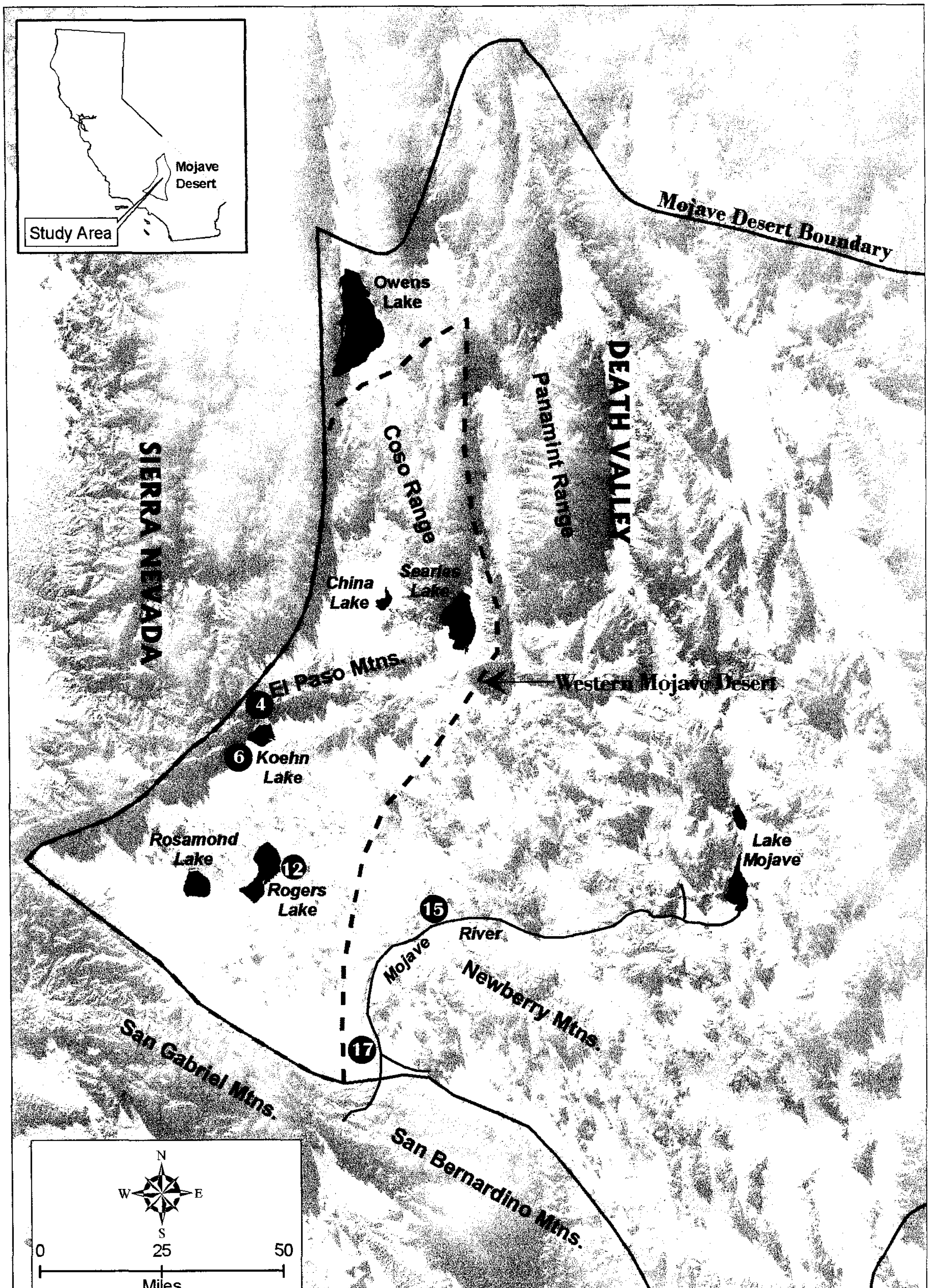

Figure 36. Map of Gypsum Period study sites (see Table 8). Numbers in the map correspond to the sites in Figure 7. No. 4 is CA-KER-246; No. 6 is CA-KER-2209, -2214, and -2218 (Cantil sites); No. 12 is CA-KER-526; No. 15 is CA-SBR-189; No. 17 is CA-SBR-6580.

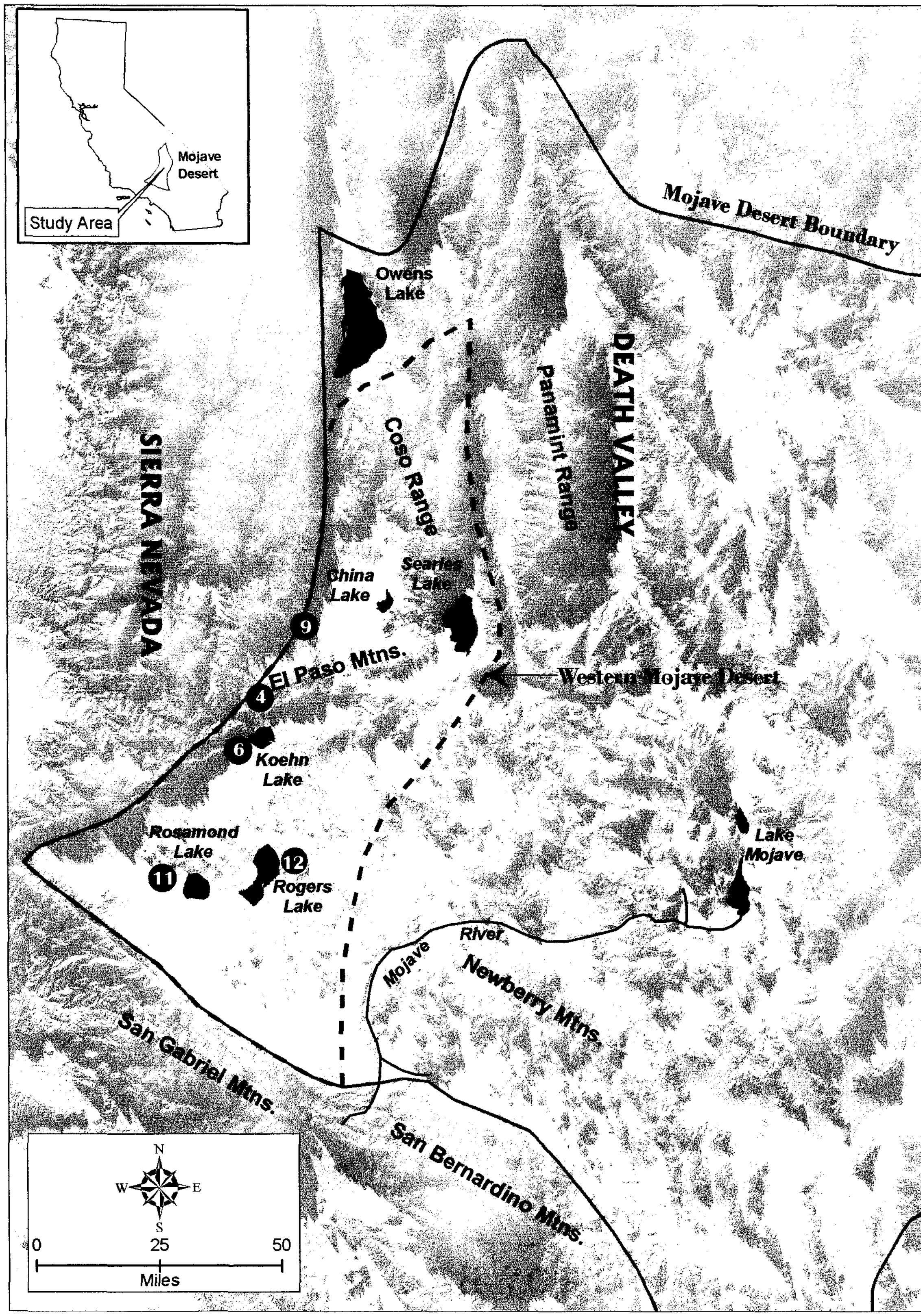

Figure 37. Map of Rose Spring Period study sites (see Table 9). Numbers in the map correspond to the sites in Figure 7. No. 4 is CA-KER-250; No. 6 is CA-KER-875 and -2215; No. 9 is CA-KER-6106; No. 11 is CA-KER-2450, -2567, -2768/H, and -2769; No. 12 is CA-KER-533.

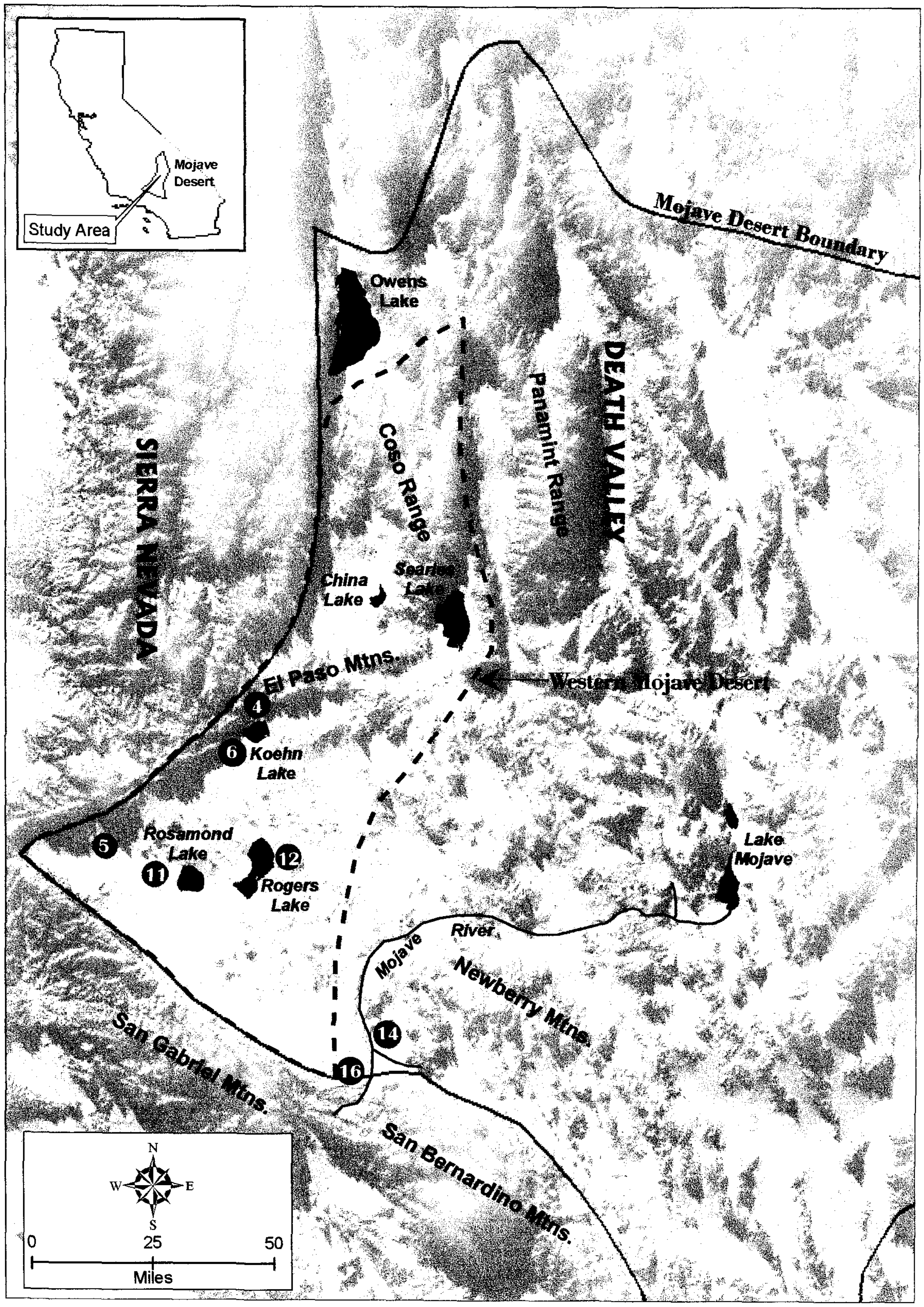

Figure 38. Map of Late Prehistoric Period study sites (see Table 10). Numbers in the map correspond to the sites in Figure 7. No. 4 is CA-KER-261; No. 5 is CA-KER-733; No. 6 is CA-KER-2210; No. 11 is CA-KER-520; No. 12 is CA-KER-1180 and -3377; No. 14 is CA-SBR-176; No. 16 is CA-SBR-1913.

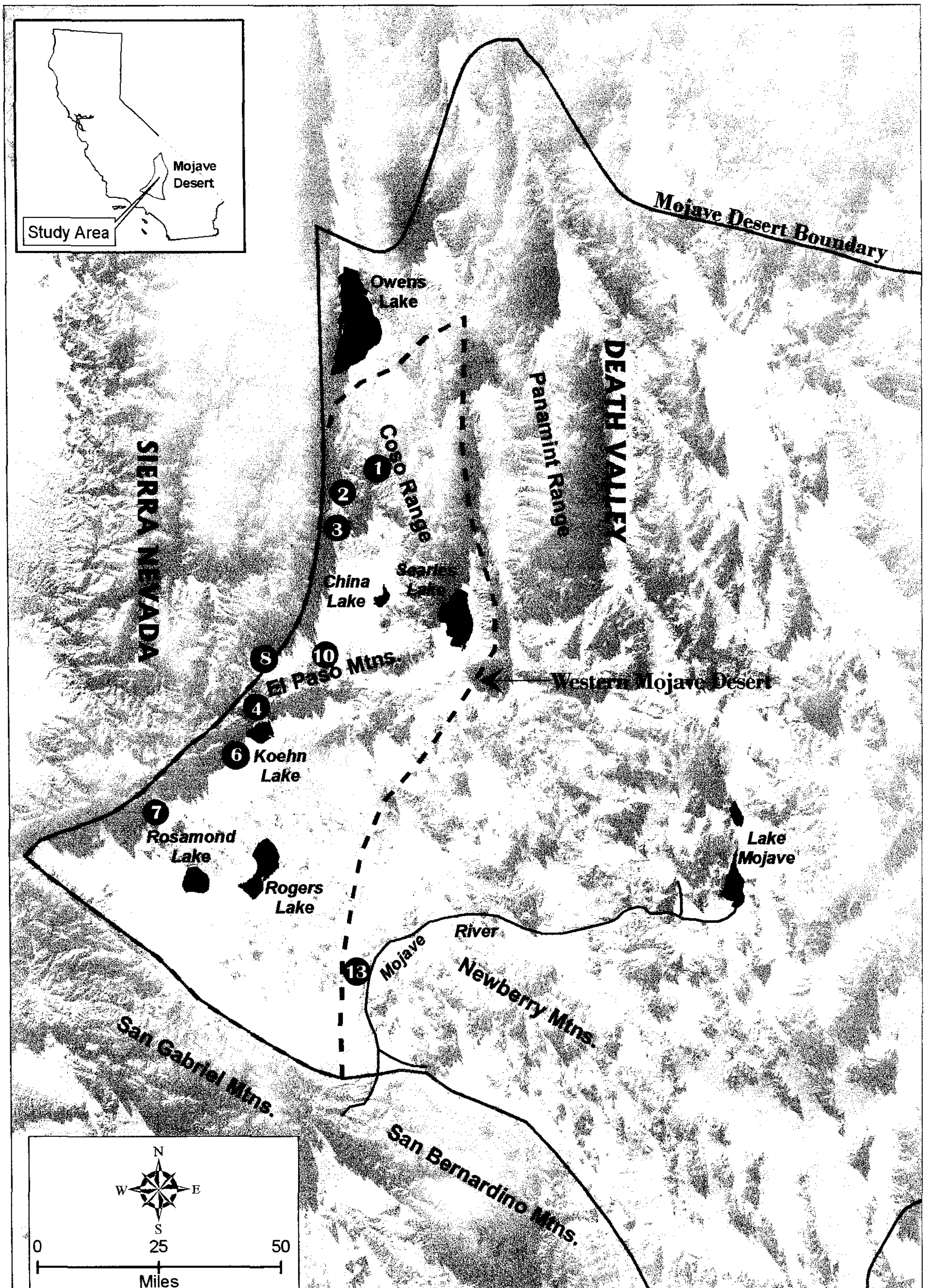

Figure 39. Map of multiple component study sites (see Table 11). Numbers in the map correspond to the sites in Figure 7. No. 1 is the Coso Locality sites; No. 2 is CA-INY-372; No. 3 is CA-INY-2284; No. 4 is CA-KER-5043; No. 6 is CA-KER-2211; No. 7 is CA-KER-1998; No. 8 is CA-KER-4619; No. 10 is CA-KER-6188; No. 13 is CA-SBR-72 (see Table 11 for components of each site).

Table 16. Temporal Relationship of Radiocarbon Dated Site Components to the MCA[a]

Site	Pre-MCA (pre-1,200 RCYBP)	MCA (1,200-650 RCYBP)	Post-MCA (post-650 RCYBP)
CA-INY-372	X	X	X
CA-INY-444	X	--	--
CA-INY-1534A	--	X	X
CA-INY-1534B	--	--	X
CA-KER-246	X	--	--
CA-KER-250	--	X	--
CA-KER-261	--	--	X
CA-KER-526	X	--	--
CA-KER-533	X	--	--
CA-KER-733	--	--	X
CA-KER-875	X	X	--
CA-KER-1180	--	X	X
CA-KER-2211	--	X	--
CA-KER-2218	X	--	--
CA-KER-2450	--	X	--
CA-KER-4619	--	--	X
CA-KER-5043	X	X	--
CA-KER-6106	--	X	--
CA-SBR-72	X	X	--
CA-SBR-189	X	--	--
CA-SBR-1913	--	--	X
CA-SBR-6580	X	--	--
Red Mountain			
CA-SBR-211	X	X	--
CA-SBR-2600	--	--	X
CA-SBR-2608	--	--	X
CA-SBR-2609	--	X	--
Coso Volcanic Field			
CA-INY-1816	--	--	X
CA-INY-1824	X	--	--
CA-INY-1906	--	--	X
CA-INY-1907	X	--	--
CA-INY-2103	--	--	X
CA-INY-3004/5	--	X	X
CA-INY-4243	--	--	X
CA-INY-4325	--	X	--
CA-INY-4329	--	--	X
CA-INY-4330	X	--	X

[a] Table excludes modern dates (see Chapters 5 and 6 for details of age assignments). The radiocarbon ages given in this table are the raw dates without the error factors.

significant increase in components dating to the Late Prehistoric Period (post-MCA), it should be noted that of the 17 post-MCA site components, all have at least one post-500 RCYBP date—300 years after the beginning of the Late Prehistoric Period and 150 years

after the end of the MCA—and only four have dates earlier than 500 RCYBP. These site components that date later than 500 RCYBP may actually reflect an entirely different pattern unrelated to the MCA. Furthermore, of the 15 site components in Table 16 dating prior to the MCA (pre-1,200 B.P.), eight of them date to the first half of the Gypsum Period and three others date to the mid-Gypsum Period. As the early part of the Gypsum Period seems to have witnessed a climatic amelioration from the previous Pinto Period (see Chapter 4), it makes sense that there would be more Gypsum-aged sites before the onset of the MCA and fewer as this climatic episode became entrenched in the Mojave Desert.

Therefore, if the post-500 RCYBP dates are disregarded and an additional column added to reflect the disparity between the early and late Gypsum Period components, the pattern that emerges in Table 17 is quite different from that in Table 16. As depicted in Table 17, of the study sites that were radiocarbon dated, five of the Gypsum-aged components are post-2,000 RCYBP and four fall in the post-MCA (pre-500 RCYBP) column. This supports the idea that there were climatic ameliorations at the beginning of the Gypsum Period well before the MCA and sometime during the Late Prehistoric Period subsequent to the terminal MCA (see Chapter 6).

Moreover, of the 14 sites with components dating within the MCA, all but two (CA-KER-1180 [Rogers Lake] and CA-SBR-2609 [Red Mountain]) date from the early to the middle part of the MCA, with most of those components predating about 900 B.P. This supports the argument made here that the early part of the Rose Spring Period witnessed a more mesic interval than that of the late Gypsum Period, coupled with an increase in human occupation of the western Mojave Desert. Then toward the end of the Rose Spring Period and continuing into the Late Prehistoric Period, the effects of the MCA become more apparent, as indicated by the concomitant decrease in site occupation and/or density that is

Table 17. Temporal Relationship of Pre-500 RCYBP Site Components to the MCA[a]

Site	Pre-2,000 RCYBP but within the Gypsum Period	Pre-MCA (2,000-1,200 RCYBP)	MCA (1,200-650 RCYBP)	Post-MCA (650-500 RCYBP)
CA-INY-372	X	X	X	X
CA-INY-444	X	X	--	--
CA-INY-1534A	--	--	X	X
CA-INY-1534B	--	--	--	--
CA-KER-246	X	--	--	--
CA-KER-250	--	X	X	--
CA-KER-261	--	--	--	X
CA-KER-526	X	--	--	--
CA-KER-533	X	--	--	--
CA-KER-733	--	--	--	--
CA-KER-875	--	X	X	--
CA-KER-1180	--	--	X	--
CA-KER-2211	--	X	X	--
CA-KER-2218	X	--	--	--
CA-KER-2450	--	--	X	--
CA-KER-4619	--	--	--	--
CA-KER-5043	X	--	X	--
CA-KER-6106	--	--	X	--
CA-SBR-72	X	--	X	--
CA-SBR-189	X	--	--	--
CA-SBR-1913	--	--	--	--
CA-SBR-6580	X	--	--	--
Red Mountain				
CA-SBR-211	X	--	X	--
CA-SBR-2600	--	--	--	--
CA-SBR-2608	--	--	--	--
CA-SBR-2609	--	--	X	--
Coso Volcanic Field				
CA-INY-1816	--	--	--	--
CA-INY-1824	X	--	--	--
CA-INY-1906	--	--	--	--
CA-INY-1907	X	--	--	--
CA-INY-2103	--	--	--	--
CA-INY-3004/5	--	--	X	--
CA-INY-4243	--	--	--	--
CA-INY-4325	--	--	X	--
CA-INY-4329	--	--	--	--
CA-INY-4330	X	--	--	X

[a] Table excludes modern dates (see Chapters 5 and 6 for details of age assignments). The radiocarbon ages given in this table are the raw dates without the error factors.

most evident in Figure 32. On the basis of this dating assessment, the following is a discussion of some of the culture changes that are proposed to be a result of the MCA, at least to some degree.

Subsistence

Subsistence is generally determined by the faunal and botanical remains recovered from archaeological sites. In the absence of such remains, it may also be determined by site location. Gypsum Period subsistence is poorly known in the western Mojave Desert, while more is known about subsistence during the Rose Spring and Late Prehistoric periods. The following is a summary and comparison of the subsistence data detailed in Chapter 5.

Discussion of the Faunal and Botanical Evidence from the Study Sites

The abundance of hares (jackrabbits) in archaeological components of the western Mojave Desert has long been known. A similar pattern can be seen at Fort Irwin in the north-central Mojave Desert, where most of the site components have produced significant quantities of lagomorphs, although desert tortoise (*Gopherus agassizii*) and artiodactyls seem to be much more abundant at the Fort Irwin sites than in the western Mojave Desert (e.g., Basgall et al. 1988; Kelly 1985; McGuire and Hall 1988). Conversely, faunal remains from the Coso Volcanic Field sites are rare (Gilreath and Hildebrandt 1997:157), which would be expected in an area where most of the sites were focused on lithic production.

The vast majority of lagomorph (including rabbit-sized) remains from the study sites was derived from multiple component Rose Spring/Late Prehistoric Period sites, although such specimens are found in almost all of the study site components. One explanation for this is that human populations expanded during the Rose Spring Period, so more lagomorphs were being captured. As noted by Jameson and Peeters (1988:333), rabbits and hares (and other herbivores, including artiodactyls) "are especially sensitive to the quality and amount of plant food available; their reproduction is clearly enhanced by a rich food supply." If the environment during the Rose Spring Period was more amenable to plant food abundance and availability, it would not be surprising that human

occupation and lagomorph exploitation would increase simultaneously, at least at the beginning of this period.

Moreover, if conditions changed significantly as a result of the MCA to a more xeric climatic regime during the Late Prehistoric Period, with a concomitant decrease in plant food availability and diversity, one would expect that lagomorph populations would also decrease. Chapman and Feldhamer (1982:100) noted that while both cottontail rabbits (*Sylvilagus* sp.) and hares (*Lepus* sp.) are adapted to desert environments, any significant shifts in seasonal weather can adversely affect population levels. Further, while hares are physiologically able to regulate water loss from evaporation, the maintenance of body temperature "would normally require substantial amounts of water for evaporative cooling" (Chapman and Feldhamer 1982:126). Thus, if drought conditions during the MCA were as impressive as proposed herein, it would not be surprising for lagomorph populations to decrease, which appears to have been the case (see Table 13). At the same time, human populations also appear to be diminishing (see below).

Roughly 2,000 to 1,500 years ago, the archaeological record of various parts of the Mojave Desert shows an apparent subsistence focus shift from artiodactyls to smaller game, predominantly lagomorphs (e.g., Yohe and Sutton 1999). At Fort Irwin, this pattern seems to be reflected in some of the rock art of the Gypsum Period, which sometimes depicts bighorn sheep (McGuire and Hall 1988:319). This subsistence shift appears to have been accompanied by decreased residential mobility, as people were no longer pursuing large mammals (Sutton 1996:234; Yohe and Sutton 1999). This trend is less evident in the western Mojave Desert, where artiodactyls never reach the levels of lagomorphs within the study site faunal assemblages, although lagomorphs do increase dramatically until their eventual decline during the Late Prehistoric Period.

This decrease in artiodactyl populations in some areas of the Mojave Desert could have been due to climatic stress (but see discussion of the bow and arrow below). Byers and Broughton (2004:237-238), for example, observed that research in the Great Basin and other areas in the western United States has demonstrated that artiodactyls such as mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), bison (*Bison bison*), bighorn sheep (*Ovis canadensis*), and elk (*Cervus elaphus*) are sensitive to changes in temperature and precipitation (also see Byers et al. 2005). They added that while other factors besides climate can affect herd size, "hot and dry climates negatively impact all Great Basin artiodactyl species," particularly in terms of the availability of sufficient forage and drinking water (Byers and Broughton 2004:238). Shifts in seasonal temperatures and precipitation that are associated with climatic stress compound the problem by increasing the mortality rate of herd sizes (Byers and Broughton 2004:238). This is particularly true for pronghorn and bison, whose reproductive success is greatly impacted by arid conditions (Byers et al. 2005:128).

A review of Table 13 in Chapter 6 does not appear to support the idea of severe depletion of artiodactyl populations after the onset of the MCA, at least not for the western Mojave Desert. Combining all categories of artiodactyls (Artiodactyla, bighorn sheep, deer/deer sized, pronghorn, and large mammals), the NISP for Gypsum components is 209, for Rose Spring it is 286, for Rose Spring/Late Prehistoric it is 255, and for Late Prehistoric it is 1,457. This tabulation is deceptive, however, as it is more likely a function of processing technique (see Chapter 6). It has been noted that at a number of sites in the Great Basin (including the study area), many of the faunal remains from Late Prehistoric Period components have been extremely fragmented (e.g., Arkush 1995; Parr 1989; Sutton 1991b). Yohe (1995:69) suggested that this was due to the

processing technique of pulverizing the long bones, skull elements, and pelves in order to "maximize extraction of bone grease and protein." This is evident in Table 14 (Chapter 6), as the vast majority of the ungulate remains in the study sites were so fragmentary that they could only be identified taxonomically as artiodactyl or deer-sized.

This processing technique might have become necessary in the face of reduced artiodactyl herds resulting from deteriorating climatic conditions. All of this assumes, of course, that artiodactyls were considered important resources at any point in time to the prehistoric populations of the Great Basin. The faunal evidence from the study sites suggests that this may not have been the case in the western Mojave Desert, although it should be kept in mind that site function may also be biasing the faunal assemblages in the study area; that is, one would not expect to find artiodactyl remains, for example, in a rabbit drive site or a lithic reduction site.

In Chapter 6, the relative abundance and ranking of artiodactyls and lagomorphs was discussed in terms of the mass collection of prey types. An important aspect of the relative abundance of any species is the determination of temporal patterns in order to assess the dietary contributions of different-sized prey animals through time (Broughton 1994b: 505). There are numerous ways to discern this temporal patterning. Calculations based on NISP or MNI can be used, although neither is ideal (see Chapter 6). Of particular interest in this study are the relative contributions in terms of useable meat of artiodactyls and lagomorphs. Because MNI was rarely provided for the faunal assemblages within the study sites, NISP was used in this analysis to make this determination. For that purpose, an artiodactyl index developed by Broughton (1994b:506) was used to summarize the contribution of artiodactyls within the 14 selected faunal assemblages shown in Table 13. This index is calculated as

$$\sum \text{Artiodactyls}_i / \sum (\text{Artiodactyls}_i + \text{Lagomorphs}_i).$$

For this formula, a higher value demonstrates higher relative frequencies of artiodactyls within an assemblage. The ratio can thus be considered an index of selective efficiency; that is, "high values represent high efficiency in vertebrate use, while low values represent low selective efficiency" (Broughton 1994b:506). Table 18 presents the selective efficiency index for the faunal assemblages of the study sites in Table 13. Figure 40 displays the relationship between the artiodactyl index and the mean occupation dates for these assemblages. No trend through time is evident in the relative abundance of artiodactyls to lagomorphs ($r = 0.231$, $P = 0.49$). In other words, at no point in time is the dietary contribution of artiodactyls greater than that of lagomorphs. This is all predicated, of course, on the assumption that NISP is an appropriate measure of abundance.

Two interesting "anomalies" occur in Figure 40. Although the linear relationship is not statistically significant, it does show a downward trend from the earliest site to the latest, suggesting low efficiency in artiodactyl use. The one exception is the nearly 0.8 index value on the far left of the graph. This point on the graph represents the faunal assemblage from *Guapiabit* (CA-SBR-1913), a Late Prehistoric Period site (Sutton and Schneider 1996). The question, then, is why this site should exhibit such a high index value for artiodactyls when all of the other sites that date after about 1,100 RCYBP in Figure 40 are substantially lower. Perhaps the answer is the location of CA-SBR-1913 adjacent to the Mojave River; thus, its proximity to a reliable water source suggests that artiodactyls were more easily discovered and hunted there, even at a time when artiodactyls appear to be decreasing elsewhere in the Mojave Desert.

The other potential anomaly occurs to the far right of the graph directly on the 0.0 line. That point represents CA-KER-526, a large, early Gypsum Period site adjacent to

Table 18. Index of Selective Efficiency for Artiodactyls Within Selected Study Sites

Site[a]	Artiodactyl Index
CA-KER-526	0.009
CA-KER-2218	0.820
CA-SBR-6580	0.930
CA-KER-250	0.262
CA-KER-533	0.000
CA-KER-2567	0.066
CA-KER-2450	0.000
CA-KER-6106	0.000
CA-KER-1998	0.256
CA-KER-2211	0.027
CA-KER-261	0.148
CA-KER-733	0.131
CA-KER-2210	0.000
CA-SBR-1913	0.781

[a] Sites in the table are divided by time period; the first three are Gypsum Period sites, the next five are Rose Spring Period sites, the next two are multiple component sites, and the last four are Late Prehistoric Period sites.

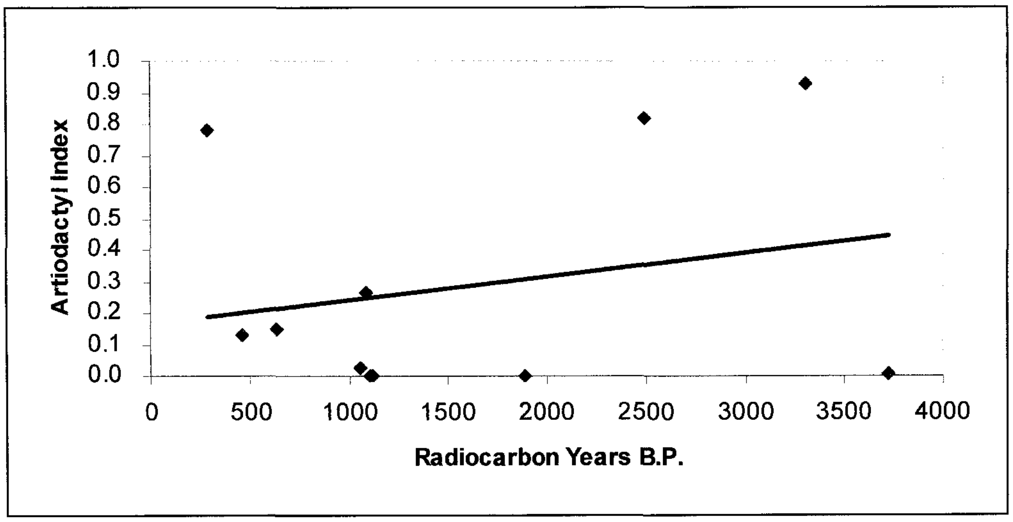

Figure 40. The relationship between the artiodactyl index and time for selected study sites. The dates were derived from the mean radiocarbon ages of selected sites. Three sites (CA-KER-1998, -2210, and -2567) that appear in Table 18 were eliminated from this graph because they did not have radiocarbon dates. Two of the 11 points on the graph are overlaid on top of each other directly on the 0.0 line at around 1,100 RCYBP.

Rogers Lake, at which only one artiodactyl specimen was recovered (Byrd et al. 1994). It is not likely that this is due to sampling bias, as 19 TUs and 88 STPs were excavated there (see Chapter 5). If the Gypsum Period was a time of high efficiency in artiodactyl

use in the Mojave Desert, as suggested by various researchers (see below), it seems odd that this large site would be virtually devoid of artiodactyls, with the possible exception of a few large mammal remains that may represent artiodactyls. There could be any number of reasons for this, but one possibility is that given its somewhat ambiguous dating (see Chapter 5), it may not be a Gypsum Period site, or at least not solely a Gypsum Period site.

Due to the paucity of botanical data from most of the study sites, not much can be determined about resource use of plant species through time. However, all of the time periods discussed here (Gypsum, Rose Spring, Rose Spring/Late Prehistoric, and Late Prehistoric) are represented in the botanical assemblages, which allows limited comparison of these remains. Of the study sites with Gypsum Period components, only the Siphon site (CA-SBR-6580; Sutton et al. 1993), the Rose Spring site (CA-INY-372; Yohe 1992), and CA-KER-526 (Byrd et al. 1994) contained a substantial amount of botanical remains.

Most of the botanical remains from the Siphon site were from the pollen samples, of which only a few were considered to be part of the site occupation, including Cheno-ams, Cruciferae, wild buckwheat, grasses (Gramineae), and gooseberry (Scott Cummings 1993:87). Cheno-ams, Cruciferae, wild buckwheat, and Gramineae are often found in drought-resistant environments, while gooseberry is generally found in forest or mountain environments (Twisselmann 1967). As the Siphon site is located near the foothills of the San Gabriel and San Bernardino mountains, the presence of gooseberry would not be unexpected. The Gypsum Period component of the predominantly Rose Spring site contained high-spine Asteraceae and Cheno-ams, both of which are considered to be xeric-adapted species (Yohe and Scott Cummings 2000).

The pollen specimens from CA-KER-526 included pine, juniper, buckwheat, sunflower, various grasses, Mormon tea, ragweed, Cheno-ams, and legumes, as well as a few other species (Smith and Anderson 1994:129). Although some of these specimens may not represent cultural activity, the use of the sunflower family and the Cheno-ams has been documented ethnographically (Smith and Anderson 1994:128). In the apparently small Gypsum Period component of the Coffee Break site (CA-KER-5043; Gardner 2002:63), a feature described as an ash pit contained a relatively large number of burned Asteraceae specimens (n = 63), as well as much smaller amounts of saltbush and creosote (n = 2 and n = 1, respectively).

While juniper and pine are represented in nearly all of the site components discussed here, it is during the Rose Spring Period that both of these species become increasingly common in archaeological components of the western Mojave Desert. Other botanical species found in Rose Spring Period components include Cheno-ams, wild mustard (Cruciferae), creosote, and wild buckwheat. Most of the identified species that first appeared during the Rose Spring Period have been documented ethnographically as having a variety of uses, including as food sources, medicine, firewood, resin, bow-making material, and even as a tattooing substance (Mormon tea; e.g., Zigmond 1981, 1986).

As noted above, juniper abundance increases considerably in the single-component Rose Spring Period sites and continues in abundance in the multiple-component Rose Spring/Late Prehistoric Period sites, suggesting that this species was growing at these locations during this time, rather than being brought into the site by natural or cultural agents. Juniper appears to have been a frequently exploited resource during Rose Spring times, at least at semipermanent habitation sites, although its current distribution is

primarily in the southern Sierra Nevada (Sutton 1991b:179). As juniper will only prosper if there is sufficient winter precipitation (Peter E. Wigand, personal communication 2005; Wigand and Rhode 2002), its presence in the western Mojave Desert supports the idea that the region experienced a significant increase in lake levels and precipitation at this time, an argument that is supported by the evidence of an imposing 586-m. shoreline at Koehn Lake (Sutton 1988, 1990, 1991a; also see Chapter 1).

As the environment became more xeric toward the end of the Rose Spring Period, juniper should (and does) drop off. This was evidenced at the Coffee Break site (Gardner 2002), for example, which is a late Rose Spring Period site that contained no juniper. Only three sites with Gypsum Period components (CA-KER-526; Byrd et al. 1994]; Rose Spring [CA-INY-372; Yohe 1992]; Siphon [CA-SBR-6580; Sutton et al. 1993]) and one site with a Late Prehistoric Period component (*Guapiabit* [CA-SBR-1913; Sutton and Schneider 1996]) contained juniper, in small quantities and mostly in the form of pollen at all but the *Guapiabit* site. This suggests that climatic conditions were more xeric during these two time periods, and that juniper was probably brought into these sites (except *Guapiabit*) by aeolian forces.

There are other explanations for the paucity of juniper in Late Prehistoric Period components, such as a shift in diet preference (assuming it was used as a dietary resource), a change in construction technique (juniper was a common construction material during the Rose Spring Period [e.g., Sutton 1991b]), or a reduction in residential mobility in that perhaps the distance to juniper patches became too costly in terms of foraging efficiency. If that were so, however, one would expect juniper abundance to remain relatively constant in the absence of foraging activity, a suggestion that is not supported by the pollen record of the Great Basin, which demonstrates increasing retreat

of juniper beginning about 1,900 years ago (Wigand and Rhode 2002:328; also see Wigand 1997).

The pollen profile at the Rose Spring site provides some support for increasing aridity toward the end of the Rose Spring Period and continuing into the Late Prehistoric Period, in that it indicates an increase in mesquite and Cheno-ams (Yohe and Scott Cummings 2000:Figure 1). This makes sense, as these are drought-resistant plants, and it is expected that their abundance would increase as a result of the MCA. At some point during the Rose Spring Period, however, high-spine—considered a drought-resistant species—began to decrease. This is likely due to an increase in summer rainfall that is observable in the pollen records in other parts of the Mojave Desert and the Great Basin overall (Wigand and Rhode 2002:328; also see Madsen et al. 2001).

Subsistence-Related Technology

Technology related to subsistence in the study area includes flaked and ground stone tools for the procurement and processing of resources; the florescence of the bow and arrow, coupled with an apparent subsistence focus shift; and the procurement, production, and trade of obsidian, as well as the ultimate collapse of this system. All of these issues are addressed in this section as they relate to the study sites.

Flaked Stone Technology

Among the flaked stone assemblages from the study sites, there seems to be an interesting dichotomy between Desert series projectile points (Desert Side-notched, Cottonwood Triangular, and Cottonwood Leaf-shaped; the latter two are subsumed under the single category of Cottonwood). Sutton (1989:102-105) also observed this dichotomy in other parts of the Mojave Desert, and argued that it demonstrates a potential interaction

sphere in the Mojave Desert, in that there is an uneven distribution of Desert series projectile points. He noted the small numbers of Desert Side-notched and Cottonwood points in later sites north of the Mojave River, with the Cottonwood type being "the dominant, and sometimes exclusive, forms along, and south of, the Mojave River" (Sutton 1989:103).

Sutton's argument is supported by the projectile points from the study sites with Late Prehistoric Period components along the river, including 68 Cottonwood points that were recovered from Oro Grande (Rector et al. 1983) and 26 that were recovered from *Guapiabit* (Sutton et al. 1993), neither of which contained Desert Side-notched points (see Table 7). While the Cottonwood point does appear north of the river, such as at Rose Spring where at least 39 Cottonwood points were recovered, they usually occur in smaller numbers in Late Prehistoric Period study site components.

Moreover, Sutton (1989:103) observed that Desert Side-notched points are commonly found in the southern Sierra Nevada, but are rarely encountered in the western Mojave Desert. In terms of the total number of Cottonwood and Desert Side-notched projectile points from the study sites, this observation is confirmed. From all of the study sites listed in Table 7, there were 197 Cottonwood and 42 Desert Side-notched points recovered. The reason for these differences in the projectile point types is unclear, but may be related to cultural and/or linguistic boundaries (Sutton 1989:112). If these differences in point types are related to cultural boundaries, it may be that these boundaries were being altered during this time, with territoriality becoming increasingly important; thus, there may be some connection to environmental degradation coupled with diminishing resources for which demand was high. This is merely speculative, however, and no direct link to the MCA can be established at this time.

There is some ethnographic evidence along inland California, however, that provides some support for this idea of increasing territoriality due to environmental degradation. Koerper et al. (2002) observed that resource stress and labor intensification can produce a number of possible reactions, including territoriality and warfare. Using ethnographic data regarding inland Luiseño rancherias as an analog for Late Holocene culture changes among prehistoric groups in Orange County, Koerper et al. (2002:75) noted that these rancherias were reported to have had strict territorial boundaries, with differential access to particular resources between and within the rancherias. Some areas were said to have been owned by families or individuals and "were jealousy guarded . . . by force of arms or witchcraft" (Koerper et al. 2002:75). They added that drought conditions and/or increasing population levels likely intensified these territorial rights, perhaps leading to conflict (Koerper et al. 2002:80).

Ground Stone Technology

The ground stone assemblages from the study sites show an increase in the use of such implements during the Rose Spring Period, continuing into the early Late Prehistoric Period (see Tables 19 through 22; the tables include complete and fragmentary specimen totals, with the exception of those reported as fitted pieces). The use of ground stone tools is thought to represent a shift in the techniques of food processing by hunter-gatherer groups. Typically, this is assumed to represent plant processing, specifically seeds, although it has been demonstrated that ground stone artifacts were also used for other purposes, such as the processing of small animals, pigments, clays, metal ores, salt, and medicines (e.g., Yohe et al. 1991; Sutton et al. 1993). At the few study sites where immunological analyses were conducted on ground stone artifacts, species that were identified include pronghorn, deer, rabbit, waterfowl,

Table 19. Milling Features and Tools from Gypsum Period Study Sites

Site	BRMs/ Slicks	Metates	Manos	Mortars/ Bowls	Pestles
CA-KER-526	--	27	27	--	2
CA-KER-2209	--	5	29	--	--
CA-KER-2214	--	3	10	--	1
CA-KER-2218	--	--	10	--	--
CA-SBR-189	--	25	22	--	--
CA-SBR-6580	--	56	66	--	9
Totals	--	*116*	*164*	--	*12*

Table 20. Milling Features and Tools from Rose Spring Period Study Sites

Site	BRMs/ Slicks	Metates	Manos	Mortars/ Bowls	Pestles
CA-KER-250	--	8	10	--	--
CA-KER-533	--	4	1	--	--
CA-KER-875[b]	--	145	295	--	1
CA-KER-2215	--	6	7	--	--
CA-KER-2567	--	5	9	--	--
CA-KER-6106	24	--	13	--	--
Totals	*24*	*168*	*335*	--	*1*

[a] The ground stone counts for CA-KER-875 are approximate based on a review of the catalogs.

Table 21. Milling Features and Tools from Late Prehistoric Period Study Sites

Site	BRMs/ Slicks	Metates	Manos	Mortars/ Bowls	Pestles
CA-KER-261	--	5	--	--	1
CA-KER-733	--	--	3	1	--
CA-KER-1180	--	6	7	1	--
CA-KER-2210	--	8	19	--	--
CA-KER-3377	--	5	1	--	--
CA-SBR-176	2	6	12	--	3
CA-SBR-1913	--	8	31	1	11
Totals	*2*	*38*	*73*	*3*	*15*

Table 22. Milling Features and Tools from Multiple Component Study Sites

Site	BRMs/ Slicks	Metates	Manos	Mortars/ Bowls	Pestles
GY/RS					
CA-KER-5043	--	5	11	--	--
CA-KER-6188	60	49	41	--	7
Totals	*60*	*54*	*52*	--	*7*
GY/RS/LP					
Coso Locality	--	113	22	5	1
CA-INY-372[b]	8	65	111	--	6
CA-SBR-72	--	54	66	4	3
Totals	*8*	*232*	*199*	*9*	*10*
RS/LP					
CA-KER-1998	--	2	11	--	--
CA-KER-2211	--	69	219	1	5
Totals	--	*71*	*230*	*1*	*5*

[a]GY/RS = sites with Gypsum and Rose Spring period components; GY/RS/LP = sites with Gypsum, Rose Spring, and Late Prehistoric period components; RS/LP = sites with Rose Spring and Late Prehistoric period components.

[b]The ground stone feature and artifact counts for CA-INY-372 are approximate based on a review of the catalogs and discussions with R. M. Yohe, whose dissertation (Yohe 1992) is about the Rose Spring site lithics.

rat, mouse, and yucca (e.g., Newman 1993b, 1996; Sutton and Schneider 1996; Sutton et al. 1993).

Keeping in mind the fact that Tables 19 through 22 do not constitute a random sample (see Chapter 6), and that not all time periods are represented by an equal number of sites, a review of the raw artifact counts for metates and manos combined demonstrates an increase of 56% in these tools from the Gypsum Period (n = 280) to the Rose Spring Period (n = 503), followed by a decrease from the Rose Spring Period to the Late Prehistoric Period (n = 111) by nearly 80%. When the multiple component Rose Spring/Late Prehistoric Period metates and manos (n = 301) are considered in the equation, while only two sites are represented, it shows a significant decrease (from 503 to 301) from the Rose Spring Period sites, followed by another decrease in the Late Prehistoric Period sites (from 301 to 111).

The majority of the ground stone tools (n = 106) from the multiple component Gypsum/Rose Spring Period sites was derived from a single site (CA-KER-6188; Terese site), and shows a significant decrease from the Gypsum Period components (Table 19). As the Terese site also has 60 bedrock mortars/slicks and as only two test units have been excavated there, however, it is quite likely that there would be a substantial increase in the number of grinding implements recovered should more large-scale excavations be undertaken there. It should also be repeated here that the Terese site was dated primarily via obsidian hydration analysis, with nine of the 13 measurements ranging between 4.0 and 6.0 microns (the other four being 10.3, 10.9, 12.9, and 13.0 microns). This indicates that while the site may have a Gypsum Period component, it is primarily Rose Spring in age; thus, it is probable that most of the milling features at the site date to the Rose Spring Period. At the Coffee Break site (CA-KER-5043), the only Gypsum component that was identified was via radiocarbon dating of charcoal recovered from a single feature, while the rest of the site was Rose Spring in age.

The multiple component Gypsum, Rose Spring, and Late Prehistoric period sites are difficult to interpret in terms of the milling equipment at the sites with these three components. This is due partly to the lack of adequate provenience for the Coso Locality sites and the fact that the Rose Spring site (CA-INY-372) has not been fully reported yet. In my discussions with Robert Yohe, whose dissertation is based primarily on the flaked stone artifacts from Rose Spring (Yohe 1992), he informed me that he strongly considers the site to be overwhelmingly Rose Spring in age; as such, the milling implements most likely date to that time as well. On the other hand, the Oro Grande site (CA-SBR-72; Rector et al. 1983) seems to be a predominantly Late Prehistoric site. Thus, if the milling tools from the Rose Spring site are placed within the Rose Spring Period totals and the

milling tools from Oro Grande placed within the Late Prehistoric Period totals, different percentages are apparent but the overall pattern is basically the same.

For the most part, the frequency of pestles remains relatively static (the largest number occurring at CA-SBR-1913 [n = 11]), while mortars are virtually absent until the Late Prehistoric Period. In terms of the pattern of bedrock mortars (BRMs), an interesting pattern can be seen. There are no BRM features from the Gypsum Period site components. Only one Rose Spring Period site (CA-KER-6106) and one Late Prehistoric Period site (CA-SBR-176) had milling features (n = 24, n = 2, respectively). The multiple component Terese site (CA-KER-6188) contains 60 such features; as noted above, however, this site is thought to be primarily Rose Spring in age (as is the Rose Spring site, which had at least eight milling features). Assuming that the milling features at the Rose Spring and Terese sites are associated with their respective Rose Spring Period components, then the vast majority of milling features occurs during this time period.

In his study of bedrock milling elements in northern San Diego County, True (1993:11) suggested that an 80% mortar to metate/slick ratio is indicative of intensive acorn processing, while anything less than 50% is more suggestive of generalized processing, particularly of hard seeds and small animals. He also indicated that differences in the various milling elements "may represent responses to environmental circumstances (kinds of resources available); responses to cultural preferences or technical factors (processing modes); and/or to different usages developed through time." Whether such differences in milling stone technology are a function of resource distribution and availability and/or processing techniques remains unclear. One of the main reasons for the ambiguity of this question for the western Mojave Desert is the

paucity of botanical remains from the study sites (see discussion below), with the exception of a few sites with disproportionate quantities of such remains.

The pattern of milling activity at the various study sites demonstrates that this type of resource processing was much more predominant during the early Rose Spring Period than at any other time in the western Mojave Desert. It also shows the technological dominance of the metate and mano over the mortar and pestle throughout the record from Gypsum to Late Prehistoric period times. The same pattern is evident in various parts of California, where a profound preference for manos and metates has been demonstrated (e.g. Basgall 1987; but see True 1993).

The fact that milling appears to have been an integral aspect of Rose Spring Period cultural adaptation in the western Mojave Desert weakens the argument made by Bettinger and Baumhoff (1982) that seeds were less important to the pre-Numic (Rose Spring Period) people than to the Numic (Late Prehistoric Period) people. It also suggests that plants were more abundant during the Rose Spring Period, at least during the early part of this time (as noted above, most of the Rose Spring site components are earlier than 900 B.P.), thus supporting the idea that the early part of the MCA was not as harsh as it was later.

Florescence of the Bow and Arrow

The archaeological and environmental record for the western Mojave Desert reflects relatively simultaneous changes in hunting technology and climate subsequent to the Gypsum Period (e.g., Allen 1986; Basgall et al. 1988; Bettinger 1999; Bettinger and Eerkens 1999; Yohe and Sutton 1999). One of the major changes in technology was the development of the bow and arrow sometime between 2,000 and 1,500 years ago, an

event that appears to be associated with an increase in large habitation sites (or villages) located near springs and other water sources (e.g., the Rose Spring, Coso Junction Ranch, Koehn Lake, Cantil [CA-KER-2211], and Oak Creek Canyon sites). Subsequently, beginning about 1,000 years ago, the nature of human subsistence and settlement appears to have changed dramatically, "perhaps in response to declining resources resulting from human overpopulation and increasing aridity" (Yohe and Sutton 2000a:1).

Yohe and Sutton (2000a) proposed a model in which the adoption of bow and arrow technology would have resulted in greater hunting success, as it had the advantage of allowing hunters to be able to hunt smaller animals that could not be taken with earlier dart and atlatl technology. If this were true, then one would expect to observe a general increase in a variety of vertebrates in the archaeological record, such as ungulates, birds, and some species of small and medium mammals. This would have resulted in increased carrying capacity and human population. They further posited that the bow and arrow was so efficient that it impacted artiodactyl populations to the point of severe depletion sometime during the MCA (Yohe and Sutton 1999, 2000a). At the same time, lagomorph exploitation increased, the implication being that artiodactyls became harder to find and hares were more abundant, requiring less procurement time and effort. Per the model, after about 1,000 B.P., vertebrate resources would begin to diminish, likely through a combination of human overexploitation and environmental degradation.

Applying this model to the Rose Spring site, however, Yohe and Sutton (2000a) noted a decrease in all vertebrate remains immediately following the introduction of the bow and arrow and an increase in all vertebrate remains during the Late Prehistoric Period. Since the Rose Spring site report had not been completed as of the time of this study, Yohe and Sutton's (2000a) analysis of the vertebrate remains from the site could

not be confirmed. The first part of their prediction does not seem to be true for other sites in the study area, as there is no apparent decrease in vertebrate remains immediately following the introduction of the bow and arrow (see Table 13). The second part of their prediction does seem to be at least partly true, however, in that Table 13 shows that deer/deer-sized, pronghorn, unidentified artiodactyls, and unidentified mammals all show an increase of NISP in the Late Prehistoric Period site components.

As the bow and arrow appears to have been introduced in the western Mojave Desert by at least 1,500 years ago, it would be difficult to argue that it emerged *because* of the MCA, but expansion of this technology during the Rose Spring Period was likely at least an indirect response to changing climatic and/or political conditions. For example, the assumption that is typically made is that the function of bow and arrow technology was for the hunting of game. While there is sufficient evidence to support this assumption, another explanation for the proliferation of this more efficient technology is warfare.

Citing ethnographic evidence of military aggression in the Great Basin (e.g., Driver 1937; Kelly 1932; Powers 1877), Sutton (1986b) argued that one of the primary mechanisms of the Numic spread was warfare coupled with population expansion (see below). The bow and arrow has greater velocity and a higher degree of accuracy than that of the dart and atlatl; it also allows the hunter (or aggressor) to remain undetected and release the weapon from a distance (Yohe 1998:26). These are enormous advantages for both the hunting of game animals and the elimination of people. Why, then, would warfare be necessary? Perhaps it was due to resource depletion as the result of environmental desiccation; in other words, demand for resources may have been high but supply was low, necessitating drastic measures.

Obsidian Procurement, Production, and Trade

One final consideration in terms of technology concerns obsidian procurement, processing, and trade in the western Mojave Desert (e.g., Jackson and Ericson 1994). Obsidian from the Coso Volcanic Field far surpasses any other source in the study sites, as can be seen in Chapters 5 and 6. As noted by Gilreath and Hildebrandt (1997:178), the large quantities of obsidian at some of the study sites with Rose Spring (or Haiwee) Period components indicates that the procurement and processing of obsidian for various tools were essential tasks, although they argued that the peak of production was during the Late Newberry Period (which begins about 2,300 B.P. and overlaps the Rose Spring Period; see Table 2). During the subsequent Late Prehistoric (or Marana) Period, there appears to have been a shift from obsidian to macrocrystalline toolstone, signaling a marked decrease in the procurement of obsidian in the Coso Volcanic Field and ultimately giving way to intensified seed processing activities during the Late Prehistoric Period (Gilreath and Hildebrandt 1997:179; also see Eerkens and Rosenthal 2004).

The decline in obsidian hydration rim measurements around the beginning of the Late Prehistoric Period (see Figure 29) suggests that trade and exchange for obsidian may have been "blocked" by changing political and/or territorial boundaries. In his discussion of interaction spheres in the Mojave Desert, Sutton (1989:109) suggested that one of the potential natural boundaries for obsidian exchange is the Mojave River. This is at least partly borne out by the study sites along the Mojave River (Oro Grande, Deep Creek, Hinkley, *Guapiabit*, and Siphon), all of which were dominated by cryptocrystalline toolstone and contained very little obsidian.

The exploitation of obsidian between the late Gypsum and early Rose Spring periods (or Late Newberry Period) indicates increased and unrestricted access to Coso obsidian.

People from various parts of southern California would have had access to Coso obsidian (Gilreath and Hildebrandt 1997:175; also see Ericson 1977). By about the middle of the Rose Spring (or Late Newberry), Period, however, there was a dramatic decrease in the number of obsidian sources being quarried (Gilreath and Hildebrandt 1997:175). This decrease supports the argument that territorial rights may have been changing. For example, because the Rose Spring and Coso Junction Ranch sites (both large village sites) were directly adjacent to the Coso Volcanic Field, they could "effectively monitor its access" (Gilreath and Hildebrandt 1997:175). As a result, people from sites at greater distances to the source may have been denied access. This proposed emergence of territorial rights could have been precipitated due to increased demand for limited resources due to environmental degradation at about this time. It would also have implications for the subsistence orientation of human populations, in that restricted access to preferred resources (such as obsidian) may have resulted in decreased mobility (see Bettinger and Baumhoff's [1982] model of travelers versus processors).

Another possible explanation for the collapse of the obsidian production and exchange system was introduction and expansion of the bow and arrow, which could have reduced the demand for obsidian because projectile points would have become smaller (although the proliferation of this technology might have actually increased demand for obsidian). Gilreath and Hildebrandt (1997:179) argued that in outlying areas to the Coso Volcanic Field, hydration values remained relatively stable from Newberry to Haiwee times, while new peaks in hydration values became established in the desert to the southeast. They suggested that this apparent contradiction was due to the fact that they only investigated two Haiwee Period quarries (Joshua Ridge and West Sugarloaf Mountain), both of which contained high-quality obsidian and were intensively exploited

(Gilreath and Hildebrandt (1997:179). The fact that there are few traces of extended stays at these quarries probably indicates that obsidian procurement was conducted by a small number of people repeatedly obtaining obsidian from the same sources and transporting it to occupation areas outside of the Coso Volcanic Field for processing (Gilreath and Hildebrandt 1997:179).

In terms of the extent of the trade and exchange system for obsidian, the hydration results presented in Table 5 demonstrate a strong correlation between the proximity of a site to the Coso Volcanic Field and the number of specimens available for hydration rim measurement. As would be expected, the closer a site was to the Cosos, the more obsidian was recovered in the archaeological assemblage of that site (including the Coso Locality sites, the Rose Spring site, the Coso Junction Ranch site, and the Coso Volcanic Field sites). For the most part, obsidian specimens from the Cosos become fewer and fewer in archaeological assemblages of the study area as one moves south and southeast. There are other sources at the south end of the study area, such as Obsidian Butte near the Salton Sea and Bristol Mountains east of Barstow. While these sources are closer to some of the study sites, there is only one specimen each from these two localities, both from *Guapiabit* (CA-SBR-1913; Sutton and Schneider 1996).

This suggests at least two possibilities: first, that the obsidian at these two sources was not of high enough quality for people to have preferred them over the Coso obsidian; and second, that there was simply insufficient obsidian at these sources to make it worthwhile to mine them or to trade for the material there. For example, while the obsidian from the Bristol Mountains source is of high quality, its geographic extent is limited to small areas of secondary deposition as a result of erosion, which may account for its virtual absence in the study sites (Shackley 1994b:126).

As noted above, Gilreath and Hildebrandt (1997:179) argued that a region-wide reduction in mobility during the Haiwee Period (1,275 to 650 B.P.) was likely the result of decreased access to Coso quarries by nonlocal populations (also see Bettinger 1989; Delacorte and McGuire 1993). Eventually, at the point that these quarries had the potential to be under the greatest level of control, the obsidian production and exchange system collapsed, and intensive seed processing became the focus in this area (Gilreath and Hildebrandt 1997:179). It is not too much of a leap to suggest that this collapse and subsequent subsistence focus shift were the result of climatic deterioration during the MCA (also see Moratto and Davis 1988).

Settlement and Population Density

The following is a discussion of various aspects of settlement and population density as they relate to the prehistoric western Mojave Desert and the MCA. These include the concepts of mobility and sedentism, site reuse, changing settlement patterns, and an apparent population recession and/or aggregation in this region beginning toward the end of the Rose Spring Period and continuing into the Late Prehistoric Period.

Mobility and Sedentism

Theories about hunter-gatherer settlement systems often refer to the dichotomy between mobility and sedentism, although these terms are seldom operationalized. Jones et al. (2003) and Kelly (1992, 1995, 1999), however, provided useful definitions for these concepts, which are summarized here. The issues of mobility and sedentism are particularly important for this study, as inferences are made regarding residential mobility, population recession and/or aggregation, and other population movements in the western Mojave Desert during the MCA.

Jones et al. (2003:9) defined mobility as the "various strategies of movement and settlement in relation to properties of the natural environment." Kelly (1999:121) defined it as "movements of an entire residential unit, such as a family," and added the concept of logistical movements, which are "forays made by individual or small parties of men and/or women to and from a residential camp." Noting that mobility is "universal, variable, and multi-dimensional," Kelly (1992:43) offered several dimensions of mobility, including the number of residential moves per year, average distance per residential move, logistical mobility, territorial coverage, return rates, and risk (also see Kelly 1995). An understanding of the dimensions of mobility in the archaeological record is necessary "because the ways people move exert strong influences on their culture and society" (Kelly 1992:43). Studies of mobility typically refer to such issues as location and group size, diet breadth, and transportation costs associated with movement and foraging activities (Kelly 1992:46-47). Mobility may also occur for reasons other than subsistence, such as to visit friends, to explore, or to relieve boredom (Kelly 1992:48).

Kelly (1995:148) defined sedentism as a reduction of mobility until ultimately a culture remains residentially stationary year-round. He cautioned, however, that sedentism is a matter of degree, in that some settlement systems become "less mobile" than they once were (Kelly 1992:49, 1995:148). Thus, mobility and sedentism could be regarded as part of a continuum rather than a true dichotomy. As Kelly (1992:60) put it, "No society is sedentary, not even our own industrial one—people simply move in different ways." The process of sedentism is particularly intriguing, in that permanent residence goes hand-in-hand with increasing sociopolitical complexity, including social hierarchy, differential access to resources, political dominance, gender inequity, food

storage, territoriality, and demography (Kelly 1995:148; also see Kelly 1992; Bettinger 1999).

Site Reuse

In looking at Tables 8 through 12 in Chapter 6, the pattern that appears to emerge is that many sites were reoccupied over multiple time periods, indicating some degree of residential continuity. This suggests that the western Mojave Desert may have witnessed fluctuations in the intensity of site use, rather than a change in overall settlement patterns. Such a proposal begs the question of whether site reuse was the result of different people using a site at different times, or the same people using different strategies over time at the same site. If the former is true, it would suggest population movements in the desert throughout its prehistory, and thus sites may have been somewhat more transitory in nature. If the latter is true, it suggests that perhaps there was little population movement (at least in some parts of the desert), but rather that a site had some type of advantage over other sites, such as a preferred resource, proximity to water, favorable climatic conditions, or some other benefit. Population fluctuations, environmental conditions, technical innovation, or other factors could explain the pattern of site reuse over time.

In their study of prehistoric hunter-gatherers in Wyoming, Smith and McNees (1999:129) observed that site reuse by hunter-gatherers "is typically interpreted in terms of their relationship to natural features of the landscape . . . particularly in contexts where prime resource patches (e.g., water holes) are relatively scarce." Such areas would then be repeatedly reoccupied "unless or until costs resulting from previous occupations of such locations made them less attractive than alternative . . . locations" (Smith and McNees 1999:129). They argued that the periodic use of slab-lined cylindrical basins found at a number of sites in southwest Wyoming indicate that hunter-gatherers in this

region repeatedly used such basins over extended periods of time in locales that were reoccupied over thousands of years in some cases (Smith and McNees 1999:133). In another study relating technology to site reuse, Nelson and Lippmeier (1993:291) argued that grinding implements in prehistoric New Mexico demonstrated the "[r]egularity and anticipation of site occupation or use [which] indicates an entrenched pattern of movement." As such, "distinguishing the extent to which site visits are anticipated and regular can enhance our understanding of how places and resources were used and how land was organized" (Nelson and Lippmeier 1993:302).

Changing Settlement Patterns and Population Recession

Based on the archaeological evidence at Koehn Lake and other sites in the Fremont Valley, Sutton (1996:235) argued that by about 2,000 B.P. people had started living in villages, suggesting an increase in population size in the western Mojave Desert at about (or just prior to) this time. This proposal for population expansion is supported by the presence of large Rose Spring village sites at Rose Spring (Yohe 1992) and Coso Junction Ranch (Whitley et al. 1988), as well as the increase in sites post-2,300 B.P. in the Coso region (Gilreath and Hildebrandt 1991) (see Chapter 5). This proposed village life and population expansion beginning at the terminal Gypsum Period and continuing into the Rose Spring Period strongly suggests an environmental amelioration at this time. It also supports the proposal by some scholars that the time span of the Rose Spring Period should be extended back a few hundred years, to perhaps 2,000 B.P. (e.g., Yohe and Sutton 2000b).

The argument for this population increase and concomitant settlement change between the Gypsum and Rose Spring periods relies on the idea that Gypsum Period sites are scarce in the Mojave Desert (Figure 29). While this may be true in the western Mojave Desert, it does not appear to be the case in other parts of the desert, such as Fort

Irwin in the central Mojave Desert and Death Valley in the eastern Mojave Desert. In these two areas, a substantial number of Gypsum Period sites has been documented (e.g., Basgall et al. 1988; Basgall and Hall 1992; Hunt 1960; McGuire and Hall 1988; Wallace 1988b), suggesting that a true paucity of such sites does not exist in other parts of the Mojave Desert. Moreover, it may not even be true for the western Mojave Desert, as suggested by the Gypsum Period sites listed in Table 8, as well as the Gypsum Period components at Rose Spring (CA-INY-372; Yohe 1992), Coffee Break (CA-KER-5043; Gardner 2002), and the Siphon site (CA-SBR-6580; Sutton et al. 1993) (keeping in mind the dating problems of some of these sites; see Chapters 5 and 6).

These exceptions suggest that rather than an actual dearth of such sites, it may simply be a function of sample size, or perhaps some of the study sites that are undated or tenuously dated are, in fact, Gypsum Period sites. As Sutton (1996:232-233) observed, the Gypsum Period represented a time of cooler and wetter conditions—at least during the first half of the period—from that of the immediately preceding Pinto Period, a situation that would likely have influenced cultures in terms of increased population, trade, and sociopolitical complexity. The identification of additional Gypsum Period sites is essential for future archaeological research in the western Mojave Desert in order to clarify this issue.

As the Rose Spring Period came to a close, there is evidence of population recession in much of the western Mojave Desert, continuing into the Late Prehistoric Period (Sutton 1990:6; see Figures 37, 38, and 39, Tables 10 and 11). This does not seem to be the case, however, at the Red Mountain sites in the west-central Mojave Desert, where Allen (2004:9) reported that use of Red Mountain Spring (formerly known as Squaw Spring) continued from the Rose Spring to Late Prehistoric periods, although the spring was never considered to be as productive as those to the west and south of Red Mountain. It is also not the case in

the Fort Irwin region in the central Mojave Desert, where a significant number of sites has been dated to the Late Prehistoric Period (e.g., Basgall et al. 1988; McGuire and Hall 1988).

Other Late Prehistoric Period occupations in the study area include two sites in the Summit Valley of the south-central Mojave Desert (Deep Creek [Altschul et al. 1989] and *Guapiabit* [Sutton and Schneider 1996]). As discussed in Chapter 6, however, the Summit Valley sites are just outside the southeastern fringe of the western Mojave Desert in a different environmental zone. Thus, they may have been more favorable locations in terms of subsistence resource availability and population density than other areas of the western Mojave Desert, even during times of environmental stress. As such, the inhabitants may not have experienced the same level of stress that populations further north did.

Additional sites with Late Prehistoric components only (see Table 10) include CA-KER-733 in the Antelope Valley (Sutton 1984), CA-KER-520 in the Rosamond site complex (Everson and Sutton 1993), CA-KER-2210 at Cantil (Sutton 1991b), two of the Rogers Lake sites (CA-KER-1180 and -3377; Byrd et al. 1994), and a few in the Coso Volcanic Field (Gilreath and Hildebrandt 1997). All of these sites had low artifact densities consisting mostly of debitage, the largest of which was CA-KER-1180 (28,000 $m.^2$), although the rest of the sites were much smaller. While 10 of the 12 multiple component sites had Late Prehistoric Period components (see Table 11), the majority of those was considered to be primarily Rose Spring in age, with more ephemeral Late Prehistoric occupations.

Thus, this site distribution pattern may not be suggestive of a population recession as much as it may indicate a population shift to a different settlement pattern. Based on the current available information from the archaeological record of the western Mojave Desert, sites appear to have been relatively spread out across the landscape for much, if not most, of

prehistory. Under the scenario of a population shift toward the end of the Rose Spring Period and beginning of the Late Prehistoric Period, people would have begun to aggregate into more compact settlement units, as a way of "joining forces," so to speak, to make better use of diminishing resources as a result of environmental deterioration. If this scenario is accurate, it should be evident in the archaeological record of the study area in the form of site clusters, rather than scattered settlements.

This may be the case at Cantil (Sutton 1991b), as one of the seven sites (CA-KER-2210) was interpreted as a Late Prehistoric Period site, and another (CA-KER-2211) as a multiple component Rose Spring/Late Prehistoric Period site. A third site (CA-KER-2215) was tenuously dated (through obsidian hydration only) to the Rose Spring Period but may, in fact, date to Late Prehistoric times. An additional site (CA-KER-2209) dated to the Gypsum Period may actually be Late Prehistoric in age (see Chapters 5 and 6). Thus, it is plausible to suggest that these four sites in the Cantil complex—and perhaps the undated site (CA-KER-2212)—may have been contemporaneous Late Prehistoric Period sites, only one of which (CA-KER-2211) contained evidence of extensive habitation (16 features, including hearths, an obsidian cache, and a structure; Sutton 1991b).

It is possible, then, that if populations were aggregating in the Cantil area during the Late Prehistoric Period, perhaps CA-KER-2211 was the major center of activity, and the other sites were subsidiary or special-purpose satellite sites to that center. The Koehn Lake site might fit somewhere in this scenario, as it is within an easy day's walk from the Cantil sites and is at least double the size of CA-KER-2211 (see Chapter 5). While the Koehn Lake site is overwhelmingly Rose Spring in age, it has a thin veneer of Late Prehistoric material; thus, even during times of resource stress, it could have been occupied (or reoccupied) on a much smaller scale and may have acted as the core of activity for the Cantil sites during this

time of proposed population aggregation. In the absence of chronological control of some of the Cantil sites, however, this suggestion must remain speculative.

A similar pattern may also be true for the Rogers Lake sites (Byrd et al. 1994), as two of the sites (CA-KER-1180 and CA-KER-3377) date to the Late Prehistoric Period, and two others (CA-KER-1765 and CA-KER-3379) were undated but may be Late Prehistoric in age. In addition, although CA-KER-526 was identified as a Gypsum Period site (Byrd et al. 1994:156), the shell beads from the site provide meager evidence of a Late Prehistoric Period component (as well as a potential Rose Spring Period component), possibly of much smaller size and scope than earlier occupations. Again, without better chronological control, one can only speculate about the relationship between these sites.

Conversely, of the 15 sites at the Rosamond complex in the Antelope Valley south of Cantil, only one (CA-KER-520) was interpreted as Late Prehistoric in age, while four had Rose Spring Period components, two had Pinto Period components, and eight were undated (Sutton 1993b). Thus, the Rosamond sites do not support the idea of population aggregation during the Late Prehistoric Period, although in the absence of chronometrics at more than half the sites, it is difficult to deny the possibility. On the other hand, 12 of the 15 Rosamond sites (including the eight undated sites and CA-KER-520) were identified as either lithic reduction sites or as small camps with a focus on lithic reduction, with rhyolite as the almost exclusive toolstone material being reduced. As the Rosamond site complex is less than 50 miles south of the Cantil complex, it is conceivable that the undated Rosamond sites were also satellite locations to CA-KER-2211 for the express purpose of acquiring and processing rhyolite. This is not an unreasonable distance in terms of transportation costs, as ethnographic accounts in the Great Basin have demonstrated that resources were transported to residential bases from distances up to about 100 km. (roughly 60 miles) (Rhode 1990:

414; also see Bettinger 1977; Thomas 1973, 1988). For the Rosamond complex, however, this suggestion must be tempered, given the absence of adequate chronometric data.

Alternatively, the Rosamond site complex may have more of a connection to CA-KER-303 than to the Cantil complex or Koehn Lake. CA-KER-303 is closer to the Rosamond sites than Cantil, as it is situated approximately 20 miles west of Rosamond Lake. Although there is no site report available (nor were the raw data accessible for this study), in an overview of western Mojave Desert archaeology, Sutton (1988:58) noted that radiocarbon assays and projectile point typology dated CA-KER-303 between 2,400 and 300 B.P. The site contained a large cemetery, three structures, and numerous trade items, including an enormous quantity of shell beads and ornaments (> 100,000) and a number of glass beads.

Although CA-KER-303 is a relatively small site (ca. 3,500 m.^{2}), it is extremely dense in terms of its artifactual remains and quite deep for its size, with a site deposit over two meters deep in some areas (Sutton 1988:56). The small size but extreme complexity of this site, along with the presence of numerous trade items, led Sutton (personal communication 2005) to suggest that CA-KER-303 was part of a system of regional interaction spheres in the Mojave Desert and may represent a trading center near the intersection of three spheres that included the Kitanemuk, the Serrano, and the Kawaiisu (also see Sutton 1989:111). If so (and assuming at least some of the sites are contemporaneous), perhaps the inhabitants at the Rosamond complex were involved in trading activities at CA-KER-303, possibly to trade rhyolite for some other resource. It remains conceivable that the inhabitants of the Rosamond site complex had their primary residence at Cantil or Koehn Lake, traveling from there to Rosamond and then to CA-KER-303 prior to returning home.

Looking at ethnographic correlates of population aggregation and dispersal in other regions of the world, it is possible that the proposed aggregation in the western Mojave

Desert may have been rooted in kinship affiliations, as seen among the !Kung San of the Kalahari Desert of southern Africa. A !Kung San camp typically includes relatives and other people referred to as kin regardless of their actual relatedness (Lee 1979:55). These would be individuals who "can live and work well together" (Lee 1979:55). In another example, for the Mardu of western Australia, the "rhythm of desert life is one of alternating aggregation and dispersal of social groups" (Tonkinson 1991:37). Their adaptation and group size varies according to local environmental conditions and the availability of food. Tonkinson (1991:37) also observed that for the Mardu, as for any human population, "it is important to distinguish between long-term climatic variations caused by droughts and short-term variations that occur within a yearly cycle and relate to seasonal changes in climate."

Archaeological correlates can be seen in North America, particularly in the Southwest. For example, using a selectionist model consisting of a number of variables, including aggregation, population size, specialized agricultural strategies and tactics, labor organization, and environment, Leonard and Reed (1993:656) argued that their model "clearly predicts aggregation during times of climatic deterioration . . ." (but see Kohler and Sebastian 1996). Applying their model to the Zuni, Leonard and Reed (1993:654) maintained that the Zuni shifted from dispersed to aggregated occupations by the early A.D. 1300s, a pattern that has been observed in other areas of the Southwest. They added that while sites dating between about A.D. 1250 and 1300 (and perhaps later) are predominantly situated along major waterways, "they are widely distributed and aggregated, leaving large amounts of productive land vacant" (Leonard and Reed 1993:655).

Regardless of whether there was a population recession or a settlement system shift (or both) in the western Mojave Desert during the Late Prehistoric Period, it seems obvious that

the environment played a role in whatever occurred at this time. We know important changes took place—that is why the name of the period changed from Rose Spring to Late Prehistoric. Why they occurred is less clear, although it is argued here that the MCA was a significant factor (see below and Chapter 8).

The Numic Expansion

One of the more enduring and hotly debated research topics in the Great Basin is the population movement known as the Numic expansion (or Numic spread), which addresses the place of origin and movement of Numic groups beginning about 1,000 years ago (e.g., Aikens and Witherspoon 1986; Beck 1999; Bettinger and Baumhoff 1982; Hopkins 1965; Kelly 1997; Lamb 1958; Madsen and Rhode 1994; Sutton 1987, 1994; Young and Bettinger 1992). Sidney Lamb (1958) was the first to address this issue in detail, garnering both support and criticism for his ideas (e.g., C. Fowler 1972; Miller 1966; but see Goss 1977).

The majority view is that this expansion originated in southeastern California, moving north and east (Sutton 1987:16). This view was initially based on the spatial distribution of mother/daughter locations of various language groups (Sutton 1987:23). The argument does not have universal appeal to scholars, however; for example, Aikens and Witherspoon (1986:15) insisted that the homeland of the Numic was the central Great Basin. A number of explanations has been proposed for the causes and mechanisms of the Numic expansion, including technological innovation (e.g., Bettinger 1976), competition between adaptive strategies (e.g., Bettinger and Baumhoff 1982), population pressures (e.g., Fowler 1983), environmental degradation (e.g., Jones et al. 1999), and warfare (e.g., Sutton 1986b). While some scholars have viewed these mechanisms as mutually exclusive, it is more likely that a combination of factors explains this phenomenon.

The idea of warfare as a mechanism for population movement and/or replacement in the Great Basin has never been especially popular (Linton 1944; Manners 1974; Steward 1938; but see Ambler and Sutton 1989; Sutton 1986b, 1987, 1994). However, based on ethnographic accounts of aggression by various Great Basin groups, Sutton (1986b:77) argued that Numic populations were "militarily aggressive and inclined to exploit their non-Numic neighbors." This was prior to the introduction of the horse; when horses finally became available, this hastened the expansion (Sutton 1986b:77). Since such activities were being documented at the time of contact, it seems reasonable to assume that they were occurring prior to that time.

Population pressures and environmental degradation have frequently been proposed as causal factors for the Numic expansion in the Great Basin (e.g., Aikens and Witherspoon 1986; Fowler 1983; Gunnerson 1962; Rudy 1953; Sutton 1987). Most agree that there was a drying trend beginning roughly 1,000 years ago (i.e., the MCA), forcing changes in subsistence systems and/or leading to population decline in several areas (e.g., Aikens 1994; Aikens and Witherspoon 1986; Sutton 1987, 1994; see above). Sutton and Hansen (1986:27-28) suggested that such conditions in the southern Sierra Nevada may have precipitated a population movement out of that area. They further argued that the "geographical location and timing of such a hypothesized population movement seems to 'fit' the hypothesized Numic Expansion" (Sutton and Hansen 1986:7).

Evidence for the Numic expansion has been derived from a variety of sources, including linguistic studies, archaeological investigations, biological analyses, ethnohistoric records, and oral tradition (e.g., Sutton 1987). Based on such evidence, Sutton (1987:172) proposed one scenario unrelated to climate change to explain the Numic expansion; that is, that the Numic moved into the rest of the Great Basin with large population aggregates and a

preexisting settlement pattern, taking over particular resource patches and denying access to the Prenumic (the term used for the people who lived there just prior to the Numic). As Bettinger and Baumhoff (1982:486) noted, this would be a situation in which "one hunter-gatherer group successfully displaces others by virtue of competitive advantages inherent in its adaptive strategy." This may have resulted in "immediate and severe disruption of the Prenumic strategy leaving them little to do but move on" (Sutton 1987:172). As the expansion progressed, the Numic would have established villages along the way—a settlement pattern they brought with them from their homeland in southeastern California—where they could find "good pinyon stands, large concentrations of hard-seeded grasses, and available large game" (Sutton 1987:172-173).

The decline of ungulate populations in the Great Basin has also been considered a possible factor in the movement of human groups during the Late Prehistoric Period, especially mountain sheep (e.g., Bettinger and Baumhoff 1982; Kelly 1985; Simms 1987). Along with a decline in mountain sheep populations at this time, there may have been an increase in the hunting of smaller game and plant utilization (Bettinger and Baumhoff 1982:495; Sutton and Rhode 1994:15). What is not clear in this proposition is whether these changes in adaptation are indicative of a population movement of Numic peoples or simply a change in resource procurement tactics and/or technological innovation (e.g., the beginnings of pinyon exploitation [Sutton and Rhode 1994:15]).

Some support for the argument of human population movement as a result of declining ungulate populations is found in the elaborate Coso style rock art of the Great Basin that frequently depicts mountain sheep, hunting weapons, and game trails (e.g., Bettinger and Baumhoff 1982; Hildebrandt and McGuire 2002; Rogers and Rogers 2004). The function of this type of rock art has been a matter of some debate, some suggesting that it was part of

a "magico-religious" ritual to ensure hunting success (e.g., Bettinger and Baumhoff 1982; Davis and Smith 1981) and others claiming that it represents a shamanic method of controlling the weather (e.g., Whitley 1994; but see Quinlan 2000). It is believed that the Prenumic were the creators of this art, rather than the Numic, primarily because the Numic speakers themselves have disavowed any knowledge of its origins (Bettinger and Baumhoff 1982:493).

Bettinger and Baumhoff (1982:493-494) maintained that the time and effort put into this art form suggest that "the procurement of large game was a major aspect of Prenumic subsistence and of sufficient importance to warrant the reservation of specific areas exclusively for this activity" and that the "absence of a similar ritual tradition among Numic peoples is significant and suggests lesser reliance on game as a subsistence resource." They further argued that the absence of associated occupation sites where such art is found supports this proposal (Bettinger and Baumhoff 1982:493). While this may be true for the most part, recent research at the Terese site (CA-KER-6188; Rogers and Rogers 2004) in the study area provides evidence (albeit meager) to the contrary. The Terese site, which has both Gypsum and Rose Spring period components, was interpreted as a long-term occupation site with numerous boulders containing Coso style rock art depicting mountain sheep (as well as other elements).

Bettinger (1999:73) proposed another factor that might be related to population movement in the Great Basin, arguing that during the late Medithermal there was a social transformation in which resources began to be treated as private property, at which point storage became more common. Whether a hunter-gatherer group chooses to store is based on whether food is regarded as public or private goods, which will have an impact on the degree of resource sharing. This practice of resource sharing is typically viewed as so

common among such groups that storage of resources by individuals would be strongly discouraged and those who practiced it would be subject to social ostracism (Bettinger 1999:71). As few attempts at storage are apparent in the Great Basin prior to about 1,700 years ago, this "very likely accounts for the failure of Great Basin populations to grow as quickly and as soon as they theoretically could have in the presence of storage" (Bettinger 1999:71). This social transition from public to private goods would have bestowed competitive advantages; thus, one possibility to account for this transition is population invasion and replacement, such as the Numic expansion (Bettinger 1999:71-72).

As the Numic homeland is in the Mojave Desert (see Sutton 1987), some of the traits attributable to the Numic should be obvious in the archaeological record of this region. For example, most of the Rose Spring Period components in the study sites display one or more traits that suggest they may have been inhabited by the Numic. First, the presence of three large "villages" and one "large site" at Rose Spring (Yohe 1992), Coso Junction Ranch (Whitley et al. 1988), Koehn Lake (Sutton 1990; Sutton and Hansen 1986), and CA-KER-1998 (Sutton and Everson 1992) support the argument that the inhabitants were the Numic who continued their preexisting settlement and subsistence patterns during the expansion (e.g., Sutton 1987). This suggests long-term occupation of the Numic in the western Mojave Desert, with these patterns developing slowly.

A second argument for the potential identification of Numic traits in the study sites is that of the 12 sites with Rose Spring Period components, only two contained rock art; a single petroglyph with a geometric design at Freeman Spring (CA-KER-6106; Williams 2004) and numerous panels of Coso style rock art at the Terese Site (see above). As noted above, Bettinger and Baumhoff (1982) suggested that the absence of such rock art during this time may indicate a Numic occupation.

A final consideration of the Numic expansion is the paucity of ungulate remains and overwhelming abundance of small game (particularly lagomorphs) from most of the Rose Spring study sites—most notably from the Rose Spring Period components at Koehn Lake (CA-KER-875), Cantil (CA-KER-2211), and Rose Spring (CA-INY-372). This suggests that there was a decline in ungulate populations and a concomitant escalation in the hunting of smaller game along with increased plant utilization, which Sutton and Rhode (1994:15) proposed might be indicative of the movement of Numic populations (see above).

As noted above, it is likely that multiple causes were responsible for the onset and progress of the Numic expansion. It seems obvious to this author that if there were population pressures due to environmental degradation at this time, warfare and migration would be two possible (and not necessarily mutually exclusive) mechanisms for coping with these stresses. These coping mechanisms are just as common in the modern world as they were for hunter-gatherers of the past. This is all the more true in a desert region such as the Mojave Desert, where droughts and the stresses associated with drought (e.g., an increase in summer rainfall [Wigand and Rhode 2002]) can often have debilitating effects on humans and other biotic communities.

A Suggested Revision of the Late Holocene Chronology for the Western Mojave Desert

Archaeologists typically base time periods on technological changes (e.g., projectile point types), sociopolitical transformations (e.g., the emergence of social hierarchy), and/or major climatic shifts (e.g., the desiccation of Pleistocene lakes). Based on the climatic and archaeological data presented in this study, then, a minor revision in the Late Holocene chronology of the prehistoric western Mojave Desert is proposed here.

This revision is based on several factors. First, there is a span of time in the western Mojave Desert for which climate and technological changes overlap the currently accepted time periods, that being the end of the Gypsum Period and the beginning of the Rose Spring Period. This span of time, between about 2,000 and 1,500 years ago, witnessed an increase in effective moisture, an apparent gradual population increase, the development of villages and large sites near major water sources, and the introduction of the bow and arrow. As such, it is recommended that the Rose Spring Period be extended back in time to 2,000 B.P., as originally suggested by Yohe and Sutton (2000), although Sutton et al. (MS) proposed that this period be extended only to 1,800 B.P. For the sake of simplicity, I further suggest that the designation "Elko" be eliminated altogether and that the period be referred to as "Gypsum."

Second, the MCA begins in the Mojave Desert about the middle of the Rose Spring Period (ca. 1,200 B.P.), signaling the return of arid conditions that continued until about 650 B.P. That alone could be the basis for starting a new time period if we only considered climate in the equation. However, assuming it takes a drought some time to reach its peak, and keeping in mind that there are several well-dated Rose Spring Period study sites that date between 1,200 and 900 B.P., then perhaps the Late Prehistoric Period should begin at about 900 B.P. (ca. 300 years after the inception of the MCA) (also see Sutton et al. MS for their argument regarding the time frame for Late Holocene cultural complexes). Thus, it is suggested here that the Late Holocene chronology of the western Mojave Desert be revised as shown in Table 23.

Caution should always be taken with such chronologies, however, because we as archaeologists attempt to define these temporal constructs based on an archaeological record that is, and will always be, incomplete; as such, they are artificial constructs. This

Table 23. Suggested Revised Late Holocene Chronology for the Western Mojave Desert

Period	Revised Time Frame
Gypsum Period	4,000 B.P.-2,000 B.P.
Rose Spring Period	2,000 B.P.-900 B.P.
Late Prehistoric Period	900 B.P.-Contact

should not be construed as an indictment of chronological frameworks; on the contrary, it would be impossible to interpret archaeological data without them. But as with any attempts to categorize cultural traits (e.g., types of subsistence systems, levels of political complexity), the time period designations archaeologists use are merely analytical units by which we compare sites, sites complexes, and regions. For that reason alone, chronologies such as the one proposed here are essential for making interpretations of the archaeological record. While this particular revised chronology is by no means earth-shattering, maybe it can fine-tune our understanding of the transitional phases of western Mojave Desert prehistory during the late Holocene.

Summary

This chapter has suggested an association between certain culture changes and the Medieval Climatic Anomaly in the western Mojave Desert. Due to the nature of the archaeological record, a direct association is rarely possible to achieve, although the data in this study provide more compelling evidence for some changes than for others. To recapitulate, the following summary briefly outlines the culture traits that may have been precipitated by this environmental episode (also see Chapter 8).

1. An extreme focus on lagomorphs in multiple component Rose Spring/Late Prehistoric Period sites, with a steeply declining emphasis on this resource during the

Late Prehistoric Period, perhaps as the result of a decline in lagomorph populations due to drought conditions.

2. Differences in ground stone assemblages and patterns of milling activity spanning the Gypsum, Rose Spring, and Late Prehistoric periods that may be the result of a change in the plant resource inventory as a potential consequence of climate change.

3. Florescence of the bow and arrow during the Rose Spring Period concomitant with an apparent subsistence focus shift from artiodactyls to smaller game, coupled with decreased residential mobility (although this is less evident in the western Mojave Desert than in other parts of the Mojave Desert). As bow and arrow technology arrived earlier than the MCA, it could not have developed *because* of the MCA, but may have been an indirect response to changing climatic conditions and/or sociopolitical conditions during the Rose Spring Period.

4. Severe reduction in obsidian use beginning toward the end of the Rose Spring Period and continuing into the Late Prehistoric Period, and specific reduction in the use of obsidian within the Coso Volcanic Field in favor of intensified seed processing activities.

5. Human population increase during the early Rose Spring Period, as evidenced by more and larger sites, gradually declining sometime between the Rose Spring and Late Prehistoric periods, which may have been the result of recession and/or population aggregation due to drought conditions.

6. Migration of human populations by way of the Numic expansion beginning approximately 1,000 years ago. The proposed causes and mechanisms for this migration include environmental degradation, technological innovation, competition between adaptive strategies, warfare, and/or other population pressures.

Is it possible that some of these traits had less to do with environmental stress than other factors, such as simple adaptive adjustments that are not directly related to the environment? Undoubtedly, but on the other hand, "although other factors certainly play a role in cultural adaptation, environmental fluctuations *must* be taken into consideration, and not simply dismissed as being of little significance" (Gardner 2002:16).

CHAPTER 8

CONCLUSIONS

Evaluation of the Research Questions

As stated in Chapter 2, the core hypothesis of this study is that culture changes that commenced about 1,200 years ago in the western Mojave Desert are associated, at least to some degree, with the MCA. Research questions were then generated in order to address the core hypothesis. The following is an evaluation of those research questions and whether the data expectations were met as a result of this study. This evaluation begins by reiterating the questions from Chapter 2. For the purpose of this evaluation, the first two questions from Chapter 2 are combined.

1. *Was the MCA a significant factor in culture change in the western Mojave Desert?*

2. *In other words, were specific technological and social changes—such as population fluctuations, settlement shifts, and technological adjustments—a response to this environmental episode?*

This question was addressed by comparing various aspects of the archaeological assemblages from the data sets described in Chapter 5, including the faunal and botanical remains, material culture, age, and function of each of the study sites. Although the small sample size of some of the botanical assemblages (and to a lesser degree some of the faunal assemblages) could have skewed the analysis, the totality of the archaeological

record tends to support the hypothesis that the MCA was a significant contributing factor in culture change in this desert region. The following provides support for this argument.

While the evidence is not overwhelming, the macrobotanical assemblages in the study sites demonstrate an increase in juniper and pine during the early part of the Rose Spring Period, both of which are mesic-adapted species. This would be expected if the Mojave Desert was experiencing a climatic amelioration from the terminal Gypsum Period. These species then appear to decrease in abundance during the Late Prehistoric Period. Toward the end of the Rose Spring Period and continuing into the Late Prehistoric Period, mesquite and Cheno-ams increase, both of which are xeric-adapted species. This would be expected if the environment had become arid once again.

The faunal assemblages show a definite trend for lagomorphs, in that they show an increase between the Gypsum and Rose Spring period components of the study sites, after which they show a more dramatic increase in the Rose Spring/Late Prehistoric Period study site components (especially if the rabbit-sized specimens are taken into consideration), followed by a steep decline during the Late Prehistoric Period. Rodent species show a similar trend, although in much smaller quantities. Coupled with the admittedly meager botanical evidence, this strongly suggests that climatic fluctuations were influencing the abundance of both botanical and faunal species in the study area throughout the late Holocene, which would have affected cultures in terms of the availability and distribution of such resources.

Changes in settlement, subsistence, and population density between the Gypsum and Rose Spring periods are apparent in that villages did not begin to become established in the western Mojave Desert until about the end of the Gypsum Period. As noted above,

this settlement change was concomitant with a shift in subsistence to an extreme focus on lagomorphs and other small mammals. Sometime between the late Rose Spring and early Late Prehistoric periods, changes in settlement and subsistence are evident in the reduced size and number of habitation sites and a decreased focus on lagomorphs.

As noted above, changes in technology suggest an environmental response (although there are other reasons for technological changes). For example, the bow and arrow made hunting ungulates much easier, eventually leading to a decline in ungulate populations, which may have been exacerbated by environmental deterioration. This decline likely led to a change in the processing technique of large animals; i.e., now the bones were being smashed in order to maximize the yield of grease and protein, suggesting a response to diminishing resources due to deteriorating climatic conditions. This could explain the scarcity of ungulate remains in the archaeological record of the study area.

Another change in technology was an increase in milling implements between the Gypsum and Rose Spring periods, which may be related to the aforementioned subsistence focus shift. During the Rose Spring Period, changes include a major expansion of the bow and arrow, as well as a substantial increase in milling tools, both of which suggest a change in resource acquisition and/or availability. While it could be due to sampling bias, there appears to have been a subsequent decrease in the number of milling tools during the Late Prehistoric Period, with the possible exception of the multicomponent CA-KER-2211 site, where quite a few manos and metates that may be Late Prehistoric in age were recovered.

A final technological consideration is the obsidian procurement, processing, and trade system in the Mojave Desert, which was a crucial aspect of Rose Spring Period sites in the study area, after which it declined radically during the Late Prehistoric Period.

Eventually, the system collapsed, possibly due to a combination of cultural and climatic changes that occurred at about the same time.

Taken together, the evidence for these social and technological changes supports the argument that the MCA was at the very least a contributing factor in these changes. While this argument is not indisputable (and not without its detractors), the synchrony of the environmental and cultural changes cannot be ignored. This statement should not be construed as suggesting that the MCA was the sole cause of culture change in the western Mojave Desert during this time, only that it was an important influence that cannot be rejected as insignificant.

3. Does the model proposed by Sutton fit in with the core hypothesis?

As discussed in Chapters 1 and 2 and reiterated in part here, Sutton (1990, 1991a, 1991b) developed a regional model of changing settlement and subsistence patterns in the western Mojave Desert that posited a relationship between culture change and environmental fluctuations over the last 4,000 years. The model suggests that during the early part of the Rose Spring Period, environmental conditions were more mesic; thus, prehistoric populations in this region would have intensified their exploitation of lacustrine resources at Koehn Lake and aggregated near the lake in permanent habitation sites. The model further postulates that beginning in the latter part of the Rose Spring Period and continuing into the Late Prehistoric Period, the climate became increasingly arid; as a result, people began to move further and further from the lake. According to the model, this would have resulted in a population decrease and/or a change from permanent habitation to more seasonal sites.

As noted in Chapter 2, to see how (or if) Sutton's model fits in with the core hypothesis, it was necessary to determine whether there was evidence of lacustrine

resources, aggregation near large sources of water, relatively large populations, and at least semipermanent residence in the Rose Spring Period components of the study sites. In the Late Prehistoric Period components, it was necessary to find evidence of a decrease in the use of lacustrine resources, residence away from large water sources, a population decline, and occupation in smaller seasonal sites in the study area.

Based on the evidence from the Rose Spring (CA-INY-372) and Koehn Lake (CA-KER-875) sites, both of which were interpreted as villages with predominantly Rose Spring Period occupations and both adjacent to once-substantial bodies of water, this part of the model is supported. To a lesser degree, the model may also be supported by the evidence from Oak Creek Canyon (CA-KER-1998), Cantil (CA-KER-2211), and Cross Mountain (CA-KER-4619), although these three sites were not necessarily considered to be predominantly Rose Spring in age. Juniper, pine, and wire grass, all mesic-adapted species, were relatively abundant at some of these sites, which also supports the model. Of course, this scenario is predicated on the assumption that there were Rose Spring Period lakes at these sites (i.e., that they had water in them), an assumption for which the current evidence is strong (at least for Koehn Lake), but circumstantial. More hydrologic studies are necessary to verify this argument.

Of the single-component Late Prehistoric Period study sites, CA-KER-261, -520, -733, -1180, -2210, and -3377 were described as temporary, short-term, special activity, or small sites. While all were located near water sources that at one time were relatively large, by the Late Prehistoric Period those sources are thought to have become severely desiccated. CA-KER-261 and -733 contained a few botanical remains, but CA-KER-520, -1180, -2210, and -3377 had no such remains. The other two Late Prehistoric Period sites, Deep Creek (CA-SBR-176) and *Guapiabit* (CA-SBR-1913), were described as a

base camp and an ethnohistoric village, respectively. Both of these sites contained drought-tolerant species such as saltbush.

Thus, while the part of Sutton's model dealing with the Late Prehistoric Period is partially supported, the presence of sites regarded as at least semipermanent (Deep Creek and *Guapiabit*) tends to weaken it, although in the absence of additional Late Prehistoric sites, it is difficult to determine whether this may simply constitute a bias in the sample size. Moreover, the model does not state that *no* such sites would be present during the Late Prehistoric Period, only that they would be diminishing in size and quantity, which does appear to be the case. It is also important to reiterate here that Deep Creek and *Guapiabit* are on the extreme southeastern fringe of the study area and are adjacent to the Mojave River, so they may not be representative of the western Mojave Desert as a whole.

Overall, the evidence from the study sites supports the model proposed by Sutton (1990, 1991a, 1991b; also see Gardner 2002). Further archaeological investigations with these problems in mind will most likely clarify these issues, and will undoubtedly force a modification and/or reevaluation of the model. So Sutton's model does what any model usually does and probably should—raises more questions than answers.

Evaluation of the Data Expectations

To answer the question of whether the data expectations outlined in Chapter 2 were met, they are first partially repeated here (in italics) and then evaluated for their accuracy as a result of this study. This evaluation follows the time line from the Gypsum through the Late Prehistoric periods.

Beginning about 2,000 years ago, at the end of the Gypsum Period, juniper woodlands began to decline and desert scrub vegetation increased in many areas of the

Great Basin. These xeric conditions were followed by a period of more mesic conditions during the first part of the Rose Spring Period. If these conditions also prevailed in the western Mojave Desert portion of the Great Basin, then evidence of such environmental change during the Gypsum Period would be apparent in wider distribution and greater diversity of xeric-adapted botanical species at this time, which would have decreased at the same time mesic-adapted species increased during the subsequent Rose Spring Period. Whether those species were being exploited by humans at that time would have depended on resource abundance, ranking, and preference.

Gypsum Period components are rare in this study, and botanical remains ever rarer. Further, despite the volume of work in the nearby central Mojave Desert at Fort Irwin, few botanical remains have been recovered there for comparative purposes. Whether this is due to an actual scarcity of botanical resources or merely a preservation and/or sampling bias is not clear. Thus, while it is difficult to state with any certainty, it seems as if xeric-adapted species were more common during this time than during the Rose Spring Period, but their abundance and distribution remain questionable.

On the other hand, it is clear that mesic-adapted species were more abundant during the subsequent Rose Spring Period, lending support for the argument of wider distribution and greater diversity of such species as compared to the Gypsum Period. Therefore, this data expectation was met, although reaffirming it will require the recovery of additional botanical remains from future archaeological investigations of Gypsum Period sites.

If such changes occurred with the botanical species, then one would also expect to see an increase in the abundance and diversity of faunal species as the Gypsum Period waned and the Rose Spring Period progressed, as more forage and water would have

been available to the local game populations as a result of this proposed climatic amelioration. This should also be evident in the study sites.

As with the botanical remains in the Gypsum Period components in this study, faunal remains are also relatively scarce during this time (with the possible exception of CA-KER-526); however, Gypsum-aged faunal assemblages include lagomorphs, artiodactyls, western pond turtle, and rodents. A comparison with Fort Irwin sites shows that along with artiodactyls (mostly mountain sheep), desert tortoise also appear in Gypsum Period components at this military installation. During the Rose Spring and Rose Spring/Late Prehistoric periods, there is greater diversity and abundance of faunal species, including lagomorphs, deer, bighorn sheep, badger, porcupine, fox, rodents, and avifauna, to name a few. As noted above, the "big ticket" resource during this time was hares and other lagomorphs, in most cases making up the vast majority of faunal remains among the Rose Spring and Rose Spring/Late Prehistoric Period study sites.

Thus, this data expectation was met, although it is possible that this scenario is more apparent than real in the absence of sufficient Gypsum Period components in the western Mojave Desert. Lacking such data, it is possible that Gypsum sites were more seasonal in nature and that the inhabitants focused on one or two resources, which would explain the lack of abundance and diversity of faunal species at known Gypsum-aged sites.

If there were greater abundance and diversity of botanical and faunal species as the Rose Spring Period commenced, then one would expect to see an increase in human population of the western Mojave Desert from that of the Gypsum Period, concomitant with documented changes in settlement, subsistence, technology, and other aspects of culture.

Despite the possibility of a skewed sample size of Gypsum Period components among the study sites, it seems clear that there was a significant increase in human population

beginning in the early part of the Rose Spring Period as compared to the late Gypsum Period, as evidenced by the appearance of large villages at Coso Junction Ranch, Rose Spring, Koehn Lake, and Cantil. Further, there is no doubt that changes in settlement, subsistence, technology, and other aspects of culture occurred at about the same time (see above). This would be expected at a time when preferred resources were at their peak of availability. Therefore, this data expectation was met.

Beginning about the middle of the Rose Spring Period, at the onset of the MCA, arid conditions began to return to the Mojave Desert. Evidence for this has been well-documented by various researchers in the last three decades. Therefore, in the study area archaeological assemblages, one would expect to see a decrease in mesic-adapted botanical species and an increase in xeric-adapted species between the Rose Spring and Late Prehistoric periods in terms of both abundance and diversity.

As noted above, during the Rose Spring Period, juniper, pine, and other mesic species began to increase in abundance. In contrast, botanical remains are relatively scarce elements of Late Prehistoric Period components, with the exception of Deep Creek and *Guapiabit*. At this point, then, although both of these sites contained xeric-adapted species, this data expectation is only tentatively met. The investigation of additional Late Prehistoric Period sites could potentially shed light on this issue, especially if more botanical remains are recovered.

If these changes in the botanical species did occur, then one would also expect to see a decrease in the abundance and diversity of faunal species during the Late Prehistoric Period as compared to the Rose Spring Period.

During the Rose Spring/Late Prehistoric transitional period, lagomorphs are extremely abundant in the faunal assemblages, declining in abundance toward the latter

part of the Late Prehistoric Period. Deer, lizards, birds, and rodents have also been recovered from Late Prehistoric components, but in much smaller quantities than that seen in the Rose Spring/Late Prehistoric Period sites. One exception is deer, which increased in NISP from 226 to 1,148 between the Rose Spring/Late Prehistoric Period and the Late Prehistoric Period. However, as all but one of these specimens were derived from a single site (CA-SBR-1913) and were extremely fragmented, this exception may be due to a change in processing technique and not an increase in the exploitation of deer. Thus, this data expectation has been met.

If the botanical and faunal species decreased in abundance and diversity during the Late Prehistoric Period, then one would expect to see a decrease in human population, along with changes in other aspects of culture. This could include a shift in subsistence reliance toward alternate resources, technological differences to accommodate changing biotic conditions, and population movements.

Keeping in mind the small number of sites with predominantly Late Prehistoric Period components (see Table 10), there does appear to have been a decrease in human population size in the western Mojave Desert at this time, as well as population movement (i.e., the Numic expansion). This proposed population decrease may also have resulted in population recession and/or aggregation in parts of the desert. The presence of possibly contemporaneous site clusters in the study area (Cantil, Rosamond Lake, and Rogers Lake) provides admittedly tenuous support for this latter suggestion. There is no clear evidence of a shift toward alternate resources during the Late Prehistoric Period in the study area, but there may have been a reduction in the diversity of resources.

In terms of technological differences, there is meager evidence from CA-KER-875 and CA-KER-2211 that manos were used for multiple purposes (milling tools and

cooking stones) during the Rose Spring Period, but were used solely as milling implements during the Late Prehistoric Period. This suggests a change in the resource inventory, a modification of the processing technology, or possibly both. Overall, this data expectation has only been weakly met, as it is based on insufficient data at this time to state with any certainty.

Concluding Remarks

It is only through future archaeological investigations that we may be enlightened about the influence of the MCA on human populations in the western Mojave Desert. Specifically, additional Gypsum and Late Prehistoric period sites must be identified to be able to clarify what was happening just before, during, and just after the MCA. Moreover, the identification of sites from various time periods is crucial not just for illuminating how environmental episodes like the MCA may have impacted prehistoric cultures in this desert region, but for other causes of culture change as well. As more sites are investigated, hopefully more faunal and botanical data will be recovered, analyzed, and reported so that we may refine our understanding of resource abundance and distribution—and hence how people adapted to fluctuations in the availability of those resources—throughout prehistory in the Mojave Desert.

To what degree environmental episodes play a role in cultural transitions depends largely on the severity and duration of such episodes. The conclusion of this study is that the MCA was of sufficient severity and duration to have been a motivating factor for much of the culture change that has been observed archaeologically in the western Mojave Desert beginning about 1,200 years ago.

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert[a]

Site	Description	Features	Material Culture[b]	Faunal/Botanical[c]	Dating Type[d]	Age of Site
Inyo County						
CA-INY-372 Rose Spring	village (fall occupation)	15 cooking features, cluster of rocks, possible house	mostly flaked stone items, ground stone, brown ware ceramic sherds, *Olivella* and steatite beads, bone artifacts; DSN, CT, RS, EL, GC	probably mostly *Lepus* (analysis incomplete); Asteraceae, Cheno-am pine, juniper, alder, mesquite, oak, creosote, Mormon tea, cactus, various grasses	RC, OH, PT	Multiple component (Gypsum, Rose Spring, Late Prehistoric)
CA-INY-444 Ray Cave	rockshelter (fall occupation)	burial (older female), hearths, petroglyphs	burial goods (flaked/ground stone, *Olivella* bead, bone artifacts)	rodent, squirrel, *Lepus*, *Sylvilagus* bird (some natural); Chenopodium pinyon hulls, grass seed, Joshua seeds	RC, OH	Multiple component (Gypsum, Rose Spring, Late Prehistoric)
CA-INY-1534A Chapman 1	rockshelter (fall occupation)	5 burials, 4 cache pits, 4 hearths, petroglyph, flagstone wall, "hoard of objects"	flaked/ground stone, pottery, basketry, cordage, matting, arrow fragments, bone awl, figurines, bone beads, *Olivella* bead; leather moccasins; DSN, CT, CL, RS, EG, ECN, PN	(see CA-INY-444)	OH, PT	Multiple component (Gypsum, Rose Spring, Late Prehistoric)
CA-INY-1534B Chapman 2	rockshelter (fall occupation)	single burial with adult and infant (with associated large obsidian knife blade)	flaked/ground stone, bone beads; *Olivella* beads; DSN, CT, CL, RS	(see as CA-INY-444)	OH, PT	Multiple component (Gypsum, Rose Spring, Late Prehistoric)
CA-INY-1535 Junction Ranch	cluster of house rings with petroglyphs (fall occupation)	5 hunting blinds, 5 mortars, 8 house rings, >100 petroglyphs	flaked/ground stone, pottery, *Olivella* beads, bone beads; DSN, CT, CL, RS	(see as CA-INY-444)	OH, PT	Multiple component (Gypsum, Rose Spring, Late Prehistoric)
CA-INY-2284 Coso Junction Ranch	large village (late summer/ early fall or late spring/ early summer occupation)	hearths, ash lenses, "living surfaces," obsidian concentrations, storage pits	flaked stone (and presumably ground stone), shell beads and ornaments; DSN, RG, EL, PN	bighorn sheep, deer, bobcat, coyote, porcupine, *Lepus*, *Sylvilagus*, squirrel, rat, mouse, vole, raven, hawk, snake, lizard; Asteraceae, Brassicaceae, Chenopodiaceae, Laminaceae, Poaceae, Solanaceae, fiddleneck, wild buckwheat, wire grass, mallow beard tongue	OH, PT	Multiple component (Gypsum, Rose Spring, Late Prehistoric)
Kern County						
CA-KER-246 Red Rock Canyon	lithic reduction site	one hearth, presumably modern "pocket drops"	predominantly flaked stone; one EL	very few small mammal remains; cheese brush, Joshua tree, fiddleneck, rabbit brush, cactus, rice grass, buckwheat, saltbush	RC, OH, PT	Gypsum Period

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert (continued)

Site	Description	Features	Material Culture	Faunal/Botanical	Dating Type	Age of Site
CA-KER-250 Bickel Site	single component rabbit drive site (late summer to winter occupation)	small concentration of charcoal with FAR; "lens" of cultural deposit	mostly flaked stone, some ground stone, *Olivella* beads (2); DSN, CT, RG, ECN	*Lepus* (708); *Neotoma* (130); *Sylvilagus* (81); *Artiodactyl* (35); rodents (18); pine seeds	RC, OH, PT	Rose Spring Period
CA-KER-261 Last Chance Site	rabbit drive site	circular hearth with FAR and charcoal	mostly flaked stone, some ground stone	*Lepus* (22); *Neotoma* (2); *Sylvilagus* (1), *Artiodactyl* (1); creosote	RC	Late Prehistoric Period
CA-KER-733	special activity site associated with CA-KER-303	numerous ash concentrations, earthen oven	flaked/ground stone, bone awl, shell beads (mostly *Olivella*), stone bead, schist pendant fragment, incised steatite tablet fragment; CT	*Lepus* (1,279); Leporidae (332); one or two each of *Odocoileus hemionus*, *Antilocapra americana*, *Taxidea taxus*, *Vulpes macrotis*, rodents, reptiles; minnow (4); juniper berries and seeds	RC, OH, PT	Late Prehistoric Period
CA-KER-875 Koehn Lake	large village (significant fall occupation)	hearths, ground stone concentration, possible ash dump, concentration of fox skulls, semisubterranean "pithouse"	flaked/ground stone, stone ball, *Olivella, Haliotis*, and clamshell beads and ornaments, stone beads, green slate ornaments, bone awls, pottery fragments; DSN, CT, RS, EG	predominantly *Lepus californicus*, *Lepus*, or lagomorph; also *Sylvilagus audubonii*; *Urocyon cinereoargenteus*, *Taxidea taxus*; *Gopherus agassizii*, *Phrynosoma* sp., various rodents; juniper berries	RC, OH, PT	Rose Spring Period
CA-KER-1998 Oak Creek Canyon Site	large site with primary focus on hare exploitation	hearth with FAR	mostly flaked stone, with some ground stone, *Olivella* bead; RS, DSN	*Lepus* (177); *Sylvilagus* (18); rabbit-sized (1,155); rodents; filaree, horehound, buckwheat, juniper	OH, PT	Multiple component (Rose Spring, Late Prehistoric)
CA-KER-4619 Cross Mtn	large habitation site with substantial cemetery	at least nine burials, two hearths, bedrock mortar	burial goods (*Olivella*, *Haliotis*, *Tivela* and steatite beads, many of which were parts of strings; *Haliotis* ornaments associated with an adult male; pottery fragments; a large amount and variety of flaked/ground stone; DS, RS	*Lepus*, small and medium size mammal; cervid; juniper seeds (faunal and botanical remains in very small amounts	RC, PT	Multiple component (Rose Spring, Late Prehistoric)
CA-KER-5043 Coffee Break	small seasonal habitation site (summer/fall occupation?)	two hearths, two ground stone scatters, ash pit	flaked/ground stone, *Olivella* beads; RS, Humboldt	Leporidae (47; 15 *Lepus*); *Artiodactyl* (2); *Neotoma* (1); *Dipodomys* (1); Asteraceae, *Atriplex*, *Larrea tridentata*	RC, OH, PT	Multiple component (Gypsum, Rose Spring)
CA-KER-6106 Freeman Spring	seasonal habitation site with focus on hare exploitation?	six hearths, rock cairn, bedrock mortars and sticks, petroglyph	flaked/ground stone, *Olivella* beads, one bead each of *Haliotis* and clamshell	*Lepus* (1,508), *Sylvilagus* (24), lagomorph (282); rabbit-sized; one burned yucca specimen	RC, OH, PT	Rose Spring Period

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert (continued)

Site	Description	Features	Material Culture	Faunal/Botanical	Dating Type	Age of Site
CA-KER-6188 Terese Site	habitation site, possibly short-term	rock rings, rock art panels, cupules, bedrock mortars/slicks, check dams, possible hearth	flaked/ground stone, *Olivella* beads	"small animal" (unquantified); no botanical remains	OH, PT	Multiple component (Gypsum, Rose Spring)
Cantil Sites						
CA-KER-2209	short-term habitation site	none	flaked/ground stone; one CT, one HU	*Lepus* (2); rabbit-sized (5), one large mammal; no botanical remains	OH, PT	Gypsum Period
CA-KER-2210	two small camps, possibly unrelated in time	none	flaked/ground stone, incised stone fragments; one DSN	*Lepus* (21); *Sylvilagus* (1); lagomorph (1); medium mammal (113); small quantities of lizard, bird, rodent; no botanical remains	OH, PT	Late Prehistoric Period
CA-KER-2211	multicomponent occupation site (two main loci)	11 at Locus 1; 4 hearths, 4 possible hearths; obsidian cache; rock pile; structure (all from Locus 1)	flaked/ground stone; *Olivella* and steatite beads; ceramics; ochre; bone awls; CT, DSN, RS, HU	Locus 1: *Lepus* (6,353); rabbit-sized (21,744); *Sylvilagus* (106); lizard; deer-sized; rats; other (all in small quantities); Locus 2: *Lepus* (610); rabbit (156); deer-sized, lizard, rat (in small quantities); juniper seeds	RC, OH, PT (Locus 1) OH, PT (Locus 2)	Multiple component (Rose Spring, Late Prehistoric)
CA-KER-2212	small lithic workshop	none	mostly flaked stone, with a small amount of ground stone; one HU	no faunal or botanical remains	OH	undated, but possibly the oldest site in Antelope Valley (based on OH)
CA-KER-2214	multifunctional camp	none	flaked/ground stone; GC, EE	one mammal vertebra; no botanical remains	PT	Gypsum Period
CA-KER-2215	small, temporary camp	none	small amount of flaked/ground stone, 3 incised slate fragments	*Lepus* (4); rodent (1); no botanical remains	OH	Rose Spring Period
CA-KER-2218	small, temporary special purpose camp	hearth	flaked/ground stone; *Olivella* bead	*Lepus californicus* (33), *Sylvilagus audubonii* (3); *Urocyon* sp. (1); medium mammal (164); large mammal (4); no botanical remains	RC	Gypsum Period
Rosamond Sites						
CA-KER-519	lithic reduction site; some domestic activity	possible hearth or cairn	small amount of rhyolite debitage; one rhyolite metate fragment	one small mammal bone; no botanical remains	none	no date
CA-KER-520	temporary camp, focus on lithic reduction	none	mostly flaked stone, one ground stone fragment; CT	small quantities of rodents, lagomorphs, canid; no botanical remains	OH, PT	Late Prehistoric Period,
CA-KER-2450	temporary camp for processing lagomorphs	two hearths	all flaked stone (mostly rhyolite debitage); one RS	*Lepus* (14); some of the remaining 264 specimens likely include hares; pronghorn protein; mesquite?	RC, OH, PT	Rose Spring Period

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert (continued)

Site	Description	Features	Material Culture	Faunal/Botanical	Dating Type	Age of Site
CA-KER-2489	milling, quarrying, and lithic reduction site	bedrock mortars, linear rock feature	all flaked stone (mostly rhyolite debitage)	four small long bone fragments (small rodent, probable lagomorph); no botanical remains	none	no date
CA-KER-2546	short-term camp for lithic reduction activities	none	flaked stone (mostly rhyolite debitage), green incised slate	small mammal bone (rabbit and rodent; noncultural); no botanical remains	none	no date
CA-KER-2567	small habitation site or temporary camp	3 concentrations of dark soil, one most likely a hearth	flaked stone (mostly rhyolite debitage), a few ground stone specimens; 5 RS	*Lepus* (61); lagomorph or rabbit-sized (90% of faunal remains); small amounts of *Sylvilagus* (7), *Crotalus*, *Gopherus*, various rodents; burned juniper seed	OH, PT	Rose Spring Period
CA-KER-2569	small camp/workshop site	none	flaked stone (mostly rhyolite debitage), metate fragments; one PN	*Lepus* (20), one or two each of lizard, (*Crotophytus*, *Phrynosoma*), squirrel (*Ammospermophilus*), mouse, rat (most faunal unburned); no botanical remains	OH, PT	Pinto Period
CA-KER-2570	lithic reduction site	none	flaked stone (mostly rhyolite debitage), one metate fragment	*Lepus* (20), mouse, rat, bobcat, snake, reptile, bird (most faunal unburned); no botanical remains	none	no date
CA-KER-2608	lithic reduction site	none	flaked stone (mostly rhyolite debitage)	one unburned bone fragment (probably lagomorph); no botanical remains	none	no date
CA-KER-2762	quarry/lithic reduction site	none	flaked stone (mostly rhyolite debitage)	no faunal or botanical remains	none	no date
CA-KER-2763	lithic reduction workshop	none	flaked stone (mostly rhyolite debitage)	no faunal or botanical remains	none	no date
CA-KER-2765	habitation and lithic reduction site	none	flaked stone (mostly rhyolite debitage), one ground stone fragment; one PN	lagomorphs and rodents (N = 21); no botanical remains	OH, PT	Pinto Period
CA-KER-2767	lithic reduction site	none	flaked stone (mostly rhyolite debitage)	no faunal or botanical remains	none	no date
CA-KER-2768/H	lithic quarry/reduction site	none	flaked stone (mostly rhyolite debitage); one RS	no faunal or botanical remains	PT	Rose Spring Period
CA-KER-2769	lithic quarry/reduction site	none	flaked stone (mostly rhyolite debitage); 11 RS	51 bones; rodents and lagomorphs; no botanical remains	OH, PT	Rose Spring Period

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert (continued)

Site	Description	Features	Material Culture	Faunal/Botanical	Dating Type	Age of Site
Rogers Dry Lake Sites						
CA-KER-526	large base camp	one hearth, with flaked stone, a mano, a hammerstone, a shell bead	flaked/ground stone, shell beads (*Olivella* [n = 17], *Tivela* [n = 1]), fired clay object	*Lepus* (709), *Sylvilagus* (7), Leporidae (612), *Taxidea* (10), *Thomomys* (11), *Neotoma* (10), *Dipodomys* (3), rodent (22), small mammal (2,380), medium mammal (8), large mammal (14), small number of reptiles, amphibians, birds; numerous pollen specimens, but Compositae and Cheno-ams thought to be the only cultural species	RC, OH, PT	early Gypsum Period
CA-KER-533	temporary camp	four FAR concentrations (thought to be either hearths, possible hearths, or remnants of hearth cleaning)	small amount of flaked and ground stone	*Lepus* (11), *Sylvilagus* (1), Leporidae (12), Rodentia (2), small mammal (32), vertebrate (125); wood charcoal (salt-bush type)	RC	very early Rose Spring Period
CA-KER-1180	temporary camp	three FAR concentrations (possibly hearths)	flaked stone (1 DSN); ground stone, ceramics	one each of *Lepus*, *Sylvilagus*, *Gopherus agassizii*, *Crotalus*; 52 vertebrate, three small mammal no botanical remains	RC, PT	Late Prehistoric Period
CA-KER-1765	very short-term camp	FAR scatter (possible hearth)	small amount of flaked stone	*Sylvilagus* (6), small mammal (7), vertebrate (16); no botanical remains	none	no date
CA-KER-3377	short-term camp	none	mostly flaked stone, some ground stone	small mammal (3), vertebrate (10); no botanical remains	OH	Late Prehistoric Period
CA-KER-3379	very short-term camp	three FAR concentrations, one a possible shallow hearth	eight pieces of debitage	two small mammal limb shafts; wood charcoal	none	no date
San Bernardino County						
CA-SBR-72 Oro Grande	seasonal occupation site (spring/autumn?)	37 hearths, a rock-lined fire pit, two dense concentrations of FAR, ancient human and animal tracks	flaked/ground stone, shell and stone beads and ornaments, bone artifacts, turtle shell rattle, pipe fragments, two incised slate fragments, ocher, quartz crystals, CT, RS, EE, HU	by MNI: *Lepus* (150), *Sylvilagus* (26), *Microtus californicus* (18), *Gopherus* (9), *Gila bicolor* (5), *Sauromalus obesus* (4), *Clemmys marmorata* (3), *Ovis canadensis* (3), birds, rodents, reptiles; Indian rice grass, filaree	RC, PT	Multiple component (Gypsum, Rose Spring, Late Prehistoric)

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert (continued)

Site	Description	Features	Material Culture	Faunal/Botanical	Dating Type	Age of Site
CA-SBR-176 Deep Creek	base camp? (possible fall occupation)	possible floor of house pit or outside pavement, expediently utilized hearth, house pit depressions	flaked/ground stone (mostly quartzite debitage), stone beads (steatite or schist); 3 CT	*Ovis canadensis* (2), *Odocoileus* (5), *Sylvilagus* (7), *Canis latrans* (1), *Citellus* (1), Charadriidae (2); small mammal (11), medium mammal (5), large mammal (2); small quantities of alder, oak, pine, willow, ambrosia sagebrush, corn, acorn	OH, PT	Late Prehistoric Period
CA-SBR-189 Hinkley Site	seasonal site (late spring or summer)	no documented features, but FAR suggest hearths	flaked/ground stone; fired clay; one EL, two possible EL	*Lepus* (40% of identified remains), hawk, squirrel, rodents; no botanical remains	RC, PT	Gypsum Period, but dating ambiguous
CA-SBR-1913 (*Guapiabit*)	ethnohistoric Serrano village (principally winter occupation?)	eight circular depressions, five hearths, one possible storage pit, four FAR scatters; one of the depressions identified as a housepit	flaked stone (mostly debitage), ground stone, quartzite shaft straightener, green slate ornament fragments, bone artifacts, *Olivella* beads, pottery sherds, quartz crystals; 26 CT points	*Lepus* (308), Artiodactyl (60), *Sylvilagus* spp. (15, 14), *Aquila chrysaetos* (10), deer-sized (1,141), rabbit-sized (2,603), rodent-sized (35), smaller quantities of pronghorn, dog/coyote, weasel, ground squirrel, vole, wood rat, western pond turtle, lizard, snake, bird, rodent; burned juniper seeds, saltbush, amaranth, alder, pine, oak, willow, Caryophyllaceae, Cheno-ams, Compositae	RC, OH, PT	Late Prehistoric Period
CA-SBR-6580 Siphon Site	single-component Middle/ Late Millingstone Horizon base camp (fall, possibly winter occupation)	11 hearths, a cairn, a human cremation, a metate cache, five FAR concentrations	flaked/ground stone, bone artifacts, quartz crystals; pipe fragments, grey slate ornaments, slate "pencils"; 2 PN points, 3 SVB points	*Clemmys marmorata* (23), *Lepus* (2), *Thomomys bottae* (2), lagomorph (12), rabbit-sized (11), Artiodactyl (32), large mammal (156), guinea pig and rabbit protein; juniper, amaranth, prickly poppy, water-hemlock, chamise, creosote, fir, alder, hickory/pecan, eucalyptus, walnut, pine, oak, willow, elm, Caryophyllaceae, Cheno-ams, Compositae, Cruciferae, *Eriogonum*, *Erodium*, others	RC, OH, PT	early Gypsum Period
Red Mountain						
CA-SBR-211 Guzzler Site	short-term, seasonal site	large, charcoal-filled feature	several shell beads, green slate pendant fragments, ceramics	analyses incomplete, but charcoal and charred seeds recovered	RC, OH, PT	Gypsum to Late Prehistoric periods
CA-SBR-2600 Well Site	short-term, seasonal site	several possible hearths	obsidian projectile points, shell bead	analyses incomplete, but charcoal and charred seeds recovered	RC, OH, PT	Gypsum to Late Prehistoric periods

Appendix A. Summary of Attributes for Study Sites in the Western Mojave Desert (continued)

Site	Description	Features	Material Culture	Faunal/Botanical	Dating Type	Age of Site
CA-SBR-2608 Hunting Blind Site	hunting blind complex	hunting blinds, storage facility	three small glass trade beads	unidentified faunal remains, charcoal	RC, OH, PT	Gypsum to Late Prehistoric periods
CA-SBR-2609 Ridge Site	short-term, seasonal site	concentration of surface rock rings	ground stone artifacts; one CT	analyses incomplete, but charcoal recovered	RC, OH, PT	Gypsum to Late Prehistoric periods
CA-SBR-2614 Saddle Site	short-term, seasonal site	large, dark midden	flaked/ground stone	unidentified faunal remains, charcoal	OH, PT	Gypsum to Late Prehistoric Periods
Coso Volcanic Field	five types of quarries, brief encampments, limited habitation camps, production stations, milling camps, isolated feature/ milling stations	not provided	flaked/ground stone, glass and shell beads, a quartz crystal, incised stone, palette, pottery sherds; 7,500 artifacts and 185,000 debitage specimens, the vast majority of which is obsidian; projectile points include Pinto to Desert series	small quantities of *Lepus* , large mammal, small mammal	RC, OH, PT	Lake Mojave to Late Prehistoric periods
Fort Irwin	full range	various	flaked/ground stone; full range of projectile points	not discussed herein	RC, OH, PT	Paleoindian to historic
Owens Lake	mostly short-term, periodic occupations, with primary focus on biface production	milling stations, rock cluster, hearth, lithic concentrations	flaked/ground stone, range of projectile points from Pinto to Late Prehistoric periods	bighorn sheep, deer, rabbits, rodents, waterfowl; pine, Indian rice grass and other Poaceae, Chenopodiaceae	RC, PT	Pinto to Late Prehistoric periods

[a] See Chapter 5 for references.
[b] Initials represent projectile point types: DSN = Desert Side-notched, CT = Cottonwood, RS = Rose Spring, EL = Elko, GC = Gypsum Cave, CL = Cottonwood Leaf-shaped, EG = Eastgate, ECN = Elko Corner-notched, PN = Pinto, RG = Rosegate, EE = Elko Eared, SVB = Summit Valley Barbed.
[c] All numbers in parentheses are number of identified specimens, except where noted.
[d] RC = radiocarbon dating, OH = obsidian hydration dating, PT = projectile point typology

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Dissertation Title: The Potential Impact of the Medieval Climatic Anomaly on Human Populations in the Western Mojave Desert

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