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INVESTIGATION INTO THE SUSPECTED LATE HOLOCENE DECLINE IN OBSIDIAN USE AT SITES ON EDWARDS AIR FORCE BASE

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INVESTIGATION INTO THE SUSPECTED LATE HOLOCENE DECLINE IN

OBSIDIAN USE AT SITES ON EDWARDS AIR FORCE BASE

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A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

—————————————

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Applied Archaeology

—————————————

by

Richard Gerard Bark

June 2017

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Approved by:

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ABSTRACT

Archaeological investigations at Edwards Air Force Base (AFB) have been ongoing for more than 40 years. Yet the findings from the vast majority of those efforts are available only as grey literature that is known only to a relative few. The primary purpose of this thesis was to investigate a late Holocene decline in obsidian frequency reported by researchers working in the Bissell Basin and Rosamond Dry Lake region of Edwards AFB near the turn of the 21st century. A secondary purpose of this thesis was to shine a light on an area of the western Mojave Desert that is not widely known despite more than four decades of research.

In order to explore the reported decline in obsidian frequency, I created an obsidian database using data gleaned from nearly 50 cultural resources management reports and supplemented those data with sourcing and hydration information for 39 additional obsidian artifacts. Those data were organized into tables, charts, and histograms to look for patterns that would support or refute the claim that obsidian use decreased significantly after the Gypsum time period (4000 to 1500 Before Present [B.P.]). Two patterns emerged from my analysis.

The first was one where the overall abundance of obsidian at Edwards AFB did not decrease during the late Holocene, thus contradicting the conclusions made in the previous research. The second was one where the obsidian abundance shifted among the various regions of the installation. Yet these shifts are nowhere near as significant as the previously reported decline.

Therefore, while the total amount of obsidian that entered the archaeological record at Edwards remained relatively stable from 1500 to 100 B.P., the amount of obsidian decreased in certain regions and increased in others.

Although not within the scope of my original intent, my research also identified two areas for future research. The first involves an apparent pattern where the number of archaeological sites from which obsidian was recovered gradually decreases during the middle-Holocene even as the overall quantity of obsidian remains essentially unchanged. The second relates to the lack of a well-established hydration rate formula for obsidian recovered from archaeological sites on Edwards AFB.

Ultimately, I concluded that the previous findings that obsidian declined during the late Holocene were affected by sampling bias and faulty data organization. Most archaeologists understand that poorly implemented sampling can lead to poorly derived findings and conclusions. What may not be as well understood is that a perfectly appropriate sample where the data are not organized well can also lead to flawed results and conclusions. It is hoped that this thesis will inform archaeologists not only about how the manner in which they organize their data can affect their interpretation of past human behavior, but also about additional research opportunities at Edwards AFB.

ACKNOWLEDGEMENTS

DEDICATION

This thesis is dedicated to:

Apasara – No matter which tube you find yourself in, I will be there with you.

and

My furry little study buddy and the most magical of all the cats, Electra.

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CHAPTER ONE

INTRODUCTION TO EDWARDS AIR FORCE BASE

Introduction

The prehistory of Edwards Air Force Base (AFB) is informed primarily from

the stone tool assemblages that have been recovered. This is largely dictated by

preservation issues typical of a desert environment. While sources of toolstone

quality chert and rhyolite are found in both Edwards AFB and the surrounding

area, the nearest obsidian source is the Coso obsidian fields, located some 75

miles (120 km) to the north. The obsidian hydration data accumulated from more

than four decades worth of archaeological investigations at Edwards Air Force

Base (AFB) is the subject of this thesis research. Specifically, I examine an

apparent late Holocene decline in the prehistoric use of obsidian in the Western

Mojave. Previous research conducted in the late 1990s and early 2000s noted a

dearth in Coso obsidian micron readings starting at around 1500 Before Present

(B.P.) in both the Bissell Basin (Giambastiani and Basgall 2000) and Rosamond

Dry Lake regions of Edwards AFB (Basgall and Overly 2004). To explore this

phenomenon, I conducted a comprehensive literature review and compiled

obsidian source and hydration data from 48 reports and supplemented these

data with new source and hydration analysis of 39 specimens selected from the

collections curated at Edwards AFB. Analyses of these data produced trends in

the frequency of Coso obsidian that run counter to those observed by previous

researchers. That is, analyses conducted using a more comprehensive and

representative database indicate that Coso obsidian frequency did not decline in the late Holocene, but remained at economically significant levels. I conclude that earlier reports of the declining frequency of Coso obsidian resulted from sampling bias. The implication of this finding is that, contrary to widely accepted ideas related to cultural patterns associated with lithic procurement, prehistoric people residing in this portion of the Western Mojave Desert continued to acquire and use obsidian at a relatively constant rate throughout the late Holocene.

Geologic and Environmental Contexts for Edwards AFB

Edwards AFB encompasses approximately 310,000 acres near the center of the southern California's Antelope Valley, which is within the western Mojave Desert (Figure 1). The Antelope Valley also forms the extreme southwestern portion of the Great Basin. Roughly triangular in shape, the Antelope Valley is defined by the Tehachapi Mountains to the northwest, the San Gabriel Mountains to the southwest, and by a poorly defined eastern boundary that is generally considered to stretch northward from Big Rock Creek, near the small community of Llano, in foothills of the San Gabriel Mountains, where it passes through Kramer Junction before terminating in the Rand Mountains near Randsburg, California (Earle et al. 1997). The most notable geologic features of Edwards AFB are three Pleistocene dry lakebeds; in decreasing order of size these are Rogers, Rosamond, and Buckhorn lakes (Figure 2) which represent the lowest portions of the Antelope Valley (2,270 feet above sea level). These lakes are

Figure 1. The Edwards AFB Vicinity.

Figure 2. The Major Land Features of Edwards AFB.

themselves the remnants of the even earlier Pleistocene Lake Thompson which began desiccating sometime around 17,000 B.P. (Orme and Yuretich 2004). Lake Thompson's lengthy desiccation resulted in the creation of a vast patchwork of seasonally flooded claypans separated by aeolian dunes that are scattered throughout the low lying interstitial areas between and adjacent to the larger dry lakes. While it was not part of Lake Thompson, the Bissell Basin, located in the northwest portion of the base, also contains a mosaic of seasonally flooded claypans and aeolian dunes. The dry lakes are bracketed by the Rosamond and Bissell Hills in the west and by Leuhman Ridge in the east, which represents the highest elevation on the base (3,400 feet above sea level). East of Leuhman Ridge, the landform consists of broad alluvial plains sporadically cut by seasonal drainages with very few areas of claypan that retain water.

The soils found within Edwards AFB are poorly developed and consist primarily of "a complex suite of lacustrine, aeolian, and fluvial deposits" of Quaternary alluvium, however pre-Quaternary igneous and metamorphic rock formations comprise the Rosamond and Bissell Hills as well as Leuhman Ridge (Orme and Yuretich 2004:2). Found anywhere from 50 to 150 centimeters (cm) below the ground surface is a caliche layer dating to the mid to late Pleistocene, beneath which no cultural deposits are found (Earle et al. 1997). In addition, a combination of sparse vegetation and strong westerly winds has a significant effect on the landscape. The wind is an especially prominent natural phenomenon at Edwards; newcomers to the installation are advised that the

windy season begins on the first of January and lasts until the thirty-first of December.

The vegetation community present on Edwards is Mojave Desert scrub (Vasek and Barbour 1977) consisting of four communities: saltbush (halophytic and xerophytic) scrub, creosote bush scrub, Joshua tree woodland, and mesquite bosque (Sawyer 1994) and ethnographic accounts indicate upwards of 90 plants from all four communities were used by the prehistoric people inhabiting the region. These vegetation communities support a wide range of both large (bobcats, badgers, and coyotes) and small mammals (rats, rabbits, and squirrels), birds (dove, raven, quail, and a variety of raptors), reptiles (desert tortoise, snakes, and lizards), and insects (ants, tarantulas, and grasshoppers), while the dry lakes support three varieties of fairy shrimp (Earle et al. 1997). Due to Edwards' position in the Pacific Flyway, the seasonally flooded lakebeds and claypans "become productive wetlands temporarily supporting a variety of hydrophytes, invertebrates, waterfowl, and shore birds" (Earle et al. 1997:49) which undoubtedly drew prehistoric people to those locations.

Preservation Issues

A factor of the broader landscape, archaeological sites on Edwards AFB are commonly found in areas of open exposure with little in the way of vegetation (Figure 3). While this provides excellent surface visibility for archaeologists surveying for new sites, when combined with the aforementioned high energy

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Figure 3. Photograph of a Typical Prehistoric Site on Edwards AFB.

environmental conditions the result is a highly dynamic landscape that complicates archaeological excavations in that there is very little in the way of vertical deposition or truly stratified deposits. Rather, in those sites with evidence of long term habitation it typically manifests as horizontal deposition. Indeed, some locations at Edwards AFB exhibit vertical stratification in archaeological deposits; however, these locations are primarily found in stabilized dunes or accreted alluvial deposits (Byrd 1996).

A recently completed year-long monitoring study of some 30 sites spread throughout three of the five Management Regions provides insight into the preservation issues affecting sites on Edwards AFB. In this study, archaeologists established a sub-datum near artifact deposits at three prehistoric sites from which they established a 1 meter (m) square grid that was used to document the movement of artifacts throughout the year. Over the course of three visits, the archaeologists documented fluctuations in the number of artifacts within the grid; in some cases previously undocumented artifacts appeared within the grid, and in other cases previously document artifacts were found outside the grid. In some instances, individual artifacts moved more than 20 centimeters (cm) between visits (Anderson 2016). While animal tracks were noted in the mapping grid on a few occasions, the constant aeolian activity characteristic of the Western Mojave is the most probable cause for the observed changes in the disposition of the surface artifacts.

In another portion of this study, the archaeologists documented the immediate aftermath of a modern fire hearth created as part of an Air Force training mission. A follow up visit to the modern hearth was conducted several months later at which time the archaeologists noted that aeolian activity had removed all the charcoal remnants observed during the initial visit (Nathan Anderson, personal communication 2016). The implication of the findings made during this study with regard to the theory and science of obsidian hydration dating are discussed further in Chapter Two. The basic conclusion is that these post depositional processes can have a substantial effect on the specimens available to archaeologists for sampling during fieldwork and as well as for determinations of association. The dynamics of spatial association and dissociation at Edwards AFB undoubtedly affect results from standard archaeological field methods where relatively small analytical units (shovel test pits or 1x1 m test units) are typically employed. Rather, more systematic surface collection or in-field sampling are likely to be more efficacious in understanding the broader archaeological deposits.

Cultural Context for Edwards AFB

In his discussion of California's desert region, Warren (1984) presents a synthesis of the competing cultural chronologies developed by different researchers. In their overview of the culture history for Edwards AFB, Earle and companions (1997) note that researchers have struggled to develop a widely accepted prehistoric cultural chronology for the western Mojave region primarily

because there is a scarcity of chronometric data upon which to build. Resulting from this, the culture history for Edwards borrows from other regions with minor modifications based on what little data are available. Researchers differentiate the sequences using various horizons, technologies, or stages. The chronology used for this research effort is adapted from that presented by Warren (1984), as presented in Basgall and Overly (2004), Earle et al. (1997), Giambastiani et al. (2014), and Sutton (2017); it relies primarily on time-sensitive projectile points and shell bead sequences. This chronology consists of the Lake Mojave, Pinto, Gypsum, Saratoga Springs, and Shoshonean Periods. Furthermore, based on evidence from Edwards AFB (Rondeau 2016), a late Pleistocene Fluted Point Period is proposed prior to the Lake Mojave Period (Table 1).

Ethnographic studies of the western Mojave region resulted in the delineation of a cultural geography placing Edwards AFB in what can be best described as the frontier of the Numic and Takic linguistic groups (Bettinger and Baumhoff 1982; Earle et al. 1997; Kroeber 1925). Whether this was the result of environmental factors or economically driven, the ethnographic and protohistoric settlement patterns of this region remain a subject of continued research. Currently, the region is characterized as a cultural crossroads for the Kawaiisu (Numic) to the north and the Kitanemuk and Vanyume Serrano (Takic) to the south, where it is likely that people from both linguistic groups exploited seasonally available resources (Earle et al. 1997; Sutton 2017). Although there are locations within Edwards containing evidence of repeated habitation, the

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Table 1. Cultural Sequence for Edwards Air Force Base

Cultural Period	Approximate Time Period	Adaptive Strategy	Cultural Markers
Late Pleistocene	>11,500 B.P.	Generalized foraging; exploitation of megafauna and smaller fauna; lakeshore habitation	Fluted points, crescents, gravers, scrapers, choppers
Lake Mojave	11,500 to 7,500 B.P.	Generalized foraging; shifting focus to plants and smaller fauna; occupation of wider range of landscapes and habitats	Lake Mojave, Silverlake, and Great Basin Stemmed points; crescents
Pinto	7,500 to 4,000 B.P.	More specialized foraging with emphasis on plant, grass seeds, and small fauna resources; potential population decline or shift to higher elevations	Pinto and leaf-shaped points; *Olivella* beads
Gypsum	4,000 to 1,500 B.P.	Beginning of vegetal resource intensification; gradual population growth; settlement focused near springs and streams; incipient increase in social complexity	Elko, Gypsum, and Humboldt points; *Olivella* beads; quartz crystals, paint, rock art
Saratoga Springs	1,500 to 700 B.P.	Increased regional population growth inferred from increased number of sites; continued emphasis on vegetal resources, possible resurgence in artiodactyl hunting	Rose Spring and Eastgate points; *Olivella* beads; stone knives and drills, stone pipes, bone awls, milling implements
Shoshonean	700 to 100 B.P.	Slight increase in seasonal sedentism and subsistence intensification, population decrease inferred from decreased number of sites	Desert Side-notched and Cottonwood points; ceramics; *Olivella* and steatite beads; slate pendants, incised stones, milling implements

Note: B.P.=Before present (A.D. 1950)

characterization of the region as a seasonally exploited crossroads is supported

by the fact that to date researchers have not identified any village sites within the

installation's boundaries that exhibit the hallmarks of long term prehistoric settlements, such as deep midden deposits, house pit remains, or "evidence of men, women, and children, evidence of ritual activities, an associated cemetery, and evidence of occupation during all four seasons" (Sutton 2017:1).

Research Setting at Edwards AFB

The history of archaeological investigations at sites on Edwards AFB dates back more than 40 years to at least the early 1970s. The earliest of those investigations were conducted by members of the (now defunct) Antelope Valley Archaeological Society (Norwood 1994). However, the first professional archaeological research began a few years later in 1976 (Basgall and Overly 2004). While the products of the Antelope Valley Archaeological Society's efforts are largely unavailable, the collections associated with the vast majority of the subsequent investigations are currently housed in the Edwards AFB curatorial facility.

In the early 1980s a series of archaeologists were employed on a short-term basis by the Air Force who were charged with the responsibility of managing Edwards' cultural resources. By 1986 the position was made permanent which afforded the base archaeologist the opportunity to develop a long-term management plan that included a standardized site classification system, a systematic sample survey of the installation, and a number of project specific site excavations (Basgall and Overly 2004; Norwood 1994). The site types and their cultural constituents relevant to this research project are shown in Table 2.

Table 2. Edwards AFB Site Types

Site Type	Site Constituents
Base Camp	Extensive deposits of habitation debris, including midden deposits
Hearth	Fire-affected rock features with fewer than 10 associated artifacts
Isolate	A location with no more than two artifacts
Lithic Deposit	Artifact deposits comprised exclusively of flaked stone artifacts
Quarry	An area of tool stone procurement
Rock Shelter	Artifacts found in caves, rock shelters, or overhangs
Temporary Camp	Sparse deposits of habitation debris with no associated midden

To assist with the administration of the resources found within an area as expansive as Edwards AFB, the base archaeologist divided the installation into five management regions (MR). The region delineations are in rough alignment with identifiably different geographic locations, however some consideration was given to Air Force mission activities (Figure 4). The five regions are: 1) Bissell Basin, 2) Rosamond Lake, 3) Central Base (i.e. Rogers Lake), 4) Air Force Research Lab (i.e. Leuhman Ridge), and 5) Precision Impact Range Area (PIRA).

The efforts of the cultural resources management (CRM) program have, to date, resulted in the survey of more than 50% of the base (excluding the surfaces of Rogers and Rosamond lakes) and the recordation of more than 2,500 prehistoric sites. In the installation's site classification system, researchers have found fewer than 15 sites containing the cultural constituents of a base camp; the majority of sites fall into one of two categories: temporary camps or lithic
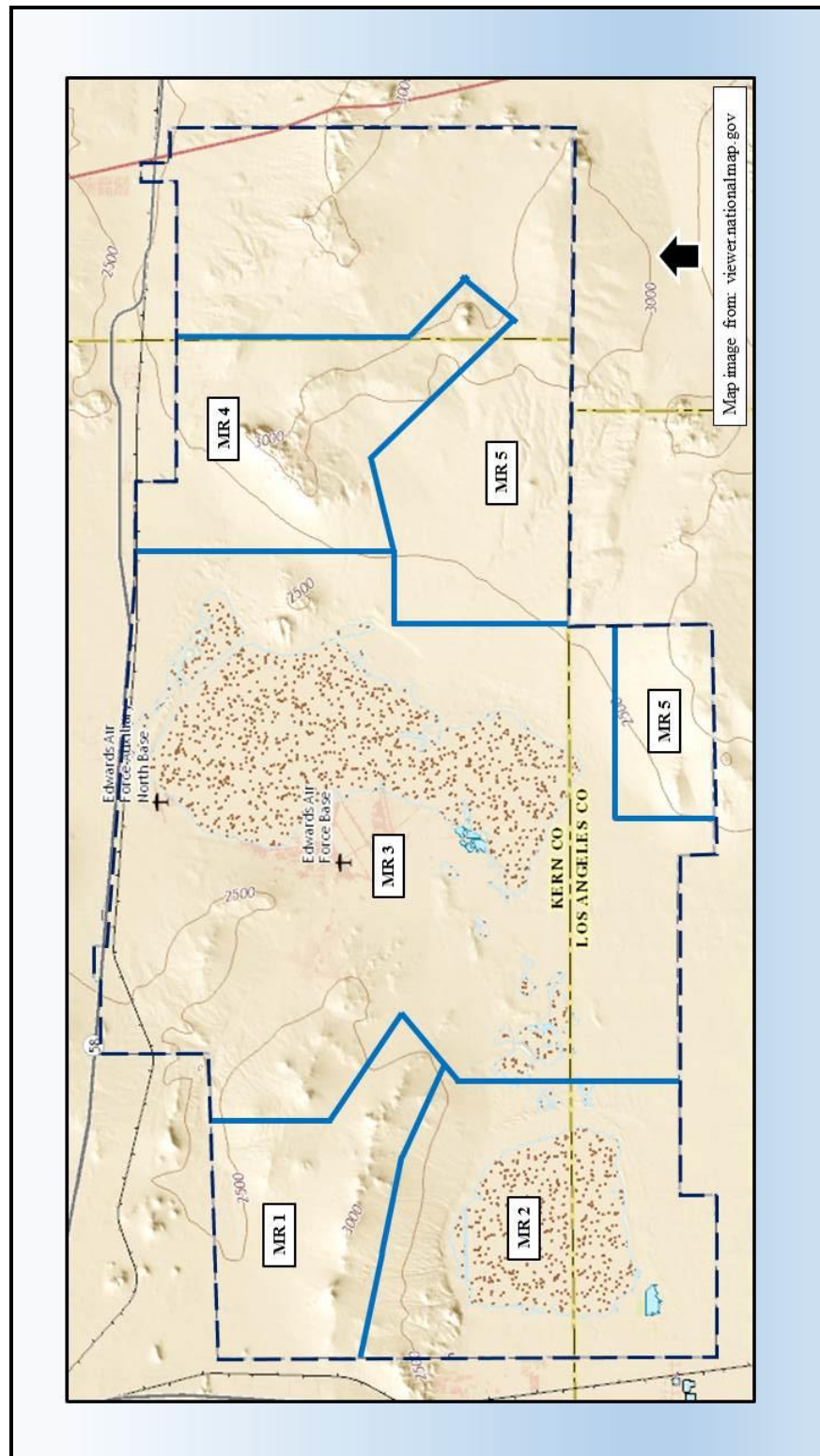
Figure 4. Management Regions of Edwards AFB.

deposits, with the remainder consisting of specialized sites such as quarries, milling stations, or hearth features.

In the mid-1990s the CRM program published an overview of the prehistoric resources (Earle et al. 1997) that summarized the results of all the earlier archaeological investigations. This overview also contained a research design intended to be the framework under which future archaeological investigations on Edwards AFB operated. The research design included research issues such as chronology, subsistence, technology, and settlement patterns among others.

Even with the umbrella research design in place, with few exceptions, the majority of the site investigations at Edwards AFB have been compliance-driven efforts intended to satisfy regulatory requirements, which meant they focused on making recommendations for National Register of Historic Places eligibility at the expense of providing substantive contributions to the understanding of Edwards' prehistory. The regulatory nature of these investigations (and the accompanying reports) has also resulted in a segmented view of the base's prehistory in that sites were frequently excavated in advance of expected impacts from federal undertakings rather than as part of a directed research effort. Even when there was no impending undertaking, many of the investigations selected sites for excavation based on the likelihood of future impacts and often consisted of a "grab-bag" of historic period and prehistoric period sites in the same study. With

that said, on the whole the reports have produced a substantial body of archaeological data that are ripe for additional research.

<u>Management Regions Studies</u>

Two exceptions to the typical approach to archaeological research at Edwards AFB occurred around the year 2000 and consisted of the archaeological investigations of sites in the two western management regions. The first, conducted in 1999, involved the evaluation of 22 prehistoric loci comprising two large temporary camps in the Bissell Basin (Management Region 1) (Giambastiani and Basgall 2000). The second, conducted in 2003, involved the evaluation of 41 prehistoric sites in the vicinity of Rosamond Dry Lake (Management Region 2) (Basgall and Overly 2004). In these studies, the researchers used obsidian frequency as a proxy to analyze regional occupational intensity as well as the inhabitants' access to obsidian (Basgall and Overly 2004; Giambastiani and Basgall 2000). The researchers' conclusions on the occupational trends for the study areas were based on interpretation of obsidian hydration profiles (Figure 5 and 6) and argued that the obsidian data indicated a decline in activity beginning in the Pinto period and continuing through the Shoshonean period. As seen in each of these figures, the bulk of the hydration rim thicknesses fall between 4.0 and 10.4 microns. According to the hydration date formula proposed by the authors, this places the majority of those artifacts in the Pinto and Gypsum time periods (8000 to 1500 B.P.). For the Rosamond
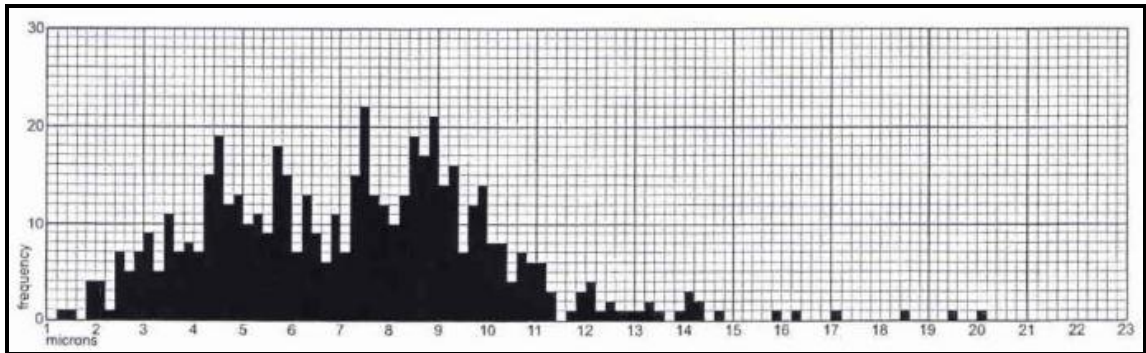
Figure 5. Aggregate Obsidian Hydration Profile for Edwards AFB as of 2000.
(Source: Giambastiani, M. A., and M. E. Basgall
         2000   *An Archaeological Evaluation of Sites CA-KER-4733/H and CA-KER-2016*
                in the Bissell Basin, Edwards Air Force Base, California).
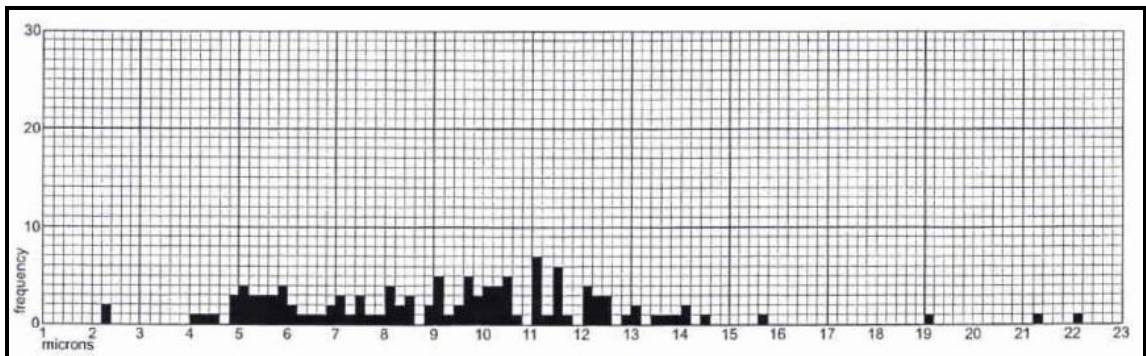

Figure 6. Rosamond Lake Obsidian Hydration Profile.
(Source: Basgall, M. E., and S. A. Overly,
         2004   *Prehistoric Archaeology of the Rosamond Lake Basin: Phase II Cultural*
                Resource Evaluations at 41 Sites in Management Region 2, Edwards Air
                Force Base, California).

Lake hydration profile, there is a near absence of smaller hydration rim readings

corresponding to the Saratoga Springs and Shoshonean time periods (1500 to

100 B.P.) (Basgall and Overly 2004).

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As noteworthy as these hydration profiles appear, discussion of the projects' chronometric data did not explore the matter in any great detail. For the Rosamond Dry Lake study in particular, the authors did not arrive at a substantive conclusion other than an assumption the decline is related to unfavorable local environmental conditions in the area of Rosamond Dry Lake during the late Holocene. This lack of further exploration is reflective of the underlying regulatory nature of the studies in which the overall goal was to establish whether or not the sites subject to investigation had the potential to answer broad research questions as opposed to actually answering very specific questions about prehistoric human behavior.

Conclusion

The central focus of this thesis is an examination of the apparent decline in obsidian hydration readings noted by previous researchers with the intent to determine whether or not it is the result of sampling bias. Most of the archaeological studies at Edwards that have identified similar declines in obsidian hydration readings have been driven by either Section 106 or 110 (of the National Historic Preservation Act) compliance projects that are focused primarily on supporting the Edwards AFB mission demands or other environmental compliance imperatives. Therefore, this thesis represents a unique opportunity to conduct an investigation of Edwards AFB archaeological data purely for research purposes. Because the fundamental concern is to establish the veracity of the trends in late prehistoric use of obsidian, it was

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appropriate to conduct additional source and hydration analyses from existing

collections from Edwards AFB to bolster the pool of data used to address

questions of sampling bias, whether or not the trend is a localized phenomenon,

and, if the trend is confirmed, to explain how these results might relate to

prehistoric human behavior.

CHAPTER TWO

THEORETICAL ORIENTATION AND

RESEARCH QUESTIONS

Introduction

There has been interest in the study of "primitive" hunter-gatherers long before anthropology and archaeology were formal academic disciplines. In this chapter I sketch a very brief summary of historical interest in hunter-gatherers, address the role that lithic technology plays in these studies, the contributions that obsidian dating and sourcing techniques have made to the larger realm of stone tool research, and summarize the various critiques of obsidian dating. Following this, I transition to a discussion of a theoretical framework for studying hunter-gatherers that is grounded in human behavioral ecology (HBE), beginning with its origins in Julian Steward's (1955) seminal concept of cultural ecology in which humankind's adaptation to the environment is used to explain culture change, and then touching on the further development of this contextual-functional paradigm during the New Archaeology. The chapter concludes with a hypothesis to be tested and further avenues of research, rooted in HBE, which may explain the phenomenon that prompted this research effort.

Hunter-Gatherers and Lithic Technology

In the 19th century, studies of hunter-gatherers often focused on fitting these so-called exotic or primitive people into various "social evolutionary schemes" (Jordan and Cummings 2014:2). These schema were strongly influenced by ideas of social Darwinism which viewed hunter-gatherers as occupying the basal level of Tylor and Morgan's Three-Age model of cultural evolution (i.e. Savagery → Barbarism → Civilization) (Willey and Sabloff 1993) and were intended to demonstrate the "stages in the progression of humanity toward higher levels of cultural, moral, and intellectual achievement" (Jordan and Cummings 2014:2). An implicit belief of this model was the notion that "mankind advanced through gradual emancipation from nature" (Bettinger 1991:17), which meant that the study of hunter-gatherers was, by extension, study of the earliest stages of human existence. In the early 20th century, scholars began moving beyond this often racist paradigm of cultural evolution which resulted in a flourishing interest in hunter-gatherers. However, due to the influence of American anthropologist Franz Boas, most of these studies looked at various hunter-gatherers as unique entities that could only be understood within their own context and "should always be studied on an individual case-by-case basis" (Jordan and Cummings 2014:3). By the 1930s, hunter-gatherer anthropology and archaeology began shifting away from the limitations of historic particularism and took steps toward the development of more scientific and nomothetic, or generalizing, approaches. This paradigm shift was fully realized in the 1960s and

1970s and became known as the New Archaeology which brought with it an overt goal to "be more scientific and more anthropological" (Johnson 2011:21). A wide array of individuals, each with their own ideas and approaches comprised the New Archaeology; however, a number of key themes pervaded their work. These include an emphasis on cultural evolution, systems thinking, and scientific method (including acknowledgement of researcher bias), the belief that culture was adaptive to the external environment, the idea of culture process to answer questions of 'why' rather than 'when,' and a concern with understanding variability through the examination of more than just "the biggest and best sites, or the most beautiful artifacts" (Johnson 2011:23-27).

Notwithstanding this concern with variability in archaeological research, within the realm of hunter-gatherer studies, a long-standing focus on lithic technology is undeniable. While it has been argued that stone tools do not represent humankind's first material expression of culture (Slocum 2013:312), the fact remains that, due to preservation bias, stone tools are often the only form of material culture available for archaeologists to work with. As such, the study of lithic technology has figured prominently in a variety of archaeological problems ranging from ideas on site formation (Binford 1980), establishing chronologies (Bettinger et al. 1991; Flenniken and Wilke 1989), culture spread (Bettinger and Baumhoff 1982), mobility patterns (Bamforth 1991; Kelly 1988; Smith 2010), sedentism and technological change (Parry and Kelly 1986), technological

adaptation and change (Bleed 1986; Blitz 1988; Hildebrandt and King 2012), and prehistoric trade patterns (Eerkens et al. 2007; Scharlotta 2014) among others.

<u>Obsidian Analyses</u>

One aspect of the New Archaeology of the 1950s and 1960s was an effort to incorporate other scientific disciplines and techniques in pursuit of solving archaeological problems (Johnson 2011). One important scientific tool with archaeological applications developed during the 1960s was the method of dating obsidian by measuring hydration rim thickness (Friedman and Smith 1960). As described in Volume 25 of *American Antiquity*, the dating technique is relatively simple and involves cutting one or more thin segments from an obsidian artifact, grinding the segment to a uniform thickness (approximately 0.1mm), and then using a high power microscope to measure how far, using microns for unit of measure, water had penetrated into the flaked surface of the obsidian artifact (Friedman and Smith 1960; Aitken 1990). Among archaeologists, the results of this technique for measuring how far water has penetrated into the surface of obsidian are commonly referred to as "rims," "rinds," and/or "microns."

While Friedman and Smith's (1960) initial article identified temperature as the key factor affecting obsidian's absorption of water, subsequent studies have found that the effective hydration temperature (EHT), i.e. a mathematically derived temperature that accounts for the diurnal and annual fluctuations in temperature at an archaeological site (Rogers 2007) as well as the elemental

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composition of the obsidian and the relative humidity from where it was recovered, also influence the hydration rate (Friedman et al. 1994; Friedman et al. 1997; Friedman and Long 1976; Friedman and Trembour 1983). Therefore, reliably converting the hydration rim thickness taken from an artifact to an absolute age requires knowledge of the specimen's chemical composition and the temperature at the site from which it was recovered, including the temperature regimes from past climatic conditions; whereas calculating a relative date requires only knowledge of the obsidian source and the associated hydration formula. An added benefit of the fact that each obsidian flow displays a unique elemental composition is that "these differences may be used to characterize or 'fingerprint'" obsidian sources (Jack and Carmichael 1969). The development of the obsidian dating technique combined with the implications of obsidian sourcing has allowed archaeologists to use obsidian artifacts to further explore a variety of research problems that include the introduction of new technologies (Yohe 1998), mobility (Eerkens et al. 2007), prehistoric trade (Gilreath and Hildebrandt 2011; Hughes and Milliken 2007), and the re-use of projectile points (Rogers and Yohe 2014).

Limitations and Criticisms of Hydration Dating. Despite the initial enthusiasm with the prospect of obsidian hydration dating "as an easy, inexpensive, yet powerful chronometric tool" (Ridings 1996:136), over the years that enthusiasm has fluctuated as researchers have identified shortcomings with the technique as a reliable method for absolute dating. In fact, in an article

published in the same volume of *American Antiquity* as the description of the

method, researchers urged caution against the uncritical use of the dating

method (Evans and Meggers 1960). Specifically, these researchers identified two

problems or limitations with the method; the first technical and the second

archaeological. The technical limitations relate to the geochemical properties of

obsidian, as discussed earlier, and how they may affect the rate at which it

hydrates. The archaeological problems concern "the inability to evaluate the

possibility of re-use or accidental association of earlier objects, or the intrusion of

later ones into an earlier site" resulting from inferences about the site based on

the hydration date produced from a single artifact (Evans and Meggers

1960:537). The authors advise that hydration rates should be established using

specimens acquired from sites where there are solid chronological data using

other methods such as radiocarbon or dendrochronology (Evans and Meggers

1960).

Thirty years after Friedman and Smith's (1960) influential article, Basgall

(1990) grappled with the problem of researchers using site specific or local

region specific hydration rate formulae to calculate dates for Coso obsidian. To

demonstrate the problem, Basgall compared dates calculated using the various

formulae that had been proposed at the time. The results of this exercise were a

range of dates derived from the same micron reading that varied anywhere from

10,600 to more than 88,000 years (Basgall 1990). In the spirit of Evans and

Meggers (1960), Basgall developed a hydration formula for the southern third of

California that was grounded in ten solid radiocarbon-hydration pairings from a site in the Owen's Valley (Basgall 1990). That formula is:

$$\text{Years B.P.} = 31.62\text{microns}^{2.32}$$

However, Basgall revisited this problem again 14 years later, as will be discussed in Chapter Three.

As the dating technique matured, other researchers continued to explore the problems associated with it. Ridings (1996) scrutinized the effect a region's variable surface temperature can have on the EHT used to calculate hydration dates. Specifically, she cautions that the reliability of dates derived using depth-specific EHT "are not likely to be representative of artifact hydration histories in locations where the amplitude of the annual surface temperature is large" (Ridings 1996:145-146). A few years later, Anovitz and associates (1999:735) argued "the standard [obsidian hydration dating] equations are inappropriate and that traditional optical measurements are inherently flawed." This argument was based on analytic comparisons of hydration dates derived from artifacts recovered from a number of different Mesoamerican sites with firmly established chronologies. The findings led the authors to argue that there is "a fundamental problem with the [obsidian hydration dating] method which … lies in the use of an inappropriate model of the hydration process, and the inherent inaccuracy of the optical measurements" (Anovitz et al. 1999:736). Despite these criticisms,

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traditional optical measurement remains the most frequently used method for measuring hydration rinds. The traditional optical measurement method was employed for this thesis in order to ensure the new data were comparable to the data generated by previous researchers. Meanwhile, researchers continue efforts to improve and refine obsidian hydration rate formulae (Hull 2001; King 2004; Rogers 2008, 2017; Rogers and Yohe 2011; Stevens 2002, 2005).

Human Behavioral Ecology

For studies of prehistoric people living in an environment as marginal as the Western Mojave Desert, it is appropriate to examine the patterns of their behavior through a theoretical framework grounded in the interactions of humans and their environment. Early 20th century attempts by scholars to explore the role the environment played with regard to culture and cultural variation fall into three general categories. Initial efforts to tackle this issue, exemplified by geographer Huntington who argued "certain climatic conditions are especially favorable to human progress, and that the greatest progress usually takes place in regions where those conditions are most closely approached" (1922:xii), were eventually viewed as overly deterministic and steeped in the outdated concept of progressive cultural evolution. In contrast to Huntington, Kroeber (1939) viewed the environment as a constraining or limiting but not determining factor for cultural behavior and variability; a view commonly referred to as "environmental possibilism." Finally, Steward (1955:5) presented a less deterministic or possibilistic "method for recognizing the ways in which culture change is induced

by adaptation to environment." Steward called this adaptation cultural ecology, and argued that it was a creative process between environment and culture.

Although cultural ecology is considered by some to be the precursor to HBE (Kelly 2007; Winterhalder and Smith 1992), Steward was not the only scholar in the 1950s to consider the relationship between environment and culture (Meggers 1955). Johnson (2011:173) describes cultural ecology as "the belief that societies will be more or less adapted to their material environment, and therefore that the characteristics of those societies can be explained in terms of such adaptation." As groundbreaking as cultural ecology was in the 1950s for supplanting environmental possibilism with a rudimentary concept of environmental adaptation it was not nomothetic because it "[sought] to explain the origin of particular cultural features and patterns which characterize different areas *rather than to derive general principles applicable to any cultural-environmental situation*" (Steward 1955:36; emphasis added). For the New Archaeologists of the 1960s, cultural ecology lacked the generalizing scientific laws that were a fundamental part of the ethos. Essentially, cultural ecology fell out of favor because Steward "never came up with an explanation or mechanism for adaptive optimization" (Winterhalder and Smith 1992:21).

Despite the perceived shortcomings and accompanying criticisms, like people building atop the collapsed ruins of a previous culture, other scholars built on the theoretical foundation established by cultural ecology, leading to a host of ecology based research. Human behavioral ecology is a broad theoretical

umbrella under which can be found a variety of more narrowly focused theories

and models for explaining human behavior. The types of models used include,

but are not limited to, those for predicting prey choice or diet breadth,

technological changes associated with improvements in handling efficiency, and

predictions of changes in territoriality and interpersonal violence (Broughton and

O'Connell 1999). Proponents of this theoretical approach tout it as providing a

solid framework for being able to answer questions such as why there were

prehistoric people living in a region (like the Great Basin) who shared culture,

language, and technology, but who displayed vastly different logistic mobility and

subsistence strategies (i.e. full-time foragers versus full-time collectors)

(Bettinger 1991).

The publication of *Theory of Culture Change* (Steward 1955) spawned a

wide range of ecology based research under a bewildering array of names used

to describe the approach – evolutionary ecology, behavioral ecology, and human

behavioral ecology being the most common. Regardless of the name used, they

all share a common theoretical underpinning: a neo-Darwinian "application of

natural selection theory to the study of adaption and biological design in an

ecological setting" (Winterhalder and Smith 1992:5). Implicit in this is the

underlying notion of biological fitness as contributing to human adaptive

behavior. One reason for the success of the various ecological theoretical

approaches is that they employ the type of hypothetico-deductive-nomological

models that the New Archaeology found so appealing. Proponents of the

ecological approach argue its strengths include that it is 1) comprehensive in that it can be used to create predictions of nearly any type of biological fitness related behavior; 2) integrative in that it can be used to predict connections between variation in different facets of behavior; and 3) produces models that are testable and which can be proven empirically false (Broughton and O'Connell 1999). Typically, the application of ecological theory begins with a question related to human behavior as it applies to biological fitness and the development of optimality models against which the behavior is tested. These models,

> … require hypotheses about a possible fitness-related goal for the behavior of interest, the alternate strategies to achieve that goal (including constraints that limit the field of possible strategies), the costs and benefits associated with each strategy, and the currencies in which those costs and benefits are to be measured. Combined in model form, these hypotheses predict an optimal pattern of behavior. Comparison between predicted and observed behaviors constitutes a test. Any mismatch implies that one or more hypotheses involving the available strategies, constraints, costs and benefits of different strategies, or currencies, is false [Broughton and O'Connell 1999:153-154].

Arguably the most recognized and well developed model employed by HBE is optimal foraging theory. Originally adapted from biology, optimal foraging

theory actually falls within a subset of models that attend "to the rational decision making of individuals under a set of specified conditions that include limited resources and unlimited needs" (Bettinger 1991:84-85). Among these are models for predicting diet choice, foraging location, duration, and group size, and settlement location. The anthropological application of optimal foraging theory "asserts that in certain arenas, human decisions are made to maximize the net *rate* of energy gain" (Bettinger 1991:84; emphasis in original). Based on these definitions and the heavy use of "simple" mathematical models, it is fair to say that optimal foraging theory appears overly mechanistic. However, unlike Leslie White's concept of culture as the mechanism by which humans "harness and control energy so that it may be put to work in man's service" (1949:367) proponents of HBE argue the difference is that optimal foraging theory is grounded in seeking explanations for variability in human behavior. Furthermore,

> It also is important to emphasize that this approach does *not* imply that selection will produce the "best imaginable" designs or behaviors … On the contrary, the optimization logic predicts only that selection will tend to favor the best strategy among *a defined set of alternatives possible in the context of interest.* It makes no claim about optimization in any absolute sense [Broughton and O'Connell 1999:154; emphasis in original].

Obsidian Use, Edwards AFB, and Human Behavioral Ecology

Having presented a synopsis of HBE, I now turn my attention to back how that theoretical framework may elucidate the pattern of obsidian use that inspired this thesis. Research has indicated that when access to high quality tool stone is constrained, hunter-gatherer societies respond by showing a preference for using high-quality material to manufacture formal tools(Andrefsky 1994), such as projectile points, knives, or another tool with a sharp edge that is kept in a kit until needed. However, obsidian hydration data from work conducted in the Bissell Basin and Rosamond Dry Lake identified a potential late Holocene decline in the frequency of obsidian in that portion of the Western Mojave that roughly coincides with the Saratoga Springs period (1500 to 700 B.P.) (Basgall and Overly 2004; Giambastiani and Basgall 2000). A similar shift in toolstone quality has been noted by other researchers working in western North America, with the phenomenon being attributed variously to restricted access for the purpose of trade (Gilreath and Hildebrandt 2011), change in lithic procurement strategies associated with sedentism (Parry and Kelly 1986), or the introduction of the bow and arrow (Basgall and Giambastiani 2000; Hale et al. 2009; Hale et al. 2010; Railey 2010).

Given that the closest source of obsidian for the prehistoric people who inhabited the Edwards AFB region is the Coso obsidian field, located approximately 70 miles (120 km) to the north, this apparent decline represents an interesting research topic because of insights into aboriginal adaptive strategies

that can be gained based on limited access to the high quality lithic resource.

Therefore, the immediate goal of this thesis is to determine if the decline in

obsidian hydration readings dating to the Saratoga Springs time period

(indicating a decline in obsidian acquisition and use) at Edwards AFB is the result

of sampling bias. If analysis shows the observed decrease in hydration readings

is not due to sampling bias, then the task becomes one of explaining the

phenomenon. To that end, this study will consider the possibility that the

widespread adoption of the bow and arrow sometime around A.D. 500 (Blitz

1988) resulted in changes in socioeconomic strategies and/or lithic procurement

strategies that influenced the use of Coso obsidian by prehistoric people

inhabiting the Western Mojave. Within the larger heuristic sphere of HBE I have

identified two models with the potential to explain why the prehistoric people

inhabiting the Edwards AFB region during the late Holocene may have used less

obsidian after the bow and arrow was adopted. Specifically, the models for time

allocation (Hames 1992) and technological investment (Bettinger 2009) are

employed to explain for the trans-Holocene trend in Coso obsidian use noted in

two studies published in the early 2000s.

 At the heart of HBE is a question that asks, "What role do ecological,

social, biological, and cultural variables play in decisions? How do hunter-

gatherers … decide whether calories, protein, or something else, is the criterion

with which to rank foods?" (Kelly 2007:340-341). Or, what raw material should be

used for manufacturing tools? Both of the time allocation and technological

investment models attempt to predict human decision making related to resource procurement, which ultimately leads to biological success.

Hames' (1992:203) time allocation model is "founded on the basic economic assumption that time and resources are limited and have alternative uses." Under this model individual success depends on engaging in activities that maximize resource acquisition (before reaching the point of diminishing returns) while minimizing opportunity cost (i.e. the benefit lost from continued pursuit of a particular behavior). Applying this model to the decline in obsidian use at Edwards involves comparing of the cost/benefit ratio for procuring Coso obsidian to manufacture arrow points to the cost/benefit ratio of manufacturing arrow points from locally procured raw materials (i.e. chert, rhyolite, etc.).

Bettinger's (2009) technological investment model is intended to explain the conditions under which hunter-gatherer technology might improve or when one particular technology might be chosen over another. In this model, the relationship of resource procurement rate to manufacturing time for various technologies are compared in order to make inferences regarding when an individual should use less productive technologies based on lower manufacturing times. For the two competing technologies to be viable in relation to each other there are two conditions that must be met:

(1) The costlier technology must result in a higher production rate, and

(2) The lower producing technology must have a return rate to

manufacturing time that is at least equal to the technology with a

higher return [Bettinger 2009:61-62].

In situations when one technology is shown to have an equal or higher

rate of return as well as a lower manufacturing time, then it is superior to the

competing technology. In applying this model to the problem of the late Holocene

decrease in obsidian use at Edwards, time spent acquiring raw material for an

arrow point is included in the manufacturing time.

Research Questions

Returning to the heart of this thesis, the goal is to determine whether or

not the trend in obsidian frequency observed by past researchers is the result of

sampling bias. To address this, I developed two simple, yet potentially

informative research questions:

1. Does the frequency of obsidian hydration dates across Edwards AFB drop

   from the Gypsum to the Shoshonean time periods?

2. Are there regional differences in the frequency of obsidian hydration dates

   from the Gypsum to the Shoshonean time periods?

An answer of "yes" to the first question, then, would support the findings of

previous researchers who had assumed a positive correlation between obsidian

frequency and habitation intensity, and who had concluded that obsidian

quantities declined at Edwards AFB after the Gypsum period (i.e. after 1500

B.P.). Whereas, an answer of "no" to the first question suggests that those

findings were the result of sampling bias, and that there was no diachronic change in habitation intensity at Edwards AFB during the late Holocene.

The second research question seeks to focus in on the trends in obsidian hydration date frequency at a level that is more refined than the entirety of Edwards AFB. A "yes" answer to the second question might ameliorate the finding of sampling bias in the previous researchers' conclusions if the regional patterns are similar to those presented for the regions where their studies were focused. On the other hand, a "no" answer to the second question would reinforce the finding that those findings were the product of sampling bias, and lend further support to the notion that habitation intensity did not change during the late Holocene.

In the event that analysis of the data produces a "yes" answer to either question, then several additional avenues of research, and associated data needs, open up that might provide an explanation for a reduction in the number of obsidian hydration dates associated with the prehistoric people residing in the Western Mojave Desert during the late Holocene. These research questions include:

- Are the regional changes in the frequency of obsidian hydration dates reflective of diachronic change in habitation areas, resource exploitation, and/or mobility patterns?

- Research suggests the bow and arrow had a significant effect on late prehistoric people residing in the Great Basin and elsewhere (Basgall and

Giambastiani 2000; Bettinger 2013, 2015; Hale et al. 2009; Hale et al. 2010; Railey 2010); therefore, what role (if any) does this technological advancement play in the prevalence of obsidian hydration dates, at both the installation and regional level, during the late Holocene? Furthermore, if the bow and arrow does play a role, how does this manifest itself in the archaeological record?

Exploring these topics further requires solid chronometric (i.e. radiocarbon) samples, robust faunal and paleoethnobotanical samples, as well as habitation features such as well-developed midden deposits and/or structural remains that date to the time periods in question. To be sure, the taphonomic and other post-depositional processes at Edwards AFB present significant impediments to acquiring the types and quantities of data requirements necessary to fully explore these additional research domains. Regardless of the answers obtained, the research proposed here has the potential to provide important insights into the trans-Holocene use of obsidian in the western Mojave Desert by the prehistoric hunter-gatherers who lived in the vicinity of the area now encompassed by Edwards AFB.

CHAPTER THREE

RESEARCH OBJECTIVE AND METHODS

Introduction

The goal of this research project is to determine whether a) obsidian use among hunter-gatherers in the Western Mojave truly declined during the late Holocene or b) the phenomenon is the product of sampling bias. As discussed previously, the inspiration for this research stems from observations made from data acquired by researchers working in the vicinity of Rosamond Lake in 2003. At that time, those researchers based their analysis and discussion of the broad temporal trends of obsidian use on an obsidian data inventory that was current as of 2000 (Basgall and Overly 2003). That inventory consisted of 819 obsidian artifacts with 605 of those sourced to the Coso obsidian fields. Therefore, a primary imperative for this research was to develop an obsidian data inventory that incorporated the obsidian hydration accumulated in the intervening 16 years.

Research Methods

As with any scientific research endeavor, the initial step taken in pursuit of making this determination consisted of a comprehensive literature review of the published excavation reports on file at the Edwards AFB curation facility. The intent of this review was to identify all the sites where obsidian has been observed and/or recovered. A selection of reports containing obsidian source and hydration data was collected from a larger body of reports on file at the curation

facility. This subset of reports was used as the primary data source for

developing an obsidian database employed to analyze the trends in obsidian

use. A table of the reports that provided obsidian data is found in Appendix A and

the database created from those obsidian data is found in Appendix B. The data

fields included in the database are discussed below.

Supplemental Obsidian Data

After the obsidian database was populated with existing data, the next

step consisted of an examination of the Edwards AFB artifact collections to

identify obsidian specimens that had not yet been submitted for sourcing and

hydration analysis. An Archaeological Survey Association (ASA) Southern

California Archaeology Endowment grant provided funding for the analysis of up

to 40 artifacts, so an effort was made to acquire the requisite number of

specimens. In the course of conducting the literature review I discovered one

project where researchers had collected obsidian artifacts from several sites, but

did not submit those artifacts for sourcing or hydration analysis. The details for

those sites were noted and follow up research was performed to locate artifacts

from that project suitable for obsidian analyses. All told, this particular project

provided 19 specimens from six sites and in all cases obsidian data had not been

previously obtained from these sites. Additionally, I selected 13 artifacts from the

curated collections that had been recovered from nine sites. Rounding out the

specimens submitted for analysis were eight artifacts from six sites, and one

isolated artifact that were collected during a survey project I directed in the spring

of 2016. The provenience and nature of each artifact selected to bolster the

existing Edwards AFB obsidian data are provided in Table 3 and a map depicting

the locations where the artifacts were recovered shown in Figure 7. More

detailed maps of the artifact locations are found in Appendix C.

Table 3. Artifacts Selected for Sourcing and Hydration Studies

Trinomial	Cat No.	Artifact	Unit (depth)	Site Type	MR
CA-KER-1161	5396	Flake	Surface	Temp camp	2
CA-KER-1161	5397	RTF	Unknown	Temp camp	2
CA-KER-1161	5400	UTF	Unknown	Temp camp	2
CA-KER-11884	4820	Flake	Surface	Temp camp	2
CA-KER-11884	4819	Flake	Surface	Temp camp	2
CA-KER-533	246-5	Flake	Surface	Temp camp	3
CA-KER-2007	559-1	Flake	Surface	Temp camp	3
CA-KER-2007	559-12	Flake	ST A (0-10)	Temp camp	3
CA-KER-2154	6836	UTF	Unknown	Hearth	3
CA-KER-3273/H	4823	Flake	Surface	Temp camp	2
CA-KER-486	10738	BFF	Surface	Lithic Deposit	2
CA-KER-4929	2402-98	Flake	Surface	Temp camp	1
CA-KER-4929	2402-119	Flake	Surface	Temp camp	1
CA-KER-4929	2402-5	Flake	Surface	Temp camp	1
CA-KER-4929	2402-49	Flake	Surface	Temp camp	1
CA-KER-4929	2402-183	Flake	Surface	Temp camp	1
CA-KER-503	236-55	Flake	SS 1 (0-5)	Lithic Deposit	2
CA-KER-503	236-66	Flake	SS 1 (0-5)	Lithic Deposit	2
CA-KER-503	236-40	Flake	TU 2 (40-50)	Lithic Deposit	2
CA-KER-5661	10742	RSP	Surface	Temp camp	2
CA-KER-698/H	10691	Flake	STP 12 (0)	Temp camp	3
CA-KER-7578	4188-172	Flake	Surface	Temp camp	1
CA-KER-7578	4188-95	Flake	Surface	Temp camp	1
CA-KER-7578	4188-182	Flake	ST 6 (0-10)	Temp camp	1
CA-LAN-1189/H	400-22	Dart	121 (0-5)	Temp camp	5
CA-LAN-1189/H	400-46	PTF	Surface	Temp camp	5
CA-LAN-1307	616-1	RSP	Surface	Temp camp	3
CA-LAN-1465/H	4024	Flake	Surface	Isolate	2
CA-LAN-2397	2021-27b	Flake	ST 2 (0)	Temp camp	3

Trinomial	Cat No.	Artifact	Unit (depth)	Site Type	MR
CA-LAN-2397	2021-2	Flake	Surface	Temp camp	3
CA-LAN-2397	2021-13	Flake	Surface	Temp camp	3
CA-LAN-2397	2021-22	Flake	Surface	Temp camp	3
CA-LAN-2397	2021-27a	Flake	ST 2 (0)	Temp camp	3
CA-LAN-716	10818	Flake	Surface	Temp camp	2
CA-LAN-716	10819	Flake	Surface	Temp camp	2
Isolate	10716	Flake	Surface	Isolate	2
TBD	10721	BFF	Surface	Lithic Deposit	1
TBD	10727	LMO	Surface	Lithic Deposit	2
TBD	10729	Flake	STP 13 (0)	Temp camp	2
TBD	10735	BFF	Surface	Temp camp	2

Notes: BFF = Biface fragment; LMO = Lake Mojve point; MR = Management region; PTF = Point fragment; RSP = Rose spring point; RTF = Retouched flake; SS = Shovel scrape; ST = Shovel test; STP = Shovel test pit; TBD =To be determined; Temp = Temporary; TU = Test unit; UTF = Utilized flake

These 40 obsidian specimens were first sent to Dr. Richard Hughes' Geochemical Research Laboratory where they underwent non-destructive energy dispersive X-ray fluorescence (XRF) analysis to determine the quantitative elemental composition estimates necessary to identify the source flows for each artifact. Following the completion of source analysis, the specimens were shipped to Origer's Obsidian Laboratory where thin sections were prepared and hydration band measurements taken. The laboratory reports for both the sourcing and hydration analyses are found in Appendix D.

Figure 7. Artifacts Selected for Source and Hydration Analysis.

Supplemental source data. While entering data from the existing obsidian reports it became clear that several hundred specimens had been cut for hydration without having been sourced. Because they were unsourced, these hydration readings would be excluded from my analysis, therefore I pursued a way to source as many of these artifacts as possible in order to maximize the total sample. The details for these artifacts (project and site number, catalog number, and artifact description) were noted and follow up research was conducted to locate as many of those artifacts that were suitable for source identification. In this case two factors reduced the overall quantity of cut but not sourced artifacts pulled from the Edwards AFB collection. Specimens where a hydration rim could not be measured by the laboratory were excluded, as were specimens that were either completely destroyed or returned as small chips as part of the hydration analysis. All told, 120 artifacts were removed from the collection for sourcing.

Over the course of a month, with the assistance of Geological Sciences professor Dr. Erik Melchiorre, I conducted XRF analysis of those 120 artifacts at the California State University San Bernardino (CSUSB) College of Natural Sciences, Geological Sciences department laboratory. The XRF analysis was accomplished using a Niton^{TM} FXL FM-XRF, which is a portable, bench-top-style elemental analyzer (Figure 8). During this process, one of the artifacts was excluded for analysis because it was determined too small. Therefore, a total of 119 artifacts that had been cut for hydration, but not sourced, were analyzed.

The readings from these analyses were output into an Excel workbook containing the quantities (in parts per million) for 39 elements for each artifact. To interpret the data I consulted with Jimmy Daniels, an archaeologist employed by

Figure 8. X-ray Fluorescence Analysis in Progress.

ASM Affiliates, who regularly conducts obsidian source analysis in the course of his professional work. Mr. Daniels plotted the elemental readings produced from my analysis against an obsidian source data library and determined the probability of each specimen "belonging to a source reference group based on a

canonical discriminant analysis" (Jimmy Daniels, personal communications 2017). Canonical discriminant analysis is a type of multivariate analysis that derives "linear combinations of interval variables that summarize between-class variation in much the same way that principal components summarize total variation" (SAS Institute Inc. 1999). The results of this source analysis were then incorporated into the main obsidian database. Of the 119 specimens analyzed, only four were not confidently assigned a sub-source. However, each of these four specimens was attributed to the Coso volcanic fields with the uncertainty lying in the sub-source. In the end, that uncertainty had no bearing on my findings because my analysis was limited to looking only at the broader obsidian sources. The obsidian source analysis table and associated plots are also included in Appendix D.

Obsidian Database Fields

The database created from the existing obsidian source and hydration reports included both administrative and analytical fields. A brief explanation of each field follows.

- **Project number** – The Edwards AFB CRM program assigns a unique identifier to every effort that produces archaeological data. This is an administrative field not included in the final table.

- **EAFB number** – The Edwards AFB CRM program assigns a unique identifier to minimize confusion associated with trinomials from three counties. This is an administrative field not included in the final table.

- **Trinomial** – The official identifier assigned by the California Historic Resources Information System.

- **Catalog number** – The number assigned to the obsidian specimen as indicated in the project report or obsidian study report if no catalog was present. The format used for catalog numbers found in older reports often varied from project to project, hence the lack of standardized numbering in this field.

- **Artifact** – A description of the obsidian specimen as described in the project report catalog or obsidian study report if no catalog was present. The artifact descriptions from some of the older reports did not conform to the Edwards AFB artifact classification system; in those instances an updated description was entered into this field.

- **Unit** – The type of unit, the unit number (if known) and the depth from which the obsidian specimen was recovered. Artifacts collected from the surface are indicated as such.

- **Raw Micron** – The mean hydration rim measurement, in microns, that appears in the hydration report. Further discussion on this appears below.

- **Raw Years BP** – The date derived from the above micron reading using the hydration rate formula from Basgall and Overly (2004).

- **Adjusted Microns** – An adjusted hydration rim thickness reading based on a proposed correction factor for obsidian recovered from Edwards AFB (Basgall and Overly 2004). This is discussed in further detail, below.

- **Adjusted Years BP** – The date derived from the adjusted micron reading using the hydration rate formula from Basgall and Overly (2004). This is also discussed further, below.

- **Time Period** – The culture chronology time period corresponding to the adjusted years B.P.

- **Source** – The obsidian source that provided the raw material comprising the artifact as determined by the artifact-to-source analysis. This is discussed in further detail, below.

- **Sub-source** – Many obsidian sources are known to have chemically distinct flows, that information is documented here.

- **Management Region** – As described in Chapter One, the general geographic region from where the obsidian specimen was recovered.

- **Management Area** – The subdivided area within each of the five management regions from where the obsidian specimen was recovered.

- **Comments** – This field was used to capture a variety of different comments that were made about the artifacts in the source reports. These comments included, but were not limited to, whether the hydration rim was diffuse, the artifact was weathered, or if more than one rim thickness was measured. This is an administrative field not included in the final table.

Micron Reading Discussion. In the more than 40 years that formal archaeological investigation has occurred on Edwards AFB, it came as no surprise that researchers employed the services of a variety of different

laboratories to conduct obsidian hydration analyses. While the techniques for conducting hydration readings are nominally the same for each lab, in the course of compiling the hydration database for this thesis, reviewing the hydration reports revealed that the manner in which the data are presented varied between labs as well as over time. For instance, some labs merely provided the mean rim thickness reading, while others provided a range of micron readings and a corresponding mean. Additionally, while most labs provided hydration rims measured to two significant digits, other labs measured to three. Therefore, when preparing the hydration database for this research, the micron readings were rounded to two significant digits using the "Banker's Rule" in which digits "followed by a 5 that [are] either standing alone or followed by zeros [are] rounded to the nearest even number" (VanPool and Leonard 2011:22). For example, hydration rim measurements of 4.23 and 4.25 were rounded to 4.2 microns, while measurements of 4.35 and 4.36 were rounded to 4.4 microns. The rationale for this rule is that "about half the time the number will be rounded up, and half the time it will be rounded down" (VanPool and Leonard 2011:22).

Another factor that had to be accounted for when compiling the data from the obsidian hydration reports was the presentation of rims with variable widths. Only a few specimens from the entire suite of hydration reports were noted as having variable widths. For those six artifacts, a mean rim thickness was derived using the minimum and maximum readings provided in the hydration report.

A final factor that had to be considered when compiling data from the obsidian hydration reports was accounting for artifacts where two hydration rim readings were reported. After careful consideration of the problem, a decision was made to enter each micron reading as a separate line of data with an entry in the comments column indicating whether the micron measurement corresponded to "band 1" or "band 2" as noted in the original report. For the purpose of using this database for analysis, both bands were included in analyses that looked at patterns in dates. However, only "band 1" was used for analyses that looked at artifact frequencies, etc.

Obsidian Source Discussion. Similar to the above discussion, over the years, researchers working at Edwards AFB have also employed a variety of different obsidian sourcing laboratories. The implications of this situation for this study are twofold. First, each lab presented their source data slightly differently and frequently used different marker elements to identify particular obsidian sources. Second, as time passed and more analyses were conducted the various labs refined their source data library of elemental markers used to identify specific sources or sub-sources. Whereas older source reports merely attributed obsidian artifacts to the Coso fields in general, later reports began to differentiate between the various flows. Furthermore, older reports might identify a source as "unknown" because that specific flow was not in the lab's library, while those same sources are identified in later reports due to the lab's accumulation of more comparative source data. The end result being that while analyses related to

primary obsidian sources are possible, analyses conducted on the sub-source level are unreliable.

Adjusted Microns and Calculated Date Discussion. As noted in Chapter Two, there are a number of competing theories related to the formula used to convert hydration rim readings to calendrical years. While this thesis is based on observations made in Basgall and Overly's 2004 excavation report, it is necessary to provide some additional context regarding the hydration date formula used in that report and in this thesis. Although Basgall (1990) proposed a formula for Southern California based on pairings with robust radiocarbon dates, he has revisited this problem twice while conducting research at Edwards AFB.

In 2000, Basgall co-authored a report for the excavation of two large temporary camps in the Bissell Basin (Management Region 1) (Giambastiani and Basgall 2000). At that time the researchers collected 47 obsidian artifacts, sourced to the Coso volcanic fields, from which thin slices were taken for hydration readings. To interpret those readings, the researchers developed a hydration formula based on regression analysis of diagnostic projectile points against the presumed age range for those artifacts (Giambastiani and Basgall 2000). This analysis produced a hydration formula of:

$$\text{years B.P.} = 15.18 \text{ microns}^{2.80}$$

"with a correlation coefficient (R value) of 0.988" which the researchers inferred

reinforced the year-to-micron relationship of the sample (Giambastiani and

Basgall 2000:43).

Several years later, when analyzing the obsidian data recovered from

sites near Rosamond Dry Lake (Management Region 2), Basgall and Overly

(2004) were forced to revisit the problem of the obsidian hydration rate formula

for Coso obsidian. This reevaluation stemmed from a recognition that the formula

developed for Bissell Basin (above) produced exceptionally old dates when

applied to the hydration profile for the Rosamond Dry Lake data. The researchers

expressed their concern using the following example, "micron values of 11.0 or

more are common in [this] sample, and these are assigned ages in excess of

12,500 years" (Basgall and Overly 2004:57). To reconcile this problem, the

researchers returned to the earlier rate formulation proposed by Basgall (1990)

for Southern California which they adjusted using an EHT derived from long term

climate data from the nearby city of Lancaster, CA. Based on the slightly higher

EHT for the region, the researchers assumed Coso obsidian found at Edwards

AFB should hydrate at a slightly faster rate.

Scrutiny of the dates derived using Basgall's (1990) formula adjusted for

the local EHT, however, proved problematic for the researchers because the

"results were inconsistent with the [Edwards] hydration distributions" which lead

them to believe that obsidian found at Edwards AFB actually hydrates at a slower

rate than it does in the Owen's Valley (Basgall and Overly 2004:57). Further

reflection on the problem prompted Basgall and Overly to propose a correction

factor that should be used when calculating hydration dates for obsidian

recovered from the Edwards AFB region. Specifically, they recommend micron

readings should be multiplied by 1.05 before employing Basgall's (1990) rate for

the Owen's Valley. For example, a reading of 12.0 microns multiplied by 1.05

produces an adjusted reading of 12.6 microns, which converts to a date of

approximately 11,290 B.P.

For the purpose of this research, then, the question is which hydration rate

formula to use to convert the micron readings into dates for the purpose of

exploring the trends in obsidian use in the Western Mojave? Ultimately, and in

keeping with the research that inspired this thesis, I decided the best course of

action was to employ the correction factor proposed by Basgall and Overly

(2004) before using Basgall's (1990) hydration rate formula for Owens Valley:

$$\text{Years B.P.} = 31.62\text{microns}^{2.32}$$

This formula was applied to both the reported (i.e. "raw microns") and adjusted

micron readings produced from applying the correction factor. Analyses to

explore the problem of late Holocene obsidian decline were conducted using the

adjusted dates; however dates derived from the raw micron readings are

included for comparative purposes.

Despite the presentation of hydration dates in Appendix B in absolute form, the potential for variability in those dates should be considered due to the, as of yet, unresolved limitations with hydration dating noted in Chapter Two. While determining the various contributing factors and, more importantly, establishing a solid hydration date formula for Coso obsidian found at Edwards AFB is an avenue of research clearly deserving of further attention, it is well beyond the scope of this thesis.

Acknowledgement of Biases and Assumptions

In keeping with the New Archaeology, it is important to acknowledge biases that may affect any research effort and this thesis is no different. In this particular case there are two forms of bias that are inherent to any study that focuses on data derived from obsidian analyses. Specifically, due to the mechanics of sourcing and hydration rim measurements, small artifacts must be excluded. This is necessarily so because a certain minimum mass of material is required to take an accurate geochemical reading of a piece of obsidian. Similarly, the process of cutting a specimen to measure a hydration rind also required a minimum sized artifact. Therefore, small chips of obsidian, such as those produced by pressure flaking, cannot be sourced or hydrated which creates an undeniable bias. The types of bias more directly related to the context of this thesis are the site preservation issues discussed in Chapter One and the uncertainty of the hydration date formula. Since there are unanswered questions about the hydration rate for obsidian at Edwards AFB, the dates derived using

the formula proposed by Basgall and Overly (2004) should be considered relative

dates until such time as research is conducted to calculate an EHT and

associated hydration formula.

During the analysis conducted using the obsidian database, the following

assumptions were made: 1) errors resulting from methodological differences

between analysts is negligible, given the overall sample size; 2) there is internal

consistency in the classification of artifacts and the projectile point types all

conform to the local classification system; and 3) the obsidian source

identifications expressed in the original reports are all correct. Additionally, with

the exception of describing the total number of obsidian pieces found on

Edwards AFB and the associated site types, only artifacts from Coso are

included in the analysis. Artifacts ascribed to geochemical sources other than

Coso were excluded.

Analytical Approach

At the outset of my thesis research I was heavily influenced by the

approaches employed in the earlier studies and sought to build on them by

simply adding the source and hydration data accumulated since 2000 to the

preexisting data and then creating similar histograms. However, as I began

exploring the matter further, it became clear that in order to make meaningful

comparisons the data should be organized in a manner that factored out the

effects of the different lengths of time comprising each cultural time period had

when quantifying the hydration dates. Additionally, at the recommendation of

CSUSB Psychology professor, Dr. Ismael Diaz, a descriptive framework was used to analyze the obsidian data. Therefore, in order to analyze the obsidian hydration data the following steps were taken:

- The micron readings were converted into dates using the correction factor and hydration date formula proposed by Basgall and Overly (2004).

- Artifacts from sources other than Coso were excluded from the pool of hydration dates because a reliable date could not be calculated.

- Hydration dates younger than 100 B.P. were excluded under the assumption they fall after European contact and may not reflect aboriginal behavior.

- Hydration dates older than 14,100 B.P. were also excluded under the assumption they fall prior to the commonly accepted human colonization of North America.

Once these steps were complete, the hydration dates were placed in bins of different intervals that were then used to create a variety of histograms that might reveal patterns in the data. To that end, intervals of 1000, 500, 250, and 100 years were used to bin the data; this process was completed for the data at the installation-wide level as well as for each of the management regions. In the case of the 100 year interval bins, only dates from the Gypsum to the Shoshonean time periods (i.e. 4000 – 100 B.P.) were organized in this manner due to increasing frequency of intervals with zero dates. Ultimately, the 250 and 100 year bins did not prove useful for identifying patterns in the trans-Holocene

abundance of obsidian, thus they are not included in my analysis. Finally, chi-square analysis was conducted on a subset of the data in order to explore the role that the introduction of the bow and arrow may have had on the obsidian frequencies at Edwards AFB. The results of these various analyses of the obsidian data are presented in the next chapter.

CHAPTER FOUR

OBSIDIAN ANALYSIS RESULTS

Introduction

Near the turn of the century two archaeological investigations were completed on Edwards AFB in which the researchers made observations about both management region specific and base wide trends in the obsidian profile that were interpreted as showing a decline in obsidian frequency during the late Holocene (Basgall and Overly 2004; Giambastiani and Basgall 2000). Given that habitation of the Edwards AFB region is known to have persisted throughout the Holocene, the decline in frequency of a high quality toolstone like obsidian is noteworthy for the potential insights the phenomenon may give researchers regarding behavioral changes of the aboriginal inhabitants of the Western Mojave. The first step in exploring this phenomenon is to determine whether the decline is real or is the product of sampling bias. In this chapter I present the results of the obsidian source and hydration studies intended to supplement the existing body of obsidian data, present some general trends in the obsidian artifacts recovered from Edwards AFB, and conclude with analyses of those data as they pertain to the research questions intended to address the larger question of sampling bias in past researchers' observation of a late Holocene decline in obsidian frequency at Edwards AFB.

Supplemental Obsidian Data

      To bolster the total sample size used to explore the trans-Holocene trend

in obsidian use at Edwards AFB, I collected 40 specimens that were submitted

for source and hydration analysis. The artifacts selected for this purpose were

acquired from both the existing collection and from a survey I led during the

spring of 2016. A total of three biface fragments, three flake-based tools, five

projectile points, and 29 pieces of debitage were submitted. Of the specimens

submitted for source analysis, 35 artifacts were manufactured from Coso, two

from Casa Diablo, and two from Saline obsidian. The final artifact was

determined to be manufactured from a stone other than obsidian (probably

chert). The results of the source analysis and hydration rim readings for the 39

obsidian artifacts analyzed for this thesis are presented in Table 4.

Table 4. Results of Sourcing and Hydration Analysis

Trinomial	Cat No.	Artifact	Source	Hydration Rim
CA-KER-1161	5396	Flake	Coso	10.3
CA-KER-1161	5397	RTF	Coso	9.7/14.4
CA-KER-1161	5400	UTF	Coso	10.8
CA-KER-11884	4820	Flake	Coso	8.8
CA-KER-11884	4819	Flake	Coso	6.8
CA-KER-533	246-5	Flake	Coso	7.0
CA-KER-2007	559-1	Flake	Coso	9.0
CA-KER-2007	559-12	Flake	Coso	4.6
CA-KER-2154	6836	UTF	Coso	8.3
CA-KER-3273/H	4823	Flake	Coso	4.8
CA-KER-486	10738	BFF	Coso	6.3
CA-KER-4929	2402-98	Flake	Coso	8.9/10.0
CA-KER-4929	2402-119	Flake	Coso	11.8
CA-KER-4929	2402-5	Flake	Coso	5.0

Trinomial	Cat No.	Artifact	Source	Hydration Rim
CA-KER-4929	2402-49	Flake	Coso	6.5
CA-KER-4929	2402-183	Flake	Not obsidian	n/a
CA-KER-503	236-55	Flake	Coso	DH
CA-KER-503	236-66	Flake	Coso	12.0
CA-KER-503	236-40	Flake	Casa Diablo	11.2
CA-KER-5661	10742	RSP	Coso	5.0
CA-KER-698/H	10691	Flake	Coso	NVB
CA-KER-7578	4188-172	Flake	Coso	6.8
CA-KER-7578	4188-95	Flake	Coso	8.1
CA-KER-7578	4188-182	Flake	Coso	7.7
CA-LAN-1189/H	400-22	Dart	Casa Diablo	7.2
CA-LAN-1189/H	400-46	PTF	Coso	6.0
CA-LAN-1307	616-1	RSP	Coso	3.6
CA-LAN-1465/H	4024	Flake	Coso	9.6
CA-LAN-2397	2021-27b	Flake	Coso	4.6
CA-LAN-2397	2021-2	Flake	Coso	7.5
CA-LAN-2397	2021-13	Flake	Coso	9.2
CA-LAN-2397	2021-22	Flake	Coso	9.6
CA-LAN-2397	2021-27a	Flake	Coso	9.8
CA-LAN-716	10818	Flake	Saline	4.8
CA-LAN-716	10819	Flake	Saline	6.3
Isolate	10716	Flake	Coso	DH
TBD	10721	BFF	Coso	14.9
TBD	10727	LMO	Coso	11.9
TBD	10729	Flake	Coso	VW
TBD	10735	BFF	Coso	8.1

Notes: BFF = Biface fragment; DH = Diffuse hydration; LMO = Lake Mojave point;
NVB = No visible band; PTF = Point fragment; RSP = Rose spring point;
RTF = Retouched flake; SLP = Silverlake point; TBD =To be determined; UTF =
Utilized flake; VW = Variable width

Two pieces of debitage (Figure 9) were collected from a small chipping

station containing more than 20 early and middle stage reduction flakes and one

broken bifacial core clustered in an area no greater than 1m x 1m. One of the

flakes observed, but not collected, had 100% cortex on its dorsal surface,

Figure 9. Artifacts 10818 (top) and 10819
(bottom), Flakes Collected from an Obsidian
Chipping Station.

suggesting that a complete or nearly complete cobble was transported to the site prior to lithic reduction. The artifacts were selected from this feature specifically to compare hydration rim thicknesses of two artifacts ostensibly produced during the same event. As shown in Table 4, the mean hydration reading for one flake (cat. no. 10819) is 1.5 microns thicker than the other (cat. no. 10818). The implications associated with these different hydration rim thicknesses are discussed further in Chapter Five.

The projectile points selected to supplement the obsidian data consisted of one large, non-diagnostic dart tip, one complete Lake Mojave dart point (Figure 10), and two complete Rose Spring arrow points (Figure 11). There is general concordance between these point forms and the hydration rim thicknesses. Measured at 6.0 microns, the hydration rim for the dart tip (cat. no. 400-46) corresponds to the Gypsum time period, while a measurement of 11.9 microns places the Lake Mojave point (cat. no. 10727) toward the beginning of the Lake Mojave time period. With a hydration rim measured at 3.6 microns, one of the Rose Spring points (cat. no. 616-01) falls on the cusp of the Saratoga Springs/Shoshonean time periods. The hydration rim for other Rose Spring point (cat. no. 10742) was measured at 5.0 microns, which places it near the beginning of the Saratoga Springs period. Based on its curved profile and characteristic flake patterning, this particular point appears to have been manufactured from a large percussion flake that may have been scavenged.

Figure 10. Artifacts 400-46 (top), Dart Point
Fragment and 10727 (bottom), Lake Mojave
Dart Point.

Figure 11. Artifacts 616-01 (top) and 10742
(bottom), Rose Spring Arrow Points. Note
the un-modified ventral flake surface near
the base of the bottom point.

General Patterns for Obsidian at Edwards AFB

Examination of the database developed for this thesis gives the

impression that obsidian artifacts are a relatively infrequent occurrence in the

landscape of Edwards AFB. Of the 2,500 or so prehistoric sites that have been

recorded to date, only 256 (10.2%) of those sites contributed obsidian artifacts

that were submitted for analysis. Additionally, 25 of the obsidian artifacts included in the supplemental analyses were recovered as isolated finds. The distribution of localities from which the obsidian included in this study was recovered is shown in Figure 12 and quantified in Table 5. It is almost certain that more obsidian artifacts await discovery or have been observed and recorded,

Figure 12. Distribution of All Obsidian by Site Type.

but not collected for analysis. However, by the very nature of their status as not having been analyzed, they were not captured by the methods employed for this study.

Table 5. Quantity of Obsidian by Site Type

Site Type	Quantity of obsidian	Percentage
Base Camp	19	7%
Hearth	7	2%
Isolate	25	9%
Lithic Deposit	61	22%
Quarry	2	1%
Rock Shelter	2	1%
Temporary Camp	165	59%
Total	**281**	**100%**

The entire obsidian database compiled for this thesis contains 1,231 artifacts. That total includes the addition of 40 pieces newly submitted for source and hydration analysis. Additionally, the source information was added for 119 previously unsourced specimens that had been cut for hydration. Of the artifacts comprising the database, 89% (n=1,096) originate from the Coso obsidian fields. For the remaining 135 artifacts, a source has not been identified for the vast

Table 6. Alternative Obsidian Sources

Source	No. Artifacts	Percentage
Bristol Mountain	2	0.2%
Casa Diablo	7	0.6%
Fish Spring	1	0.1%
Mono	1	0.1%
Obsidian Butte	1	0.1%
Queen	1	0.1%
Saline	2	0.2%
Shoshone Mountain	1	0.1%
Total	**16**	**1.3%**

majority (n=118), with the final remainder originating from the alternative geochemical sources shown in Table 6. Given the preponderance of Coso obsidian found at Edwards AFB, it is presumable that most, if not all, of the unsourced specimens also originate from Coso. To be sure, exploring the dominance of Coso obsidian in the archaeological record of Edwards AFB compared to obsidian from other sources is intriguing and warrants further investigation. Unfortunately, the overall low frequency of specimens from alternate sources makes such an endeavor an exceptional challenge.

Examining the distribution of artifact classes represented, 865 (79%) specimens are debitage, 226 (21%) are tools of some variety, one is a core (<1%), and the nature of four (<1%) specimens is not known despite a search of the collection housed at the Edwards AFB curation facility in an attempt to locate and classify them. The distribution of artifact classes is presented in Figure 13, while the quantity of each artifact class is provided in Table 7.

Table 7. Quantity of Artifact Classes

Artifact	Quantity	Percentage
Arrow	54	5%
Biface	66	6%
Core	1	0%
Dart	41	4%
Debitage	865	79%
Point	28	3%
Tool	37	3%
Unknown	4	0%
Total	**1096**	**100%**

Figure 13. Distribution of Coso Obsidian by Artifact Class.

It is noteworthy that of the artifacts that can be generally classified as tools
(i.e. not debitage, core, or unknown), fully 84% (n=189) are formal tools (arrow
and dart points, bifaces, etc.) while the remaining 16% (n=37) consist of
expedient tools such as utilized flakes, retouched flakes, and the like (Figure 14).
In this case, artifacts classified simply as "tools" were also considered expedient
tools under the assumption that they would have been assigned to a more formal
category by the analysists who originally examined them if the relevant
diagnostic attributes were present. In contrast, fully 90% (n=783) of the debitage
are classified simply as flakes with the remaining artifacts falling into the shatter

Figure 14. Distribution of Formal and Expedient Tools Manufactured from Coso Obsidian.

(n=22; 3%) or biface thinning (n=60; 7%) categories (Figure 15). A more in-depth analysis of the debitage assemblage is complicated by the fact that over the years some researchers invested more effort in describing and cataloging the debitage collected during their site investigations. Consequently, deriving meaningful inferences about aboriginal lithic reduction strategies would require re-analysis of the entire obsidian debitage assemblage. Although such an effort is beyond the scope of this thesis, it would likely contribute to our understanding of the prehistoric lifeways of the aboriginal inhabitants of Edwards AFB.

Figure 15. Distribution of Coso Obsidian Debitage.

Obsidian Date Histograms

As described in Chapter Three, the obsidian data compiled for this thesis

was organized in bins of different lengths of time for the purpose of creating

histograms that were then used to look for patterns in the obsidian dates and are

presented below. Histograms for the Edwards AFB aggregate obsidian dates as

well as the management regions produced from the 1000 year bins are

presented first. They are followed by the same arrangement of histograms

produced from the 500 year bins. The histograms created from the 250 and 100

year intervals are provided in Appendix E.

1000 Year Bins. Figures 16 through 21 present histograms of the obsidian

hydration date frequencies for all of Edwards AFB and for each of the

management regions at a 1000 year bin interval. Intervals of this size are useful

for illustrating the trend in obsidian hydration date frequency for the entire

Holocene, but do not provide fine enough resolution to capture changes that

occur within or between cultural time periods.

An immediately obvious pattern emerges when hydration date profile for

all of Edwards AFB is examined (Figure 16). Obsidian date frequencies are low

during the early Holocene and begin to increase slowly during the Lake Mojave

period (11,500 to 7500 B.P.) and into the Pinto period (7500 to 4000 B.P.). The

frequency of hydration dates increased by more than 50% near the mid-point of

the Pinto period (6100 to 5100 B.P.; 72 dates → 120 dates). From that point on

Figure 16. Coso Obsidian Hydration Date Frequency for all of Edwards
AFB in 1000 Year Bins.

Figure 17. Coso Obsidian Hydration Date Frequency for Management Region 1 in 1000 Year Bins.

Figure 18. Coso Obsidian Hydration Date Frequency for Management Region 2 in 1000 Year Bins.

Figure 19. Coso Obsidian Hydration Date Frequency for Management Region 3 in 1000 Year Bins.

Figure 20. Coso Obsidian Hydration Date Frequency for Management Region 4 in 1000 Year Bins.

Figure 21. Coso Obsidian Hydration Date Frequency for Management Region 5 in 1000 Year Bins.

there are minor fluctuations in the number of hydration dates in each bin; however there is an average 117 hydration dates per period. There is a slight increase in the number of hydration dates sometime around the transition from the Pinto to Gypsum period (4100 to 3100 B.P.) which is followed by a nearly equal drop in frequency in the middle of the Gypsum period (3100 to 2100 B.P.), however neither is as large a change as occurred during the Pinto period.

Examining the histograms for the five management regions tells another tale. Notably, there is no consistent pattern in the obsidian hydration date frequencies across the management regions. In fact, no two regions share a similar pattern.

The obsidian hydration date frequencies for Management Region 1 (Figure 17) shows no or very low quantities from the Late Pleistocene to the Pinto period. There is a threefold jump in the frequency of dates near the middle

of the Pinto period, after which they average 11 dates per interval through to the

end of the Shoshonean period. Despite the dramatic upsurge in hydration dates

noted for the middle Pinto, the overall quantity (n=76; 8% of total) of hydration

dates for Management Region 1 is low compared to the quantities for nearly all of

remaining regions. A discussion of the current findings compared to those of

Giambastiani and Basgall (2000) appears in Chapter Five.

The hydration profile for Management Region 2 (Figure 18) presents a

very different picture. For most of prehistory in this region of the base the

frequency of obsidian hydration dates fluctuates around an average of 13 dates

per interval. Very minor increases are observed in the Lake Mojave and Pinto

periods. However, a significant proliferation in dates occurs sometime around the

transition from the Gypsum to Saratoga Springs period (11 dates → 29 dates).

This is followed by a moderate decline in hydration dates for the interval covering

the transition from the Saratoga Springs to the Shoshonean period (29 dates →

18 dates). The overall total of obsidian hydration dates derived from

Management Region 2 is fairly robust (n=198; 20% of total). The implications

associated with this pattern compared to the observations made by Basgall and

Overly (2004) are discussed further in Chapter Five.

Turning to Management Region 3, still another pattern in the obsidian

hydration date frequencies emerges (Figure 19). The frequency of obsidian

hydration dates is low during the early Holocene, averaging eight dates per time

interval through to the beginning of the Pinto period. During the 7100 to 6100

B.P. interval the frequency more than doubles (14 → 37 dates); this is followed by an undulating series of increases that culminates in 77 hydration dates from the 1100 to 100 B.P. time interval. While this is the single highest total for any time interval in all the management regions, the intervals that are within the span of time from 6100 to 100 B.P. are consistently higher than the same intervals in the other management regions as well. Consequently, the total number of hydration dates for Management Region 3 (n=454; 47% of total) is more than double that of the management region with the next highest total (Management Region 5; n=200). Given the overall contribution that Management Region 3 makes to the aggregate hydration dates for all of Edwards AFB, it is unsurprising that there is similarity between the two patterns. If obsidian hydration date frequency is truly a proxy for habitation intensity, then clearly prehistoric hunter-gatherers concentrated their attention in the areas near Rogers Dry Lake.

The pattern of obsidian hydration date frequency for Management Region 4 is unusual, but not surprising given the nature of the region (Figure 20). Primarily encompassing Leuhman Ridge, this management region contains few locations where the prehistoric inhabitants would have access to reliable water sources. As a result, Management Region 4 contains the lowest quantity of obsidian hydration dates (n=39; 4% of total). The pattern for this paltry sum is unique in that the dates are concentrated in the Lake Mojave through Gypsum period (i.e. 10,100 to 3100 B.P.), with the greatest number (n=9) found near the middle of the Pinto period (7100 to 6100 B.P.)

Finally, the pattern of obsidian hydration dates for Management Region 5 (Figure 21) demonstrates a distinctly elevated frequency from the middle of the Pinto Period through to the middle of the Gypsum period (i.e. 6100 to 2100 B.P.) There is an average of 35 hydration dates in each interval for this span of time, whereas the average is 10 dates per interval for those that immediately precede and succeed this time span. Despite the unusual pattern, Management Region 5 contains the second highest total of hydration dates (n=200; 21% of total). This pattern can be interpreted as period of high activity in this region from the mid to beginning of the late Holocene.

500 Year Bins. Figures 22 through 27 present histograms of the obsidian hydration date frequencies for all of Edwards AFB and for each of the management regions at a 500 year bin interval. Intervals of this size are also useful for illustrating the trend in obsidian hydration date frequency for the entire Holocene. Unlike the 1000 year bins, however, the 500 year interval is small enough to provide the fine resolution needed to capture changes that occur within and between cultural time periods. This interval also provides the opportunity to compare the number of hydration dates before and after the arrival of bow and arrow technology to this portion of the Western Mojave Desert.

Figure 22. Coso Obsidian Hydration Date Frequency for all of Edwards AFB in 500 Year Bins.

Figure 23. Coso Obsidian Hydration Date Frequency For Management Region 1 In 500 Year Bins.

Figure 24. Coso Obsidian Hydration Date Frequency for Management
Region 2 in 500 Year Bins.

Figure 25. Coso Obsidian Hydration Date Frequency for Management
Region 3 in 500 Year Bins.

Figure 26. Coso Obsidian Hydration Date Frequency for Management Region 4 in 500 Year Bins.

Figure 27. Coso Obsidian Hydration Date Frequency for Management Region 5 in 500 Year Bins.

At both the individual management region level and the combined

Edwards AFB level, the patterns in hydration date frequency visible in the figures

for the 500 year intervals are largely similar to the figures for the 1000 year

intervals. With minimal recapping those similarities, some noteworthy differences

do occur and they are discussed here.

Beginning with the combined profile for all of Edwards AFB (Figure 22),

the previously noted increase in the number of hydration dates that occurs during

the Pinto period becomes more pronounced, and can be narrowed down to the

span of time between 6100 and 5600 B.P., placing this event in the middle of that

cultural period. A sharp decline occurs in the immediately succeeding interval (71

→ 49 dates), which is followed by a steady increase until the 3600 to 3100 B.P.

interval, at which point the number of dates dips slightly until leveling off in the

last two intervals (1100 to 100 B.P.). Notably, there is a slight increase (56 → 64

dates) in the interval (1600 to 1100 B.P.) spanning the time when the bow and

arrow is believed to have been adopted by the inhabitants of these environs.

Admittedly, this rise is not great, however its presence suggests the bow and

arrow did not have a negative effect on the prehistoric use of obsidian. All told,

the general tendency of a consistent frequency of hydration dates in the late

Holocene does not change when examined under the slightly higher resolution

provided by the 500 year interval.

For Management Region 1, the 500 year interval hydration date profile

(Figure 23) follows a similar pattern as the one observed in the 1000 year interval

(Figure 17). The notable exception occurs in the very last interval at which point the number of hydration dates drops precipitously (10 → 1 dates). Such a steep drop may indicate a shift in habitation in this region of Edwards AFB very late in prehistory. With regard to the effect the bow and arrow had on obsidian use in this region of Edwards AFB, there is a considerable jump (4 → 9 dates) in the frequency of hydration dates from the before to after intervals (i.e. between 2100 to 1600 B.P. and 1600 to 1000 B.P.). That said, these quantities may not be large enough to be provide meaningful insight into the matter.

The 500 year interval hydration date profile for Management Region 2 (Figure 24) does not reveal any new patterns when compared to the 1000 year interval profile (Figure 18). Both profiles display the same undulating pattern of hydration date frequency throughout the early and middle Holocene, with a spike (7 → 15 dates) near the end of prehistory. That spike occurs just prior to the introduction of the bow and arrow with a barely perceptible decline (15 → 14 dates) occurring in the immediately succeeding interval. The hydration date frequency for Management Region 2 stabilizes at 9 dates during the final two intervals.

A comparison of the 500 year profile to the 1000 year profile for Management Region 3 reveals one new insight into the frequency of hydration dates. As noted in the discussion of the 1000 year profile, the greatest number of hydration dates (n=77) for any of the management regions is found in the final interval for Management Region 3 (Figure 19). Examining the 500 year profile

(Figure 25) shows that the bulk of the hydration dates (n=45) occur in the final interval (600 to 100 B.P.). Focusing in on the transition from the Gypsum to Saratoga Springs cultural periods (i.e. about when the bow and arrow entered the area), a very small increase in hydration dates is noted (27 → 30 dates) which again suggests that the new technology did not result in a declining use of obsidian. Aside from this, the 500 year profile narrows down the timing for the fluctuations in the number of hydration dates through the middle Holocene, but does not reveal any other changes to the overall pattern seen in the 1000 year profile.

The 500 year profile for Management Region 4 (Figure 26) provides no substantive insight into the frequency of obsidian hydration dates for this portion of Edwards AFB. The most noteworthy observation to be made is that the elevation of hydration dates previously noted during the Pinto period can be narrowed down to having occurred in the span of time between 6600 and 6100 B.P. Additionally, at the point in time when bow and arrow technology reaches the Western Mojave Desert, the frequency of obsidian dates for this management region are practically non-existent. Stated again, the lack of access to reliable water sources in this portion of Edwards AFB likely explains the overall low number of dates recovered from this management region.

Examining the 500 year profile (Figure 27) for Management Region 5 serves to narrow down the timing on some of the trends observed in the 1000 year profile (Figure 21). Specifically, the distinct rise in hydration dates noted in

middle Holocene occurred sometime between 6100 and 5600 B.P. and consisted of nearly a fivefold increase (4 → 19 dates). Additionally, the late Holocene decline in hydration dates (c. 3100 – 2100 B.P.) visible in the 1000 year profile, while distinct, is not nearly as sharp when viewed from the perspective of 500 year profile. As seen in the profiles for other management regions, there is a very slight boost in the number of hydration dates around the time at which bow and arrow technology arrived at Edwards AFB. However, the quantities involved are small and not significantly different enough (i.e. 6 → 8 dates) to be able to make a definitive statement about the effect the new technology had on the pattern of obsidian use by the prehistoric inhabitants of this management region.

Number of Sites vs. Number of Dates

Another pattern in the Coso obsidian hydration data for Edwards AFB emerges when the number of hydration dates is compared to the number of sites that produced those dates (Figure 28). During the early Holocene there is a close relationship between the frequency of hydration dates and the frequency of sites that produced those dates, with 20 or fewer dates and sites recorded from 14,100 to 11,100 B.P. Following that point in time a slight gap appears between the the frequency of dates and sites. The gap continues to widen as time progresses with the number of sites increasing slowly compared to the number of hydration dates they produced. During the middle Holocene, corresponding to the middle of the Pinto cultural period (i.e. 6100 to 5100 B.P.), there is a significant (100%)

Figure 28. Comparison of the Number of Hydration Dates to the Number of Sites Producing Those Dates.

increase in the number of sites (49 → 98) that is accompanied by a slightly smaller (67%) increase in the number of dates (72 → 120). From this point until the end of prehistory the number of hydration dates fluctuates around an average of 117 dates per 1000 years. However the number of sites producing those dates shows a gradual decline; first dropping to 113 sites in the period immediately following (5100 to 4100 B.P.) before falling to a mere 60 sites at the end of prehistory (100 to 1100 B.P.).

Taking obsidian frequency in the landscape as a proxy for habitation density (Giambastiani and Basgall 2000), then the pattern exhibited in Figure 28 indicates a shift in the way in which prehistoric hunter-gatherers inhabited this portion of the Western Mojave Desert. Specifically, after 5100 B.P. it appears people began concentrating in fewer locations even while producing similar quantities of obsidian. Additional data are required to fully explore the

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implications of this pattern, however it may also provide new insights into

population density, mobility patterns, and/or a shift in the formality of tool

manufacture that produced more wastage.

Introduction of the Bow and Arrow

A number of archaeologists have suggested that bow and arrow

technology sparked a wide range of change among prehistoric hunter-gatherers

in the Great Basin and elswhere in the western United States (Basgall and

Giambastiani 2000; Bettinger 2013, 2015; Hale et al. 2009; Hale et al. 2010;

Railey 2010). A Chi-square analysis comparing the frequency of obsidian dates

of three 1,400 year bins that span from 100 BP to 4300 B.P. was completed to

test whether this new technology had an effect on the use of obsidian by the

aboriginal inhabitants of the Edwards AFB region (Table 8). There are no

significant changes in the aggregate number of dates per bin (Bin 1 = 165, Bin 2

= 155, Bin 3 = 179), which suggests that the bow and arrow did not have an

effect on the overall amount of obsidian being used prehistorically at Edwards

AFB.

However, the results of the Chi-square analysis do suggest that the

distribution of obsidian between the management regions is significantly different

across the bin intervals. Specifically, there are minor changes in hydration dates

for Management Regions 1 and 2, and major changes in hydration dates for

Management Regions 3 and 5. The data for Management Region 4 are

insufficiently large to make meaningful inferences and will not be addressed

further. Regions 1 and 2 both show slight increases in the amount of obsidian

Table 8. Chi-Square Test of Obsidian Frequency by Management Region for
Three 1400 Year Time Intervals

MR/Bin	Observed	Expected	(Obs-Exp)	$(Obs-Exp)^2$	$(Obs-Exp)^2/Exp$
MR 1/Bin 1	20	15.9	4.1	17.04	1.07
MR 1/Bin 2	12	14.9	-2.9	8.47	0.57
MR 1/Bin 3	16	17.2	-1.2	1.48	0.09
MR 2/Bin 1	27	24.5	2.5	6.41	0.26
MR 2/Bin 2	28	23.0	5.0	25.14	1.09
MR 2/Bin 3	19	26.5	-7.5	56.93	2.14
MR 3/Bin 1	103	88.9	14.1	197.46	2.22
MR 3/Bin 2	77	83.6	-6.6	43.00	0.51
MR 3/Bin 3	89	96.5	-7.5	56.17	0.58
MR 4/Bin 1	1	3.3	-2.3	5.32	1.61
MR 4/Bin 2	2	3.1	-1.1	1.22	0.39
MR 4/Bin 3	7	3.6	3.4	11.65	3.25
MR 5/Bin 1	14	32.4	-18.4	338.74	10.45
MR 5/Bin 2	36	30.4	5.6	30.90	1.02
MR 5/Bin 3	48	35.2	12.8	165.01	4.69
Total	**499**	**499**	**0**	**964.95**	**X^2 = 29.96**
Notes: Bin 1 = 100-1500 BP; Bin 2 = 1500-2900 BP; Bin 3 = 2900-4300 BP; MR = management region					df=8 p=.003

found after 1500 B.P. In contrast, Region 3 shows a sizeable increase in the

amount of obsidian found after 1500 B.P. whereas in Region 5 there is an even

greater decrease in the amount of obsidian found during that same timespan.

To explore this even further, a second Chi-square analysis of just bins 2

and 3 was performed (Table 9). The goal of the second analysis was to look for a

difference in the frequency of obsidian dates throughout Edwards AFB before

and after 2900 B.P. The results of that test indicate that there is not a significant

difference in the frequency of obsidian throughout Edwards AFB in the 1,400

years before or after 2900 B.P. This finding, then, confirms that a change did

occur in the distribution of Coso obsidian within and between the management

regions following the introduction of the bow and arrow at 1500 B.P. Again, the

overall amount of obsidian being used by the prehistoric people living in the

Western Mojave did not change; however the patterns of use within the various

Table 9. Chi-Square Test of Obsidian Frequency by Management Region for
Two 1400 Year Time Intervals

MR/Bin	Observed	Expected	(Obs-Exp)	$(Obs-Exp)^2$	$(Obs-Exp)^2/Exp$
MR 1/Bin 2	12	13.0	-1.0	0.99	0.08
MR 1/Bin 3	16	15.0	1.0	0.99	0.07
MR 2/Bin 2	28	21.8	6.2	38.30	1.76
MR 2/Bin 3	19	25.2	-6.2	38.30	1.52
MR 3/Bin 2	77	77.0	0.0	0.00	0.00
MR 3/Bin 3	89	89.0	0.0	0.00	0.00
MR 4/Bin 2	2	4.2	-2.2	4.74	1.13
MR 4/Bin 3	7	4.8	2.2	4.74	0.98
MR 5/Bin 2	36	39.0	-3.0	8.89	0.23
MR 5/Bin 3	48	45.0	3.0	8.89	0.20
Total	**334**	**334**	**0.0**	**105.84**	**$X^2 =5.96$**

Notes: Bin 2 = 1500-2900 BP; Bin 3 = 2900-4300 BP;
MR = management region

df=4
p=.2022

regions of Edwards AFB did change. Specifically, the quantity of obsidian found

in Region 3 increased after 1500 B.P. while the quantity found in Region 5

decreased at the same time. The phenomenon identified in these analyses may

have resulted from changes to the settlement patterns and/or food exploitation following the arrival of bow and arrow technology. However, additional investigations are needed to develop a better understanding of the cause of behind these changes in obsidian use in this portion of the Western Mojave Desert.

Conclusion

Throughout this chapter, I have employed a variety of means to examine the obsidian data from Edwards AFB. From these investigations it is clear that even though it is not toolstone commonly found at sites on the base, obsidian from Edwards AFB can provide insight into prehistoric human behavior when examined through an appropriate lens. The histograms produced from the obsidian hydration data clearly illustrate that using arbitrary slices of time to create periods of equal length to view those data results in more interpretable patterns compared to looking at those same data using unequal periods of time. However, there are limits to the utility of this method. As noted in Chapter Three, the data were also divided into 250 and 100 year intervals; however the resulting patterns were too pixelated to provide additional insight. In this instance the most meaningful patterns about the prehistoric use of Coso obsidian at Edwards AFB were teased out from the data when it was viewed in 500 and 1000 year slices of time. Finally, the examinations of the data show distinct changes in the distribution of obsidian across the landscape and through time. Both the patterns and the organization of data will be discussed further in Chapter Five.

CHAPTER FIVE

DISCUSSION

Introduction

In this chapter I consider the meaning of the results presented in the preceding chapter. I begin by returning to the questions set out in Chapter 2; explore whether the conclusions arrived at by previous researchers were affected by sampling bias, and provide commentary on how data organization can influence research findings. I then segue to a brief proposal for an alternative method for data normalization. This is followed by an examination of the implications associated with the difference in hydration rim thicknesses for two artifacts that were part of the supplemental analysis. This chapter concludes with a summary of a critical research avenue identified in this thesis.

Obsidian Decline at Edwards AFB

This thesis is inspired by observations on the pattern of obsidian deposition at Edwards AFB made in two studies published in the early 2000s (Basgall and Overly 2004; Giambastiani and Basgall 2000). In these studies the researchers concluded that habitation intensity declined during the late Holocene based on two factors. The first factor was the low quantities of artifacts with small hydration rim readings they recovered in their fieldwork. The second factor was their interpretation of a histogram of hydration rim thicknesses for all of Edwards AFB that was current as of 2000. In response to their conclusion, my research

seeks to answer the following question: Does the amount of obsidian in the archaeological record at Edwards AFB truly decline during the late Holocene?

Although this appears to be a straight forward question that should have an equally straight forward answer, as with most aspects of archaeological research, the actual answer to this question is equivocal.

At the installation-wide level there is no late Holocene decline in obsidian frequency. In fact, the trans-Holocene pattern of obsidian abundance for the whole of Edwards AFB shows quite a different pattern. Obsidian quantities are generally low during the late Pleistocene and early Holocene (14,100 to 10,100 B.P.), gradually increase through the remainder of the early Holocene and into the middle Holocene (10,100 to 6100 B.P.), then increase significantly and remain at a stable level for the duration of the late Holocene (6100 to 100 B.P.).

On the other hand, when the obsidian frequencies for the five management regions are examined, different patterns emerge. Although each is slightly different, the pattern of obsidian frequency for Management Regions 1, 2, and 3 all show an increase in abundance during the late Holocene. However, slight declines occur in Regions 1 and 2 during the Shoshonean period (i.e. 700 to 100 B.P.) while a significant increase occurs in Management Region 3 at that same time. In contrast, Management Region 5 shows a distinct decline during the late Holocene. The pattern for Management Region 4 also declines sharply during the late Holocene; however the overall low quantity of obsidian recovered from this region should be considered a red flag when drawing conclusions. The

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end result, however, is that during the late Holocene some portions of Edwards AFB experienced an increase in the amount of obsidian being used by prehistoric hunter-gatherers, while other portions a decrease occurred. Further investigation into this causes behind the patterning of obsidian across Edwards AFB are well worth pursuing.

These findings also prompt a different question: are obsidian hydration dates a reliable proxy for habitation intensity? This theoretical approach is understandable for those portions of the Great Basin, such as in the Owens Valley, where obsidian is ubiquitous, contribute greatly to the artifact assemblage, and the hydration rate is well understood. However, it is a problematic approach for an area like Edwards AFB where obsidian is not commonly found; when it is found its contribution to the artifact assemblage is frequently measured in single digits, and the rate at which obsidian hydrates is poorly understood. Individually, any one of these factors should instill caution in archaeologists when equating the abundance of obsidian hydration dates to habitation levels. In a case like Edwards where all three factors are present, the use of obsidian as a proxy for habitation intensity should be considered highly problematic.

Influence of the Bow and Arrow

Another aspect of my research was to examine the impact a new weapon technology may have had on obsidian use in the western Mojave Desert. Researchers working in the Great Basin or elsewhere in the western United

States have observed declines in obsidian during the late Holocene (Gilreath and Hildebrandt 2011; Parry and Kelly 1987). Some researchers have advanced the idea that the introduction of the bow and arrow was the cause (Hale et al. 2009; Hale et al. 2010; Railey 2010). My analysis of the obsidian data for Edwards AFB did identify a change in the pattern of obsidian discard that coincides with the arrival of the bow and arrow (c. 1500 B.P.). That change was limited to Management Region 3, where obsidian quantities increased, and Management Region 5, where obsidian quantities decreased. For the whole of Edwards AFB, however, there is no discernable change in the quantity of obsidian after 1500 B.P. Additional data are required to confirm whether the changes in obsidian frequency in the two management regions are specifically tied to changes to residential mobility, settlement patterns, or economic strategies associated with bow and arrow technology, or if some other factor is involved.

<center>Sampling Bias and Data Organization</center>

My research also sought to determine whether sampling bias played a role in the previous researchers' conclusions that obsidian use at Edwards AFB declined during the late Holocene. Again, the answer to this question is ambiguous. The stark difference between my findings and those from the reports published in the early 2000s strongly suggests that those earlier efforts were affected by sampling bias. Differences in the obsidian distribution between my findings and those of the earlier studies were visible whether comparing the aggregate obsidian data, or those for Management Regions 1 or 2 (i.e. the areas

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studied by the earlier researchers). It very well could be that the addition obsidian

sourcing and hydration data from the past 16 years contributed to findings that

contradicted this decline. However, extended rumination on the subject of

sampling bias leads me to believe that data organization played an equal or

greater role in the erroneous conclusions arrived at by past researchers.

Returning to the two studies that inspired my thesis, the researchers

considered both the obsidian assemblages collected during their fieldwork and

the aggregate obsidian assemblage for all of Edwards AFB as proxies for

analyzing regional occupation intensity as well as the inhabitant's access to

obsidian (Giambastiani and Basgall 2000, Basgall and Overly 2004). In each

instance the researchers based their analyses and conclusions on histograms

created from the micron thicknesses measured for the specimens collected

during their fieldwork (Figure 5), or for all of the obsidian collected on Edwards

(Figure 6). Later researchers who also explored this apparent trend in obsidian

frequency at Edwards AFB went a step further and created histograms from the

hydration rim frequencies grouped by the time periods for the cultural sequence

for the installation (Figure 29) (Hale, et al. 2009:39). As can be seen in these

figures, both approaches create convincing graphical evidence of a decline in

obsidian use at Edwards AFB.

Figure 29. Frequencies of Coso Obsidian Hydration Rims by Project, Region, and Time Period.
(Source: Hale, M., M. Giambastiani, D. Iversen, and M. Richards,
    2009 *Phase II Cultural Resource Evaluation at 51 Archaeological Sites in Management Regions 1A, 1B, 2B, 2C, and 3E, Bissell Hills and Paiute Ponds, Edwards Air Force Base, Kern and Los Angeles Counties, California*)

When I began this research project, my efforts were heavily influenced by the way that these previous researchers organized their obsidian data. My initial explorations of the data consisted of replicating those types of data presentation using a much larger suite of source and hydration data. However, the further I delved into my research, the clearer it became there was a flaw with this form of data organization. Specifically, both approaches do not take into consideration the fact that each cultural time period constitutes a different span of time. In fact, creating histograms based on hydration date frequency for each time period

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compresses the dates in such a manner that results in elevated quantities in a seemingly uniform distribution. For example, compare the following three figures prepared using the data compiled for this thesis. The first is a histogram of the Coso obsidian hydration dates for all of Edwards AFB grouped by the cultural sequence for Edwards AFB (Figure 30). The second is a histogram of the micron readings for all Coso obsidian artifacts recovered from Edwards AFB (Figure 31). The third is a histogram where the data are arranged in 500 year intervals (Figure 32).

Examining Figure 30, there are significantly more hydration dates for both the Pinto and Gypsum time periods compared to those that come before or after. If obsidian date frequency can truly be considered a proxy for habitation intensity, then taking this figure at face value gives the viewer the impression of a significant jump in habitation activity during the Pinto and Gypsum periods that is followed by an even greater decline in habitation during the Saratoga Springs and Shoshonean time periods. What this type of histogram fails to take into account, however, is the dissimilar time spans each of these cultural periods represents. The Pinto period spans 3,500 years and the Gypsum period spans 2,500 years compared to the Saratoga Springs period (800 years) and the Shoshonean period (600 years). Recognizing the different lengths of time associated with each cultural period, it is understandable that more obsidian entered the archaeological record during those longer spans of time. By

extension, less obsidian would have entered the record during the shorter spans of time.

Figure 30. Distribution of Coso Obsidian Hydration Dates for all of Edwards AFB by Cultural Time Period.

A commonly employed method for displaying obsidian hydration data is to simply construct a histogram based on the micron readings for each specimen in the sample. Once constructed, archaeologists use the micron readings intervals assigned to the various cultural time periods to analyze and interpret the distribution of those micron readings; the inset box of Figure 29 is an example of this type of micron interval for the cultural periods at Edwards AFB. Figure 31 is just such a histogram created from the data compiled for this study; the red vertical bars indicate the micron reading serving as the dividing point for each cultural time periods. To be sure, the micron readings from this data set create a classic 'battleship' shape with multimodal distribution and the bulk of the readings falling within the lines bounding the Pinto time period. As is the case with Figure

30, however, this method of displaying the data does not take into consideration the different length of time each cultural period represents. Consequently, inferences about prehistoric human behavior relying on this type of diagram are based on unequal distributions of the data and do not account for the reasonable expectation that more obsidian would have entered the archaeological record during a longer span of time.

Figure 31. Histogram of Coso Obsidian Micron Readings for all of Edwards AFB.

In contrast to those two methods of data organization, the distribution of obsidian hydration dates depicted in Figure 32 shows a radically different pattern. As in Figure 30, the quantities of obsidian hydration dates in the earliest periods (Late Pleistocene and Lake Mojave) are low. However, there are two jumps in obsidian frequency during the Pinto period. The first is a moderate increase in the 7,100 to 6,600 B.P. interval while the second is an even larger increase in the 6,100 to 5,600 B.P. interval. From 5,600 to 100 B.P. there are some fluctuations

in the quantity of obsidian dates for each 500 year interval, but during that span

of time each interval has an average of 58 dates. Importantly, this illustrates a

pattern of obsidian dates that is relatively stable across the date intervals

corresponding to the Gypsum and Saratoga Springs time periods compared to

Figure 32. Distribution of Coso Obsidian Hydration Dates for all of
Edwards AFB in 500 Year Intervals.

the dramatic decline suggested in Figure 30. An added benefit of using arbitrary,

but equally long, time slices is that it affords archaeologists the opportunity to

identify patterns that serve as launching points for further research that would

ordinarily be obscured by simply grouping data by cultural time period.

An Alternative Method for Data Normalization

As noted previously, the researchers who inspired my project explored the

issue of habitation intensity by simply interpreting the hydration profiles

generated by their field efforts and the aggregate for all of Edwards AFB (that was current as of 2000) without factoring for the disproportionate lengths of time for each cultural period. That is, they did not normalize the data when conducting their analysis. The problem with this lack of normalization is that it does not factor for the high likelihood that more obsidian will enter the archaeological record given a longer span of time. My approach to normalizing the data consisted of "slicing" it into equal segments and then examining the outcome. However, further pondering on the problem of the led me to arrive at another, perhaps simpler, approach.

This approach begins with a basic assumption that the rate of obsidian deposition remains constant for each cultural time period. From this starting point, it is possible to determine a multiplier needed to equalize the time spans being compared, i.e. increase the 'smaller' time period so that it is equal to the 'larger' time period. Once that multiplier is identified, it can then be applied to the quantity of obsidian for the smaller time period in order to arrive at the quantity of obsidian that would have been deposited if the smaller time period had lasted as long as the larger time period. As an example using the data from this thesis, a comparison of the obsidian frequency for the Saratoga Springs and Gypsum time periods would look like this:

- The Gypsum period lasted for 2,500 years (4000 to 1500 BP) and produced 291 hydration dates.

- The Saratoga Springs period lasted for 800 years (1500 to 700 BP) and produced 85 hydration dates.

- There is difference of 206 hydration dates between these two cultural periods (i.e. there are 206 more Gypsum period dates).

- A multiplier of 3.125 is needed to increase the duration of the Saratoga Springs period so that it is equal to the Gypsum period (3.125*800 = 2500).

- Appling the multiplier to the quantity of hydration dates for the Saratoga Springs period produces a total of 266 dates (3.125*85 = 265.6 rounded up).

- Therfore, assuming that obsidian was deposited into the archaeological record at a constant rate for this elongated Saratoga Springs period, then we would expect analysis of those artifacts to produce 266 hydration dates.

Clearly, 266 is still a smaller quantity of hydration dates than the 289 for the Gypsum period. However, the difference is only 25 dates, which is significantly less than a difference of 206 arrived at when comparing totals from the unequal lengths of time.

The above is a proof-of-concept for an alternate method for normalizing data to make in comparable between disproportionate time spans. A caveat must be given that this method was not exhaustively tested using all of the obsidian hydration dates for Edwards AFB or for the various management regions.

However, this initial exercise suggests this method may be useful for providing a different view of the data in order lend confidence to interpretations of the data from the "time slice" method of data normalization.

Hydration Rate at Edwards AFB

Two of the obsidian artifacts (cat. no. 10818 and 10819) included in the supplemental sourcing and hydration analysis for my thesis were selected specifically because they were part of an obsidian chipping station. Specifically, a discrete lithic feature of this nature can be considered a temporally bounded activity because it is located well away from the original lithic source which reduces the possibility of multiple deposition episodes. Additionally, the flakes comprising the feature can be assumed to have been produced in a short time span; perhaps even in a single sitting. Therefore, my intention in selecting two artifacts from such a temporally bounded feature was to empirically assess the rate that obsidian hydrates at Edwards AFB.

Considering the context from which they were recovered it comes as no surprise that both specimens have the same geochemical signature. Unfortunately, that signature places them as originating from the Saline Range source, which means that dates cannot be derived using Basgall's (1990) Coso hydration formula. Therefore, my assessment of the obsidian hydration rate at Edwards AFB is based simply on a comparison of the hydration rims. In the case of these artifacts, the hydration rim for one flake (cat. no. 10819) was measured as 1.5 microns thicker than the other flake (cat. no. 10818). As can be seen in

the hydration report found in Appendix D, the largest measurement taken for artifact number 10818 is still 1.2 microns smaller than the smallest measurement taken for artifact 10819. Had these artifacts been from the Coso volcanic fields, then the age difference between the two artifacts would be 1,185 years with one flake dating to the Gypsum period and the other to the Saratoga Springs period. This large of a difference between the micron readings for two artifacts recovered from this context is clearly problematic. Again the context in which these artifacts were found must be considered. It is assumed these two flakes were created during the same temporally discrete event that created the chipping station – if not on the same day, certainly within a time span that cannot be picked up by obsidian hydration dating. Therefore, scavenging is not a probable explanation for the difference in rim thicknesses. A more likely explanation for the divergence in the hydration rim readings is that one of the artifacts spent more time on the surface than the other. Given the depositional forces noted in Chapter 1, this supposition is not unreasonable. However, this finding raises a question regarding the reliability of hydration rim readings measured on artifacts recovered from Edwards AFB.

Recommendations for Further Research

A recurrent concern I had with my research efforts was the effect that various factors have on obsidian hydration and the impact that had on the dates derived for my analysis. Ultimately, I rationalized using the adjustment to Basgall's (1990) Coso hydration formula proposed by Basgall and Overly (2004)

because doing so allows for the comparison of my findings to theirs using the same metric, thus strengthening the results of my analysis. Using another hydration formula, would have produced a different suite of dates and removed the ability to compare between our studies. Revisiting the criticism of the obsidian hydration dating method, the concordance between the point forms and the hydration rim thicknesses returned from the supplemental analysis conducted for this thesis suggests that the matter is not as dire as the critics suggest.

However, the fact remains that a hydration formula grounded in solid research that accounts for variables such as EHT, humidity, intrinsic water, and depositional forces, does not currently exist for the Edwards AFB region. Consequently, researchers who want to incorporate obsidian hydration dates in their investigations are forced to make do with applying formulae developed for other regions of the Great Basin. Therefore, future archaeological investigations in and around Edwards AFB would benefit greatly from a comprehensive research effort that established an obsidian hydration formula specifically for this region of the western Mojave Desert.

As evidenced by the theoretical models presented in Chapter Two, a fundamental assumption at the beginning of my research was that the obsidian decline reported in the earlier studies was a real phenomenon. Therefore, the models for time allocation and technological investment were considered useful for explaining the decline in obsidian frequency. However, once my analysis showed there was no decline, my focus shifted to examining and seeking to

explain how and/or why the previous researchers came to the conclusions they did. Consequently, the theoretical models were no longer relevant to the explaining the particular question I was interested in because there was no longer a need to seek an explanation for the decline.

While the results of my research show that the bow and arrow did not fundamentally change the lithic procurement strategies of the aboriginal inhabitants of Edwards AFB, both the time allocation and technological investment models may help when exploring other research topics involving obsidian use on the installation. One such future research topic is an examination of the diachronic change in the lithic material used to manufacture both formal and informal tools at Edwards AFB. This effort would require an examination of the raw materials used to manufacture all of the tools recovered on Edwards AFB to see if such a change is evident, which was a task clearly outside the scope of this thesis.

CHAPTER SIX

CONCLUSION

The goal of my thesis was to investigate a pattern of obsidian use in the western Mojave Desert that was proposed by researchers working at Edwards AFB near the end of the last millennium. In their studies, the researchers concluded that prehistoric obsidian use declined sharply after 1500 B.P. This coincides with the transition from the Gypsum to the Saratoga Springs cultural periods. Significantly, this timing also roughly corresponds to when the bow and arrow is believed to have arrived in this region of the Mojave Desert.

The results of my research demonstrate that past perceptions of the intensity of aboriginal obsidian use at Edwards AFB were detrimentally affected by factors of sampling bias and data organization. The sampling bias is likely a byproduct of the reality that many of the past archaeological studies were commissioned to look specifically at sites within a management region rather than across the entire installation. While the effects of sampling bias are something that most people are familiar with, the effect that data organization can have is less well known. Matthew Johnson contends, "theory is *the order we put facts in*" (2011:2, emphasis in original). The implication of this statement is that the ordering of facts – the way data are organized – influences their interpretation. With regard to the earlier studies that inspired my research, the manner in which their data were organized clearly influenced their interpretations.

In contrast to the earlier studies, my research focused on organizing the data into arbitrary, but equal intervals that allowed for meaningful comparisons of the data. In doing so, my research showed that rather than declining, the amount of obsidian entering the region remained at a relatively stable level from 1500 B.P. until European contact. To be sure, minor fluctuations occurred, but any declines observed are nothing like the near total absence reported in the earlier studies.

My research also identified several intriguing patterns in the distribution of obsidian at Edwards AFB that serve as useful springboards for additional research. The first is that significant fluctuations were observed when the late Holocene quantities of obsidian present in the individual management regions were examined. Specifically, for Management Regions 3 and 5 there is a significant difference in the pattern of obsidian frequency before and after 1500 B.P. Whether these shifts in obsidian quantities were the result changing human behavior due to bow and arrow technology or the result of some other aspect of human behavior is something that warrants further exploration. The fact remains that there is no detectable change in the overall amount of obsidian entering the archaeological record at Edwards AFB subsequent to the arrival of the bow and arrow at about 1500 B.P.

The second is that while the overall amount of obsidian entering the archaeological record remained fairly constant, the number of sites where obsidian was being discarded began to shrink after about 5000 B.P. If obsidian

can truly be considered a proxy for habitation intensity, then this pattern suggests that prehistoric people began occupying fewer locations across Edwards AFB even as they continued using the same amount of obsidian. During the late Holocene it appears that aboriginal land use shifted from one that manifests in the archaeological record as small quantities of obsidian distributed in a large number of sites across a wide area, to one where larger quantities of obsidian are found in a smaller number of sites in a more limited area. Additional research is required to gain a better understanding, but possible explanations for this social transformation include changes in the environment, population levels, mobility patterns, or lithic reduction strategies.

These avenues for future research cannot be understated. Despite more than 40 years' worth of investigations, the archaeology of Edwards AFB is not widely known. In journal articles published about the southwestern Great Basin or the western Mojave Desert, the Edwards AFB is notably absent from the research efforts. This is undoubtedly due to the regulatory nature of the bulk of the work that has occurred on the installation; where the goal was to satisfy some aspect of historic preservation law as opposed to provide meaningful contributions to the archaeological literature. Therefore, it is hoped that this aspect of my research can serve to "pull back the curtain" on an archaeologically interesting area that has been shrouded in mystery for too long.

APPENDIX A

BIBLIOGRAPHY OF REPORTS CONTAINING

OBSIDIAN HYDRATION DATA

Date Published	Authors	Title
1988	Sutton	Obsidian Analyses in the Mojave Desert, California: Results, Cautions, and Comments
1988	Rosenthal, Breece, Padon, and Cerreto	Test Level Investigations at CA-LAN-1295, Edwards Air Force Base, California
1988	Hector, Gross, Bull, Wade, Manley, Haynall, and Cheever	Cultural Resource Investigation for the Farm Drop Zone, Edwards Air Force Base, California
1989	Wade and Hector	Archaeological Testing and National Register Evaluation of Site LAN-1316, Edwards Air Force Base, California
1990	Wessel, Charlton, Crawford, Howard, Kilanowski, Kummer, McIntyre, Perry, Smock, and Wessel	CA-KER-1830 Test and Evaluation: Technical Report
1991	York and Hull	Archaeological Investigations at CA-KER-2816 and CA-KER-2817, Edwards Air Force Base, California
1993	Macko	National Register Eligibility Determinations for Historic Resources Along the Proposed AT&T Lightguide System, Victorville to Bakersfield, California
1994	Byrd, Pallette, and Serr	Prehistoric Settlement along the Eastern Margin of Rogers Dry Lake, Western Mojave Desert, California
1995	Swope, Clement, and Pfingst	Phase I Report Cultural Resources Survey for Remedial Investigation/Feasibility Study South Base Operable Unit No. 2, Edwards Air Force Base
1995	Boyer, Underwood, Alexander, and Earle	Phase II Cultural Resource Evaluation of the Rich Road Area, Edwards AFB, Kern County California
1995	Campbell, Boyer, Johannesmeyer, Ronning, way, and Wessel	Phase II Cultural Resource Evaluation for the Emplacement of an Underground Natural Gas Transmission Pipeline to Boron from the Phillips Laboratory, Edwards AFB, Kern County, California
1996	Campbell	Phase II Cultural Resource Evaluation for the Abandoned Prime Base Emergency Engineering Force (PRIME BEEF) Facility, Edwards AFB, Kern County, California
1996	Alcock and Torres	Phase II Cultural Resource Evaluation of Three Branch Memorial Park Sites: California-Kern (CA-KER) -673/H, CA-KER-1822H, and CA-KER-2309/H, Edwards AFB, Kern County, California
1996	Byrd (editor)	Camping in the Dunes: Archaeological and Geomorphological Investigations of Late Holocene Settlements West of Rogers Dry Lake

Date Published	Authors	Title
1996	Bupp, Komprolides, Chandler, Doyle, and Meyer	Cultural Resources Investigations at Phillips Laboratory, Edwards Air Force Base, California, Installation Restoration Program (IRP) Site Inspection Activities
1996	Silsbee	Phase II Cultural Resource Evaluation of Site CA-KER-2083, Precision Impact Rang Area (PIRA) West Range, Kern County, Edwards AFB, California
1997	York, Wahoff, and Corbett	Cultural Resource Investigations at Area P Housing Complex and Adjacent Sites, Edwards Air Force Base, California
1997	Taşkiran, Graham, Doyle, Titus, and Komprolides	The Evaluation of Site CA-LAN-863, South Rogers Lake Area, Edwards Air Force Base, California
1997	Titus, Chandler, Cotterman, Doyle, Guerrero, Knell, Komprolides, Retamal, and Taşkiran	The Evaluation of Five Archaeological Sites Along 140th Street, Edwards Air Force Base, California
1998	Eckhardt	Phase II Archaeological Test Evaluation of Six Cultural Resource Sites at Edwards AFB, Kern County, California
1998	Bupp, Chandler, Cotterman, Doyle, Guerrero, Hallett, and Smith	The Legacy of Buckhorn Springs: Phase I and II Cultural Resources Investigations, Edwards AFB, Kern County, California
1999	Computer Sciences Corporation	ETSS Support
1999	Pritchard Parker, Wells, Puckett, and Cooper	Phase II Cultural Resource Evaluation of Five Archaeological Sites in the Rogers Lake North Management Area, Edwards AFB, Kern County, California
1999	Hughes and Origer	Geochemical Research Laboratory Letter Report 99-82
2000	Giambastiani and Basgall	Phase II Cultural Resource Evaluation for Sites CA-KER-4773/H and CA-KER-2016 in the Bissell Basin, Edwards Air Force Base, California
2000	Parker	Phase II Cultural Resource Evaluation for 19 Sites, Edwards AFB, Kern County, California
2001	Walsh	Cultural Resource Testing and Phase II Evaluation of the Proposed Jackrabbit Hill Archaeological District, Area 5A, West Range, Precision Impact Range Area (PIRA) at Edwards Air Force Base, California
2001	Walsh, Clewlow, and Van Wyke	Cultural Resource Testing and Phase II Evaluation of Seven Archaeological Sites Along the Edwards Air Force Base Research Laboratory (AFRL) Waterline, Kern County, California
2001	Campbell	Phase II Evaluation of the Ettinger Cave Area, Management Region 5, Edwards AFB, Kern

Date Published	Authors	Title
		County, California
2002	Chatters, Davy, Fogerty, and Flemming	Cultural Resource Testing and Evaluation for 30 Sites in Management Region 5, Edwards Air Force Base, Kern, San Bernardino, and Los Angeles Counties, California
2002	Walsh and Wells	Phase II Cultural Resource Evaluation for Five Sites, Management Region 5, Edwards Air Force Base, California
2002	Deis, Gross, and Ludwig	Phase II Cultural Resource Evaluation for Archaeological Sites in Management Region 5 Edwards AFB, Kern, Los Angeles, and San Bernardino Counties, California
2002	Gross, Deis, and Ludwig	Phase II Cultural Resource Evaluation for Archaeological Sites in Target PB-6 Area Edwards AFB, San Bernardino County, California
2002	Walsh and Green	Phase II Cultural Resource Evaluation for Thirty-Two Sites, Management Regions 3 and 5, South Central Region, Edwards AFB, California
2002	Walsh, Green, Crosby, Johnson, and Clewlow	Phase II Cultural Resource Evaluation for Twenty-Seven Archaeological Sites in Cultural Resource Management Regions 3 and 4, Edwards Air Force Base, Kern County, California
2002	Parker	Phase II Cultural Resources Evaluation for 20 Sites at Edwards AFB, Kern, Los Angeles, and San Bernardino Counties, California
2004	Basgall and Overly	Prehistoric Archaeology of the Rosamond Lake Basin: Phase II Cultural Resource Evaluations at 41 Sites in Management Region 2, Edwards Air Force Base, California
2004	Budinger, Nicoloff, Campbell, and Spinney	Classification of Projectile Points from Edwards Air Force Base and the Western Mojave Desert, California and a Guide to Projectile Points of Edwards Air Force Base and the Western Mojave Desert
2005	Chatters and Fogerty	Archaeological Evaluation for 15 Prehistoric Sites Along the Southern Base Boundary, Edwards AFB, Los Angeles County, California
2005	Horne and McDougall	A Phase II Evaluation of 25 Prehistoric Archaeological Sites Located in Management Region 3, Edwards Air Force Base, California
2007	Fogerty and Farrell	Archaeological Evaluation of Selected Sites Along the Northeast Boundary Region, Edwards AFB, Kern and San Bernardino Counties, California
2007	Giambastiani, Ghabhláin, Hale, Catacora, Iversen, and Becker	Phase II Cultural Resource Evaluations of 21 Sites Along the West and Northwestern Boundaries, Edwards AFB, Kern and Los Angeles Counties, California

Date Published	Authors	Title
2009	Hale, Giambastiani, Iversen, and Richards	Phase II Cultural Resource Evaluations at 51 Archaeological Sites in Management Regions 1A, 1B, 2B, 2C, and 3E, Bissell Hills and Paiute Ponds, Edwards Air Force Base, Kern and Los Angeles Counties, California
2010	Hale, Giambastiani, Daniels, and Dalope	Phase II Cultural Resources Evaluations at 85 Archaeological Sites in Management Areas 2b, 2c, 3F, 3H, 3I, and 4B, Edwards Air Force Base, Kern and Los Angeles Counties, California
2010	Chandler, Mason, Cotterman, Bholat, Hale, Aguirre, Howard, Knypstra, Budinger, and Puckett	Prehistoric Themes Study for Cultural Resources Management Region 2 at Edwards Air Force Base, California
2011	Giambastiani, Moore, and Giambastiani	Phase II Cultural Resource Evaluations at 31 Archaeological Sites in Management Areas 3I and 4B, Edwards Air Force Base, Kern County, California
2014	Giambastiani, Hale, Cole, and Moore	Evaluations, Archaeological Sites (Mesquite Processing), Range: Edwards Air Force Base, California
2016	Pritchard Parker and Lopez	A Phase II Archaeological Evaluation of 12 Prehistoric Sites in Management Regiond 2, Edwards Air Force Base, Los Angeles County, California

APPENDIX B

OBSIDIAN DATABASE

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-1161	716	Flake	Surface	11.3	8,772	11.9	9,823	LPL	UNK	NS	TC	2	A
CA-KER-1161	5396	Flake	Surface	10.3	7,075	10.8	7,923	LMO	CO	WS	TC	2	A
CA-KER-1161	5397	RTF	UNK	9.7	6,156	10.2	6,893	PTO	CO	WS	TC	2	A
CA-KER-1161	5397	RTF	UNK	14.4	15,394	15.1	17,239	LPL	CO	WS	TC	2	A
CA-KER-1161	5400	UTF	UNK	10.8	7,898	11.3	8,844	LMO	CO	WS	TC	2	A
CA-KER-1162	68-68-1	Flake	UNK	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	3	G
CA-KER-1162	68-68-1	Flake	UNK	6.2	2,179	6.5	2,440	GYP	CO	WS	TC	3	G
CA-KER-1162	45-45-1	UTF	UNK	5.6	1,721	5.9	1,927	GYP	CO	WS	TC	3	G
CA-KER-1162	230-230-1	PF	UNK	6.0	2,020	6.3	2,262	GYP	CO	WS	TC	3	G
CA-KER-1174	718	Point	Surface	10.3	7,075	10.8	7,923	LMO	CO	WCP	TC	3	H
CA-KER-1174	720	UTF	Surface	10.3	7,075	10.8	7,923	LMO	CO	WCP	TC	3	H
CA-KER-1174	721	Flake	Surface	10.4	7,236	10.9	8,103	LMO	CO	WCP	TC	3	H
CA-KER-1176	3-3-1	Flake	UNK	0.0	0	0.0	0	--	CO	WS	TC	3	H
CA-KER-1176	1-1-1	Flake	UNK	0.0	0	0.0	0	--	CO	WS	TC	3	H
CA-KER-1180/H	722	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	TC	3	G
CA-KER-1180/H	723	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	TC	3	G
CA-KER-1182	724	Flake	Surface	6.2	2,179	6.5	2,440	GYP	CO	WCP	TC	3	I
CA-KER-1183	725	Flake	Surface	11.1	8,416	11.7	9,425	LPL	CO	WCP	TC	3	I
CA-KER-1183	726	Flake	Surface	9.4	5,723	9.9	6,409	PTO	CO	WCP	TC	3	I
CA-KER-1183	1	BFF	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	I
CA-KER-1183	2	Flake	Surface	13.0	12,143	13.7	13,598	LPL	CO	WS	TC	3	I
CA-KER-1183	3	Flake	Surface	13.8	13,947	14.5	15,619	LPL	CO	WS	TC	3	I
CA-KER-1183	4	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	I
CA-KER-1184	727	Flake	Surface	6.5	2,432	6.8	2,723	GYP	CO	WCP	TC	5	A
CA-KER-1187	728	Biface	Surface	0.0	0	0.0	0	--	UNK	NS	TC	5	F
CA-KER-11884	4820	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	2	A
CA-KER-11884	4819	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	2	A
CA-KER-1189	947	Flake	Surface	12.3	10,679	12.9	11,959	LPL	CO	WS	TC	3	F
CA-KER-1189	947	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	TC	3	F
CA-KER-1189	948	Flake	Surface	5.2	1,449	5.5	1,623	GYP	CO	WCP	TC	3	F
CA-KER-1189	950	Flake	Surface	12.3	10,679	12.9	11,959	LPL	CO	WCP	TC	3	F
CA-KER-1189	160	Flake	TU 3 (0-10)	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	3	F
CA-KER-1189	183	Flake	TU 3 (60-70)	10.3	7,075	10.8	7,923	LMO	CO	CO	TC	3	F
CA-KER-1189	186	Flake	TU 4 (0-10)	4.4	983	4.6	1,101	SSP	CO	CO	TC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-1189	190	Flake	TU 4 (10-20)	3.7	658	3.9	737	SSP	CO	CO	TC	3	F
CA-KER-1189	202	Flake	TU 5 (10-20)	8.5	4,531	8.9	5,074	PTO	CO	CO	TC	3	F
CA-KER-1189	202	Flake	TU 5 (10-20)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	3	F
CA-KER-1189	207	Flake	TU 5 (20-30)	0.0	0	0.0	0	--	CO	CO	TC	3	F
CA-KER-1189	227	Flake	TU 5 (10-20)	8.6	4,656	9.0	5,214	PTO	CO	CO	TC	3	F
CA-KER-1208	1173	Scraper	Surface	6.2	2,179	6.5	2,440	GYP	CO	CO	TC	3	F
CA-KER-1439	280	BTF	TU 1 (S)	7.1	2,985	7.5	3,342	PTO	UNK	NS	TC	3	B
CA-KER-1439	280	BTF	TU 1 (S)	5.6	1,721	5.9	1,927	GYP	UNK	NS	TC	3	B
CA-KER-1439	281	BTF	TU 2 (S)	9.8	6,304	10.3	7,059	PTO	UNK	NS	TC	3	B
CA-KER-1439	281	BTF	TU 2 (S)	8.4	4,408	8.8	4,937	PTO	UNK	NS	TC	3	B
CA-KER-1439	4650	PF	Surface	2.1	177	2.2	198	SHO	UNK	NS	TC	3	B
CA-KER-1702/H	269	Flake	TU 4 (30-40)	6.3	2,262	6.6	2,533	GYP	CO	WCP	TC	5	D
CA-KER-1753	349-191	Flake	Surface	7.9	3,823	8.3	4,282	PTO	UNK	NS	TC	3	J
CA-KER-1763	12	DSN	Surface	1.7	108	1.8	121	SHO	CO	WS	TC	3	J
CA-KER-1763	115	BFF	Surface	6.2	2,179	6.5	2,440	GYP	CO	WCP	TC	3	J
CA-KER-1764	3690	Dart	Surface	0.0	0	0.0	0	--	UNK	UNK	TC	3	J
CA-KER-1810/H	45	LSD	Surface	2.9	374	3.0	419	SHO	CO	WS	TC	3	B
CA-KER-1810/H	47	CWT	Surface	3.0	404	3.2	453	SHO	CO	WS	TC	3	B
CA-KER-1813	19	Flake	Surface	9.2	5,444	9.7	6,097	PTO	CO	CO	TC	3	B
CA-KER-1813	13	Flake	Surface	10.4	7,236	10.9	8,103	LMO	CO	CO	TC	3	B
CA-KER-1813	17	Flake	Surface	11.9	9,891	12.5	11,076	LPL	CO	CO	TC	3	B
CA-KER-1830	2	SLP	Surface	8.4	4,408	8.8	4,937	PTO	UNK	UNK	TC	3	I
CA-KER-1830	15	FT	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	3	I
CA-KER-1830	16	Flake	Surface	13.2	12,580	13.9	14,088	LPL	CO	SL	TC	3	I
CA-KER-1830	17	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	WS	TC	3	I
CA-KER-1830	15	Flake	Surface	13.1	12,360	13.8	13,842	LPL	CO	WS	TC	3	I
CA-KER-1830	71	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	3	I
CA-KER-1830	144	FT	Surface	11.0	8,241	11.6	9,229	LPL	CO	WS	TC	3	I
CA-KER-1830	156	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	3	I
CA-KER-1830	171	Flake	Surface	10.9	8,068	11.4	9,035	LMO	CO	WS	TC	3	I
CA-KER-1830	172	Flake	Surface	10.0	6,606	10.5	7,398	LMO	CO	WS	TC	3	I
CA-KER-1830	180	Flake	Surface	19.5	31,106	20.5	34,834	LPL	CO	WS	TC	3	I
CA-KER-1830	180	Flake	Surface	11.3	8,772	11.9	9,823	LPL	CO	WS	TC	3	I
CA-KER-1830	197	Flake	Surface	9.1	5,308	9.6	5,944	PTO	CO	WS	TC	3	I

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-1830	205	Flake	Surface	12.4	10,882	13.0	12,186	LPL	CO	WS	TC	3	--
CA-KER-1830	208	Flake	Surface	12.1	10,281	12.7	11,513	LPL	CO	JR	TC	3	--
CA-KER-1830	209	FT	Surface	9.6	6,009	10.1	6,730	PTO	CO	WS	TC	3	--
CA-KER-1830	227	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	3	--
CA-KER-1830	228	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	3	--
CA-KER-1830	241	FT	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	3	--
CA-KER-1830	268	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	3	--
CA-KER-1830	289	BFF	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	3	--
CA-KER-1830	309	FT	Surface	11.0	8,241	11.6	9,229	LPL	CO	WS	TC	3	--
CA-KER-1830	309	FT	Surface	4.5	1,036	4.7	1,160	SSP	CO	WS	TC	3	--
CA-KER-1830	341	BFF	Surface	10.7	7,729	11.2	8,655	LMO	CO	WS	TC	3	--
CA-KER-1830	394	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-1830	398	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-1830	399	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	3	--
CA-KER-1830	626	FT	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	3	--
CA-KER-1830	626	FT	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	TC	3	--
CA-KER-1830	634	FT	Surface	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	3	--
CA-KER-1830	658	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	CO	TC	3	--
CA-KER-1830	687	BFF	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	--
CA-KER-1830	733	FT	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	--
CA-KER-1830	745	Flake	TU 2 (10-20)	8.3	4,288	8.7	4,802	PTO	CO	WS	TC	3	--
CA-KER-1830	868	Flake	TU 9 (0-10)	9.7	6,156	10.2	6,893	PTO	CO	WS	TC	3	--
CA-KER-1830	901	Flake	TU 9 (20-30)	9.7	6,156	10.2	6,893	PTO	CO	CO	TC	3	--
CA-KER-1830	910	Flake	Surface	11.0	8,241	11.6	9,229	LPL	CO	WS	TC	3	--
CA-KER-1830	933	FT	Surface	9.1	5,308	9.6	5,944	PTO	CO	WS	TC	3	--
CA-KER-1830	935	Flake	Surface	7.8	3,712	8.2	4,157	PTO	CO	WS	TC	3	--
CA-KER-1830	936	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	CO	TC	3	--
CA-KER-1830	942	Flake	Surface	16.3	20,523	17.1	22,982	LPL	CO	WS	TC	3	--
CA-KER-1830	942	Flake	Surface	8.7	4,782	9.1	5,356	PTO	CO	WS	TC	3	--
CA-KER-1830	950	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	3	--
CA-KER-1830	951	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	3	--
CA-KER-1830	968	Flake	Surface	9.9	6,454	10.4	7,228	PTO	CO	WS	TC	3	--
CA-KER-1830	980	Flake	Surface	17.1	22,936	18.0	25,685	LPL	CO	SL	TC	3	--
CA-KER-1830	982	Flake	Surface	14.7	16,149	15.4	18,084	LPL	CO	SL	TC	3	--

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-1830	986	Flake	Surface	0.0	0	0.0	0	–	CO	WS	TC	3	–
CA-KER-1830	988	Flake	Surface	9.9	6,454	10.4	7,228	PTO	CO	CO	TC	3	–
CA-KER-1830	989	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	CO	TC	3	–
CA-KER-1830	990	Flake	Surface	0.0	0	0.0	0	–	CO	WCP	TC	3	–
CA-KER-1830	991	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	3	–
CA-KER-1830	993	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	3	–
CA-KER-1830	994	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	WS	TC	3	–
CA-KER-1839	368-205	Flake	Surface	6.1	2,099	6.4	2,350	GYP	UNK	NS	TC	3	–
CA-KER-1839	368-206	PF	Surface	8.1	4,052	8.5	4,537	PTO	UNK	NS	TC	3	–
CA-KER-1878	7308	HBT	Surface	0.0	0	0.0	0	–	CO	WS	TC	3	–
CA-KER-1878	13-13-1	UTF	UNK	6.4	2,346	6.7	2,627	GYP	CO	WS	TC	3	–
CA-KER-1880	382-94	Flake	Surface	9.1	5,308	9.6	5,944	PTO	CO	WS	RS	5	A
CA-KER-1880	7031	BFF	Surface	7.2	3,083	7.6	3,452	PTO	CO	SL	RS	5	A
CA-KER-1883/H	386-1-6	Flake	Surface	21.3	38,177	22.4	42,753	LPL	CO	CO	TC	2	D
CA-KER-1883/H	386-1-7	Flake	Surface	9.6	6,009	10.1	6,730	PTO	CO	WS	TC	2	D
CA-KER-1883/H	386-10-34	Flake	STU (20-30)	9.1	5,308	9.6	5,944	PTO	CO	CO	TC	2	D
CA-KER-1884	387-1-2	Flake	Surface	10.5	7,398	11.0	8,285	LMO	CO	CO	TC	2	D
CA-KER-1889	4660	CWL	Surface	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	3	F
CA-KER-1922/H	173A	Flake	TU 1A (0-5)	6.3	2,262	6.6	2,533	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	173B	Flake	TU 1A (0-5)	6.6	2,519	6.9	2,821	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	183	Flake	TU 2A (10-20)	6.6	2,519	6.9	2,821	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	184	Flake	TU 2A (20-30)	5.9	1,942	6.2	2,175	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	172	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	WCP	BC	3	F
CA-KER-1922/H	242A	Flake	1AAA (0-5)	0.0	0	0.0	0	–	UNK	NS	BC	3	F
CA-KER-1922/H	242B	Flake	1AAA (0-5)	7.7	3,603	8.1	4,034	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	242C	Flake	1AAA (0-5)	5.7	1,793	6.0	2,008	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	242D	Flake	1AAA (0-5)	6.7	2,609	7.0	2,922	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	242E	Flake	1AAA (0-5)	5.9	1,942	6.2	2,175	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	249	PF	1AAA (0-5)	6.1	2,099	6.4	2,350	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	274B	Flake	3AAA (0-5)	6.5	2,432	6.8	2,723	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	279	CWT	4AAA (0-10)	2.9	374	3.0	419	SHO	CO	WCP	BC	3	F
CA-KER-1922/H	288A	Flake	5AAA (0-10)	10.0	6,606	10.5	7,398	LMO	UNK	NS	BC	3	F
CA-KER-1922/H	294	Flake	5AAA (10-20)	5.8	1,867	6.1	2,091	GYP	CD	LM	BC	3	F
CA-KER-1922/H	192C	Flake	6AAA (0-5)	9.7	6,156	10.2	6,893	PTO	UNK	NS	BC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-1922/H	192D	Flake	6AAA (0-5)	8.4	4,408	8.8	4,937	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	192E	Flake	6AAA (0-5)	4.8	1,203	5.0	1,348	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	192G	Flake	6AAA (0-5)	6.1	2,099	6.4	2,350	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	192H	Flake	6AAA (0-5)	4.6	1,090	4.8	1,221	SSP	UNK	NS	BC	3	F
CA-KER-1922/H	192I	Flake	6AAA (0-5)	6.1	2,099	6.4	2,350	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	192J	Flake	6AAA (0-5)	6.2	2,179	6.5	2,440	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	192K	Flake	6AAA (0-5)	0.0	0	0.0	0	-	UNK	NS	BC	3	F
CA-KER-1922/H	192L	Flake	6AAA (0-5)	4.1	835	4.3	935	SSP	UNK	NS	BC	3	F
CA-KER-1922/H	192M	Flake	6AAA (0-5)	0.0	0	0.0	0	-	UNK	NS	BC	3	F
CA-KER-1922/H	192N	Flake	6AAA (0-5)	4.9	1,262	5.1	1,414	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	192O	Flake	6AAA (0-5)	4.5	1,036	4.7	1,160	SSP	UNK	NS	BC	3	F
CA-KER-1922/H	192P	Flake	6AAA (0-5)	8.2	4,169	8.6	4,668	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	192Q	Flake	6AAA (0-5)	9.0	5,174	9.5	5,794	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	192R	Flake	6AAA (0-5)	6.1	2,099	6.4	2,350	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	192S	Flake	6AAA (0-5)	8.2	4,169	8.6	4,668	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	204A	Flake	7AAA (0-10)	7.3	3,183	7.7	3,565	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	204B	Flake	7AAA (0-10)	7.7	3,603	8.1	4,034	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	210	Flake	7AAA	12.3	10,679	12.9	11,959	LPL	UNK	NS	BC	3	F
CA-KER-1922/H	227A	Flake	8AAA (0-10)	7.9	3,823	8.3	4,282	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	227B	Flake	8AAA (0-10)	6.9	2,793	7.2	3,128	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	238A	Flake	8AAA (30-40)	4.6	1,090	4.8	1,221	SSP	UNK	NS	BC	3	F
CA-KER-1922/H	238B	Flake	8AAA (30-40)	7.8	3,712	8.2	4,157	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	244	Flake	8AAA (40-50)	7.7	3,603	8.1	4,034	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	263	Flake	8AAA (130-140)	6.8	2,700	7.1	3,024	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	267	Flake	Surface	5.4	1,582	5.7	1,771	GYP	CO	WCP	BC	3	F
CA-KER-1922/H	276	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	BC	3	F
CA-KER-1922/H	291	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WCP	BC	3	F
CA-KER-1922/H	313	Flake	1B (10-20)	1.1	39	1.2	44	SHO	UNK	NS	BC	3	F
CA-KER-1922/H	323	Flake	1B (60-70)	9.6	6,009	10.1	6,730	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	332	Flake	3B (0-50)	7.7	3,603	8.1	4,034	PTO	CO	WCP	BC	3	F
CA-KER-1922/H	336	Flake	4B (0-10)	2.0	158	2.1	177	SHO	UNK	NS	BC	3	F
CA-KER-1922/H	342	Flake	Surface	6.4	2,346	6.7	2,627	GYP	CO	WCP	BC	3	F
CA-KER-1922/H	841	Flake	31KKK (0-10)	8.2	4,169	8.6	4,668	PTO	BM	BM	BC	3	F
CA-KER-1922/H	864	Flake	31KKK (40-50)	6.6	2,519	6.9	2,821	GYP	UNK	NS	BC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-1922/H	650A	Flake	12T (20-30)	7.1	2,985	7.5	3,342	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	650B	Flake	12T (20-30)	6.1	2,099	6.4	2,350	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	661	Flake	12T (30-40)	4.7	1,146	4.9	1,283	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	683	Flake	12T (60-70)	0.0	0	0.0	0	-	UNK	NS	BC	3	F
CA-KER-1922/H	712	Flake	12T (100-110)	5.2	1,449	5.5	1,623	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	395	Flake	5T (30-60)	8.9	5,041	9.3	5,646	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	467	Flake	13V (0-30)	6.9	2,793	7.2	3,128	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	543	Flake	17V (0-10)	6.6	2,519	6.9	2,821	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	1016	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WCP	BC	3	F
CA-KER-1922/H	1017	Flake	Surface	8.8	4,911	9.2	5,499	PTO	FS	FS	BC	3	F
CA-KER-1922/H	920	Flake	Surface	8.3	4,288	8.7	4,802	PTO	CO	WCP	BC	3	F
CA-KER-1922/H	969A	Flake	41 (0-10)	8.0	3,937	8.4	4,408	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	969B	Flake	41 (0-10)	7.0	2,888	7.4	3,234	PTO	UNK	NS	BC	3	F
CA-KER-1922/H	969C	Flake	41 (0-10)	5.5	1,650	5.8	1,848	GYP	UNK	NS	BC	3	F
CA-KER-1922/H	4788	AB	Surface	2.0	158	2.1	177	SHO	CO	WS	BC	3	F
CA-KER-1922/H	423-1023	DSN	Surface	3.1	436	3.3	489	SHO	CO	WS	BC	3	F
CA-KER-1922/H	2018	DSN	Surface	2.5	265	2.6	297	SHO	CO	WS	BC	3	F
CA-KER-1922/H	1018	DSN	Surface	2.9	374	3.0	419	SHO	CO	JR	BC	3	F
CA-KER-2007	559-1	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	1	A
CA-KER-2007	559-12	Flake	STP A (0-10)	4.6	1,090	4.8	1,221	SSP	CO	WS	TC	1	A
CA-KER-2009/H	1078	Pinto	Surface	8.5	4,531	8.9	5,074	PTO	CO	WS	TC	1	A
CA-KER-2016	1080	ECN	Surface	5.2	1,449	5.5	1,623	GYP	CO	WS	TC	1	A
CA-KER-2016	7702	RSP	Surface	4.2	883	4.4	989	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-519	Flake	Surface	0.0	0	0.0	0	-	CO	WS	TC	1	A
CA-KER-2016	568-1-640	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-695a	Flake	SRU Cell E (S)	1.4	69	1.5	77	SHO	CO	WS	TC	1	A
CA-KER-2016	561-1-695b	Flake	SRU Cell E (S)	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	1	A
CA-KER-2016	561-1-2	Flake	Surface	0.0	0	0.0	0	-	CO	WS	TC	1	A
CA-KER-2016	568-1-3	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-5	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-6	Point	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-7a	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-7b	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-9	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	1	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-2016	568-1-21	Flake	Surface	3.5	578	3.7	648	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-22	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	1	A
CA-KER-2016	568-1-24	Flake	Surface	4.4	983	4.6	1,101	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-25	Flake	Surface	4.5	1,036	4.7	1,160	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-26	Point	Surface	4.2	883	4.4	989	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-28	Flake	Surface	8.3	4,288	8.7	4,802	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-29	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-30	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WS	TC	1	A
CA-KER-2016	568-1-31	Flake	Surface	4.4	983	4.6	1,101	SSP	CO	CO	TC	1	A
CA-KER-2016	568-1-32	Point	Surface	4.5	1,036	4.7	1,160	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-243	Point	Surface	4.4	983	4.6	1,101	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-316	Flake	SRU Cell A (S)	4.6	1,090	4.8	1,221	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-333a	Flake	SRU Cell F (S)	4.4	983	4.6	1,101	SSP	CO	WS	TC	1	A
CA-KER-2016	568-1-333b	Flake	SRU Cell F (S)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	1	A
CA-KER-2016	568-10-360	Flake	N1/W4 (10-20)	3.2	470	3.4	526	SHO	CO	CO	TC	1	A
CA-KER-2016	568-10-376a	Flake	N1/W6 (10-20)	3.5	578	3.7	648	SSP	CO	WS	TC	1	A
CA-KER-2016	568-10-434	Point	S6/W6 (60-70)	3.4	541	3.6	606	SSP	CO	WS	TC	1	A
CA-KER-2016	568-10-464	Point	S8/W5 (10-20)	4.4	983	4.6	1,101	SSP	CO	CO	TC	1	A
CA-KER-2016	568-10-481	Flake	S8/W5 (50-60)	3.4	541	3.6	606	SSP	CO	CO	TC	1	A
CA-KER-2016	568-1-8	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	1	A
CA-KER-2016	568-1-22	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-27	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	1	A
CA-KER-2016	568-1-37	Point	Surface	6.6	2,519	6.9	2,821	GYP	CO	WS	TC	1	A
CA-KER-2016	568-10-198	Flake	N38/W49 (10-20)	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	1	A
CA-KER-2016	568-10-211	Flake	N40/W49 (10-20)	7.9	3,823	8.3	4,282	PTO	CO	WS	TC	1	A
CA-KER-2016	568-10-233	Flake	S15.5/E47 (20-30)	5.7	1,793	6.0	2,008	GYP	CO	CO	TC	1	A
CA-KER-2025	1599	DSN	Surface	4.0	788	4.2	883	SSP	CO	WS	TC	3	-
CA-KER-2027	1190	LMO	Surface	9.3	5,583	9.8	6,252	PTO	UNK	UNK	TC	3	-
CA-KER-2038	101	Dart	TU 16 (20-30)	6.0	2,020	6.3	2,262	GYP	CO	SL	TC	3	-
CA-KER-2038	132	Pinto	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	3	-
CA-KER-2038	133	Dart	Surface	0.0	0	0.0	0	-	CO	WS	TC	3	-
CA-KER-2038	7269	Elko	Surface	5.8	1,867	6.1	2,091	GYP	CO	WS	TC	3	-
CA-KER-2038/H	7282	RSP	Surface	4.3	932	4.5	1,044	SSP	CO	WS	TC	3	-
CA-KER-2053	174	BTF	TU 6 (20-30)	9.3	5,583	9.8	6,252	PTO	CO	WS	TC	4	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-2053	106	BTF	TU 3 (S)	9.2	5,444	9.7	6,097	PTO	CO	WS	TC	4	B
CA-KER-2053	99	BTF	TU 3 (S)	0.0	0	0.0	0	--	CO	WCP	TC	4	B
CA-KER-2059	1	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	SL	TC	3	--
CA-KER-2059	2	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	3	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	4	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	5	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	6	Flake	Surface	7.4	3,285	7.8	3,679	PTO	CO	SL	TC	3	--
CA-KER-2059	7	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	SL	TC	3	--
CA-KER-2059	8	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	SL	TC	3	--
CA-KER-2059	9	Flake	Surface	8.5	4,531	8.9	5,074	PTO	CO	SL	TC	3	--
CA-KER-2059	9	Flake	Surface	1.5	81	1.6	91	SHO	CO	SL	TC	3	--
CA-KER-2059	10	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	SL	TC	3	--
CA-KER-2059	11	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	SL	TC	3	--
CA-KER-2059	12	Flake	Surface	12.2	10,479	12.8	11,735	LPL	CO	SL	TC	3	--
CA-KER-2059	13	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	SL	TC	3	--
CA-KER-2059	14	Flake	Surface	11.5	9,137	12.1	10,232	LPL	CO	SL	TC	3	--
CA-KER-2059	15	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	SL	TC	3	--
CA-KER-2059	16	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	17	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	18	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	19	Flake	Surface	11.1	8,416	11.7	9,425	LPL	CO	SL	TC	3	--
CA-KER-2059	20	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	21	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	22	Flake	Surface	7.2	3,083	7.6	3,452	PTO	CO	WS	TC	3	--
CA-KER-2059	23	Flake	Surface	0.0	0	0.0	0	--	CO	SL	TC	3	--
CA-KER-2059	24	Flake	Surface	11.4	8,953	12.0	10,026	LPL	CO	SL	TC	3	--
CA-KER-2059	25	Flake	Surface	9.5	5,865	10.0	6,568	PTO	CO	SL	TC	3	--
CA-KER-2091	4912	PF	Surface	6.5	2,432	6.8	2,723	GYP	CO	WS	TC	3	J
CA-KER-2124	2124-111	BFF	Surface	4.1	835	4.3	935	SSP	CO	WS	TC	3	B
CA-KER-2131	99	BTF	TU 2 (30-40)	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	3	F
CA-KER-2131	594	Shatter	TU 7 (S)	8.6	4,656	9.0	5,214	PTO	CO	CO	TC	3	F
CA-KER-2154	6836	UTF	UNK	8.3	4,288	8.7	4,802	PTO	CO	WS	HE	3	F
CA-KER-2200	6770	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	WS	RS	5	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-2200	6771	Flake	Surface	10.5	7,398	11.0	8,285	LMO	CO	WCP	RS	5	A
CA-KER-2200	6771	Flake	Surface	7.9	3,823	8.3	4,282	PTO	CO	WCP	RS	5	A
CA-KER-2200	6772	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	RS	5	A
CA-KER-2234	11-11-1	Flake	UNK	4.6	1,090	4.8	1,221	SSP	CO	WS	TC	3	--
CA-KER-2234	27-26-2	UTF	UNK	4.7	1,146	4.9	1,283	GYP	CO	WS	TC	3	--
CA-KER-2234	24-24-1	UTF	UNK	9.5	5,865	10.0	6,568	PTO	CO	WS	TC	3	--
CA-KER-2234	5-5-1	UTF	UNK	6.4	2,346	6.7	2,627	GYP	CO	WS	TC	3	--
CA-KER-2234	9-9-1	RTF	UNK	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	3	--
CA-KER-2308/H	2776-1	Flake	Surface	14.6	15,895	15.3	17,800	LPL	CO	WCP	LD	5	F
CA-KER-2308/H	2776-2	Flake	Surface	6.0	2,020	6.3	2,262	GYP	CO	WCP	LD	5	F
CA-KER-2308/H	2776-15	Flake	STP 7 (30-40)	12.2	10,479	12.8	11,735	LPL	CO	WCP	LD	5	F
CA-KER-2308/H	2776-27a	Flake	STP 15 (10-20)	16.2	20,232	17.0	22,657	LPL	UNK	NS	LD	5	F
CA-KER-2346	920-02	Flake	Surface	7.6	3,495	8.0	3,914	PTO	CO	WCP	TC	3	C
CA-KER-2347	921-51	Flake	Surface	7.9	3,823	8.3	4,282	PTO	CO	WCP	TC	3	C
CA-KER-2347	921-54	Flake	Surface	8.2	4,169	8.6	4,668	PTO	CO	WCP	TC	3	C
CA-KER-2347	921-54b	Flake	Surface	9.6	6,009	10.1	6,730	PTO	CO	WCP	TC	3	C
CA-KER-2351	931-51	Flake	Surface	11.3	8,772	11.9	9,823	LPL	CO	WS	TC	3	A
CA-KER-2378	168	Flake	TU 4 (10-20)	9.2	5,444	9.7	6,097	PTO	CO	CO	TC	3	F
CA-KER-2482/H	53	Flake	TU 1 (50-60)	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	3	F
CA-KER-2482/H	74	Flake	TU 1 (100-110)	8.3	4,288	8.7	4,802	PTO	CO	CO	TC	3	F
CA-KER-2482/H	79	Flake	TU 1 (110-120)	8.5	4,531	8.9	5,074	PTO	CO	CO	TC	3	F
CA-KER-2482/H	82	Flake	TU 2 (0-10)	11.9	9,891	12.5	11,076	LPL	CO	CO	TC	3	F
CA-KER-2482/H	86	Flake	TU 2 (10-20)	9.3	5,583	9.8	6,252	PTO	CO	CO	TC	3	F
CA-KER-2482/H	113	Flake	TU 2 (90-100)	0.0	0	0.0	0	--	CO	CO	TC	3	F
CA-KER-2482/H	115	Flake	TU 2 (100-110)	9.2	5,444	9.7	6,097	PTO	CO	CO	TC	3	F
CA-KER-2482/H	121	Flake	TU 2 (100-110)	10.9	8,068	11.4	9,035	LMO	CO	CO	TC	3	F
CA-KER-2482/H	132	Flake	TU 2 (120-130)	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	3	F
CA-KER-2532	1065-69	Flake	Surface	9.1	5,308	9.6	5,944	PTO	CO	WCP	TC	3	J
CA-KER-2533	4592	RSP	Surface	4.2	883	4.4	989	SSP	CO	WS	HE	2	A
CA-KER-2558/H	81	Flake	Surface	14.3	15,148	15.0	16,963	LPL	CO	WS	TC	2	B
CA-KER-2558/H	82	Flake	Surface	13.3	12,803	14.0	14,337	LPL	CO	WS	TC	2	B
CA-KER-2558/H	83	Flake	Surface	10.7	7,729	11.2	8,655	LMO	CO	CO	TC	2	B
CA-KER-2558/H	84	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	2	B
CA-KER-2558/H	85	Flake	Surface	13.1	12,360	13.8	13,842	LPL	MO	MO	TC	2	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-2558/H	86	Flake	Surface	5.2	1,449	5.5	1,623	GYP	MO	MO	TC	2	B
CA-KER-2558/H	87	Flake	Surface	5.3	1,515	5.6	1,696	GYP	CO	WS	TC	2	B
CA-KER-2558/H	88	Flake	Surface	0.0	0	0.0	0	--	CO	WCP	TC	2	B
CA-KER-2558/H	89	Flake	TU (70-80)	11.8	9,699	12.4	10,861	LPL	CO	WS	TC	2	B
CA-KER-2558/H	91	Flake	TU (60-70)	11.8	9,699	12.4	10,861	LPL	UNK	UNK	TC	2	B
CA-KER-2558/H	92	Flake	TU (0-10)	11.8	9,699	12.4	10,861	LPL	CO	CO	TC	2	B
CA-KER-2562	1121-7	Flake	Surface	7.6	3,495	8.0	3,914	PTO	CO	WCP	TC	3	D
CA-KER-2562	1121-15	Flake	Surface	6.7	2,609	7.0	2,922	GYP	CO	WCP	TC	3	D
CA-KER-2710	641-3	Flake	Surface	6.5	2,432	6.8	2,723	GYP	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp6a	Flake	TU 2 (S)	7.4	3,285	7.8	3,679	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp6b	Flake	TU 2 (S)	7.4	3,285	7.8	3,679	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp6c	Flake	TU 2 (S)	7.9	3,823	8.3	4,282	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp6d	Flake	TU 2 (S)	12.1	10,281	12.7	11,513	LPL	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp7a	Flake	TU 2 (0-10)	8.6	4,656	9.0	5,214	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp7b	Flake	TU 2 (0-10)	8.6	4,656	9.0	5,214	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp7c	Flake	TU 2 (0-10)	7.7	3,603	8.1	4,034	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp8	Flake	3 (0-10)	8.6	4,656	9.0	5,214	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp9	Flake	3 (0-10)	8.6	4,656	9.0	5,214	PTO	UNK	NS	TC	5	A
CA-KER-2711	1138-Temp10	Flake	4 (40-50)	0.0	0	0.0	0	--	UNK	NS	TC	5	A
CA-KER-2816	27	Flake	STP 9 (20-40)	9.5	5,865	10.0	6,568	PTO	CO	CO	TC	3	F
CA-KER-2816	52	Flake	STP 14 (20-40)	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	3	F
CA-KER-2816	100	Flake	STP 24 (20-40)	6.5	2,432	6.8	2,723	GYP	CO	CO	TC	3	F
CA-KER-2816	178	Flake	TU 1C (10-20)	8.7	4,782	9.1	5,356	PTO	CO	CO	TC	3	F
CA-KER-2816	321	Flake	TU 20 (30-40)	9.5	5,865	10.0	6,568	PTO	CO	CO	TC	3	F
CA-KER-2816	408	Flake	TU 3A (10-20)	5.8	1,867	6.1	2,091	GYP	CO	CO	TC	3	F
CA-KER-2816	571	Flake	TU 7 (40-50)	6.3	2,262	6.6	2,533	GYP	CO	CO	TC	3	F
CA-KER-2816	566	Flake	TU 7 (20-30)	6.8	2,700	7.1	3,024	PTO	CO	CO	TC	3	F
CA-KER-2816	570	Flake	TU 7 (30-40)	7.0	2,888	7.4	3,234	PTO	CO	CO	TC	3	F
CA-KER-2816	621	Flake	TU 8 (60-70)	6.8	2,700	7.1	3,024	PTO	CO	CO	TC	3	F
CA-KER-2816	645	PF	TS-66 (S)	6.4	2,346	6.7	2,627	GYP	CO	CO	TC	3	F
CA-KER-2816	662	CWB	TS-95 (S)	2.8	345	2.9	386	SHO	CO	CO	TC	3	F
CA-KER-2816	671	Biface	TS-111 (S)	18.5	27,530	19.4	30,829	LPL	CO	CO	TC	3	F
CA-KER-2817	312	Dart	SCU-7H (S)	9.3	5,583	9.8	6,252	PTO	CO	CO	TC	3	F
CA-KER-2817	698	Dart	TS-90 (S)	5.1	1,385	5.4	1,551	GYP	CO	CO	TC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-2817	702	Biface	TS-97 (S)	0.0	0	0.0	0	-	CO	CO	TC	3	F
CA-KER-2817	713	CWU	TS-108 (S)	3.4	541	3.6	606	SSP	CO	CO	TC	3	F
CA-KER-2817	687	CWU	TS-126 (S)	2.5	265	2.6	297	SHO	CO	CO	TC	3	F
CA-KER-2817	719	CWU	TS-118 (S)	9.7	6,156	10.2	6,893	PTO	CO	CO	TC	3	F
CA-KER-2817	719	CWU	TS-118 (S)	2.2	197	2.3	221	SHO	CO	CO	TC	3	F
CA-KER-2817	746	Biface	TS-178 (S)	5.9	1,942	6.2	2,175	GYP	CO	CO	TC	3	F
CA-KER-2817	747	RSP	TS-179 (S)	4.4	983	4.6	1,101	SSP	CO	CO	TC	3	F
CA-KER-2817	832	Flake	STU-9 (20-30)	5.1	1,385	5.4	1,551	GYP	CO	CO	TC	3	F
CA-KER-2817	1140	DSN	U-4G (10-20)	2.5	265	2.6	297	SHO	CO	CO	TC	3	F
CA-KER-2817	1286	Flake	U-6E (0-10)	10.3	7,075	10.8	7,923	LMO	CO	CO	TC	3	F
CA-KER-2817	1290	RSP	U-6E (10-20)	3.9	743	4.1	833	SSP	CO	CO	TC	3	F
CA-KER-2817	1340A	Flake	U-7P (0-10)	8.2	4,169	8.6	4,668	PTO	CO	CO	TC	3	F
CA-KER-2817	1340B	Flake	U-7P (0-10)	8.2	4,169	8.6	4,668	PTO	CO	CO	TC	3	F
CA-KER-2817	1340C	Flake	U-7P (0-10)	8.3	4,288	8.7	4,802	PTO	CO	CO	TC	3	F
CA-KER-2817	1345A	Flake	U-7P (10-20)	7.7	3,603	8.1	4,034	PTO	CO	CO	TC	3	F
CA-KER-2817	1345B	Flake	U-7P (10-20)	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	3	F
CA-KER-2817	1345C	Flake	U-7P (10-20)	6.7	2,609	7.0	2,922	GYP	CO	CO	TC	3	F
CA-KER-2817	1353A	Flake	U-7P (20-30)	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	3	F
CA-KER-2817	1353B	Flake	U-7P (20-30)	7.6	3,495	8.0	3,914	PTO	CO	CO	TC	3	F
CA-KER-2817	1353C	Flake	U-7P (20-30)	7.2	3,083	7.6	3,452	PTO	CO	CO	TC	3	F
CA-KER-2817	1353D	Flake	U-7P (20-30)	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	3	F
CA-KER-2817	1353E	Flake	U-7P (20-30)	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	3	F
CA-KER-2817	1355A	Flake	U-7P (30-40)	7.6	3,495	8.0	3,914	PTO	CO	CO	TC	3	F
CA-KER-2817	1355B	Flake	U-7P (30-40)	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	3	F
CA-KER-2817	1355C	Flake	U-7P (30-40)	7.3	3,183	7.7	3,565	PTO	CO	CO	TC	3	F
CA-KER-2817	1355D	Flake	U-7P (30-40)	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	3	F
CA-KER-2817	1355E	Flake	U-7P (30-40)	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	3	F
CA-KER-2817	1355F	Flake	U-7P (30-40)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	3	F
CA-KER-2817	1359	Flake	U-7P (40-50)	7.7	3,603	8.1	4,034	PTO	CO	CO	TC	3	F
CA-KER-2817	1364	CWT	SCU-8 (S)	1.9	140	2.0	157	SHO	CO	CO	TC	3	F
CA-KER-2817	1367	CWT	U-8 (0-10)	2.1	177	2.2	198	SHO	CO	CO	TC	3	F
CA-KER-2817	1374	CWT	U-8 (10-20)	1.8	124	1.9	138	SHO	CO	CO	TC	3	F
CA-KER-2817	1426	Flake	U-13 (20-30)	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	3	F
CA-KER-2817	1438	Flake	U-14 (20-30)	6.8	2,700	7.1	3,024	PTO	CO	CO	TC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-2817	4743	RSP	Surface	5.1	1,385	5.4	1,551	GYP	CO	WS	TC	3	F
CA-KER-2975/H	1178-1-6	BFF	Surface	5.5	1,650	5.8	1,848	GYP	CO	WS	HE	2	A
CA-KER-3158	1223-4	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	QUA	3	J
CA-KER-3158	1223-4	Flake	Surface	4.7	1,146	4.9	1,283	GYP	CO	WS	QUA	3	J
CA-KER-3273/H	1225-1-252	Flake	Surface	14.4	15,394	15.1	17,239	LPL	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-257	Flake	Surface	10.3	7,075	10.8	7,923	LMO	CO	WS	TC	2	B
CA-KER-3273/H	1225-1-265	Biface	Surface	6.5	2,432	6.8	2,723	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-281	Pinto	Surface	6.0	2,020	6.3	2,262	GYP	CO	WS	TC	2	B
CA-KER-3273/H	1225-1-286	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	WS	TC	2	B
CA-KER-3273/H	1225-1-287	Biface	Surface	5.1	1,385	5.4	1,551	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-289	Flake	Surface	5.4	1,582	5.7	1,771	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-295	Flake	Surface	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-305	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-312	Biface	Surface	10.4	7,236	10.9	8,103	LMO	CO	WS	TC	2	B
CA-KER-3273/H	1225-1-313	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	TC	2	B
CA-KER-3273/H	1225-1-314	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-317	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-317	Flake	Surface	6.9	2,793	7.2	3,128	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-318	Flake	Surface	11.5	9,137	12.1	10,232	LPL	CO	CO	TC	2	B
CA-KER-3273/H	1225-1-319	BFF	Surface	9.1	5,308	9.6	5,944	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-362	Flake	N64/W221 STU (30-40)	5.3	1,515	5.6	1,696	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-365	Flake	N64/W221 STU (40-50)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-378	Flake	N64/W221 STU (80-90)	10.5	7,398	11.0	8,285	LMO	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-383	Flake	N64/W221 STU (90-100)	11.4	8,953	12.0	10,026	LPL	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-388	Flake	N64/W221 STU (100-110)	12.9	11,927	13.5	13,356	LPL	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-391	Flake	N64/W221 STU (110-120)	11.4	8,953	12.0	10,026	LPL	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-405	Flake	N63/W81 STU (20-30)	5.1	1,385	5.4	1,551	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-410	Flake	N63/W81 STU (30-40)	5.0	1,323	5.3	1,482	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-422	Flake	N63/W81 STU (50-60)	8.9	5,041	9.3	5,646	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-427	Flake	N63/W81 STU (60-70)	8.3	4,288	8.7	4,802	PTO	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-431	Flake	N63/W81 STU (70-80)	6.7	2,609	7.0	2,922	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-422A	Flake	N63/W81 STU (90-100)	5.7	1,793	6.0	2,008	GYP	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-422B	Flake	N63/W81 STU (90-100)	0.0	0	0.0	0	-	CO	CO	TC	2	B
CA-KER-3273/H	1225-10-457	Flake	S174/W291.5 STU (30-40)	9.0	5,174	9.5	5,794	PTO	CO	CO	TC	2	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-3273/H	4823	Flake	Surface	4.8	1,203	5.0	1,348	GYP	CO	WS	TC	2	B
CA-KER-3361	4	BTF	Surface	0.0	0	0.0	0	–	CO	WS	TC	4	B
CA-KER-3361	6	BTF	Surface	8.5	4,531	8.9	5,074	PTO	CO	WS	TC	4	B
CA-KER-3361	9	BTF	Surface	9.3	5,583	9.8	6,252	PTO	CO	WS	TC	4	B
CA-KER-3361	10	BTF	Surface	12.0	10,085	12.6	11,293	LPL	CO	WCP	TC	4	B
CA-KER-3361	11	Flake	Surface	10.7	7,729	11.2	8,655	LMO	CO	S2F	TC	4	B
CA-KER-3361	12	Shatter	Surface	10.1	6,761	10.6	7,571	LMO	CO	S2F	TC	4	B
CA-KER-3361	13	BTF	Surface	9.9	6,454	10.4	7,228	PTO	CO	WS	TC	4	B
CA-KER-3361	16	BTF	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	TC	4	B
CA-KER-3361	43	Point	Surface	10.0	6,606	10.5	7,398	LMO	CO	WS	TC	4	B
CA-KER-3361	68	Shatter	Surface	0.0	0	0.0	0	–	CO	WS	TC	4	B
CA-KER-3361	102	BTF	Surface	9.5	5,865	10.0	6,568	PTO	CO	WS	TC	4	B
CA-KER-3361	106	BTF	Surface	10.3	7,075	10.8	7,923	LMO	CO	WS	TC	4	B
CA-KER-3361	108	BTF	Surface	10.6	7,563	11.1	8,469	LMO	CO	WS	TC	4	B
CA-KER-3361	109	BFF	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	4	B
CA-KER-3361	112	BTF	Surface	9.4	5,723	9.9	6,409	PTO	CO	WS	TC	4	B
CA-KER-3361	115	BTF	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	4	B
CA-KER-3361	117	Flake	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	4	B
CA-KER-3361	125	BTF	Surface	11.0	8,241	11.6	9,229	LPL	CO	WS	TC	4	B
CA-KER-3361	126	BTF	Surface	11.1	8,416	11.7	9,425	LPL	CO	WS	TC	4	B
CA-KER-3361	138	BTF	Surface	10.7	7,729	11.2	8,655	LMO	CO	WS	TC	4	B
CA-KER-3361	139	Flake	Surface	9.5	5,865	10.0	6,568	PTO	CO	WS	TC	4	B
CA-KER-3361	140	Shatter	Surface	10.3	7,075	10.8	7,923	LMO	CO	WS	TC	4	B
CA-KER-3361	141	Shatter	Surface	9.3	5,583	9.8	6,252	PTO	CO	WS	TC	4	B
CA-KER-3361	142	BTF	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	4	B
CA-KER-3361	151	BTF	Surface	10.9	8,068	11.4	9,035	LMO	CO	S2F	TC	4	B
CA-KER-3361	153	BTF	Surface	8.7	4,782	9.1	5,356	PTO	CO	WS	TC	4	B
CA-KER-3361	232	Flake	TU 2 (10-20)	9.4	5,723	9.9	6,409	PTO	CO	WS	TC	4	B
CA-KER-3361	254	BTF	TU 2 (50-60)	6.1	2,099	6.4	2,350	GYP	CO	JR	TC	4	B
CA-KER-3361	255	Flake	TU 2 (50-60)	14.0	14,420	14.7	16,149	LPL	CO	SL	TC	4	B
CA-KER-3361	291	BTF	TU 6 (10-20)	9.9	6,454	10.4	7,228	PTO	CO	WS	TC	4	B
CA-KER-3377	106	Flake	1 (10-20)	4.8	1,203	5.0	1,348	GYP	CO	CO	TC	3	H
CA-KER-3377	108	Flake	1 (30-40)	3.7	658	3.9	737	SSP	CO	CO	TC	3	H
CA-KER-3377	116	Flake	3 (50-60)	4.8	1,203	5.0	1,348	GYP	CO	CO	TC	3	H

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-3434	1256-1	Flake	Surface	0.0	0	0.0	0	--	UNK	UNK	LD	4	B
CA-KER-3556	1306-18	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	WS	LD	3	I
CA-KER-3556	1306-25	Flake	TU 6 (10-20)	11.7	9,509	12.3	10,649	LPL	CO	JR	LD	3	I
CA-KER-3875/H	102	UNK	Surface	9.5	5,865	10.0	6,568	PTO	CO	JR	TC	3	I
CA-KER-3875/H	23	UNK	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	I
CA-KER-3875/H	8a	Flake	4 (0-10)	3.2	470	3.4	526	SHO	CO	CO	TC	3	I
CA-KER-3875/H	8b	Flake	4 (0-10)	2.9	374	3.0	419	SHO	CO	CO	TC	3	I
CA-KER-3875/H	8c	Flake	4 (0-10)	2.7	317	2.8	355	SHO	CO	CO	TC	3	I
CA-KER-3875/H	8d	Flake	4 (0-10)	2.9	374	3.0	419	SHO	CO	CO	TC	3	I
CA-KER-3875/H	8e	Flake	4 (0-10)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3875/H	8f	Flake	4 (0-10)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3875/H	8g	Flake	4 (0-10)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3875/H	19	Flake	4 (10-20)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3875/H	22	Flake	4 (20-30)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3875/H	26a	Flake	4 (30-40)	2.7	317	2.8	355	SHO	CO	CO	TC	3	I
CA-KER-3875/H	26b	Flake	4 (30-40)	2.7	317	2.8	355	SHO	CO	CO	TC	3	I
CA-KER-3875/H	52	Flake	5 (0-10)	2.9	374	3.0	419	SHO	CO	CO	TC	3	I
CA-KER-3875/H	79	Flake	5 (30-40)	2.6	290	2.7	325	SHO	CO	CO	TC	3	I
CA-KER-3876/H	2	Flake	Surface	8.5	4,531	8.9	5,074	PTO	CO	CO	TC	3	I
CA-KER-3876/H	115	Flake	9 (20-30)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3876/H	116	Flake	9 (20-30)	2.0	158	2.1	177	SHO	CO	CO	TC	3	I
CA-KER-3876/H	117	Flake	9 (20-30)	0.0	0	0.0	0	--	CO	CO	TC	3	I
CA-KER-3876/H	143	Flake	9 (50-60)	2.1	177	2.2	198	SHO	CO	CO	TC	3	I
CA-KER-3876/H	176	Flake	10 (30-40)	8.7	4,782	9.1	5,356	PTO	CO	CO	TC	3	I
CA-KER-3876/H	318	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	CO	TC	3	I
CA-KER-3877/H	70	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	CO	TC	3	I
CA-KER-3878/H	133	Flake	9 (30-40)	9.2	5,444	9.7	6,097	PTO	CO	CO	TC	3	I
CA-KER-3983	27	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	5	F
CA-KER-3983	28	Flake	TU (0-20)	17.3	23,563	18.2	26,387	LPL	CO	CO	TC	5	F
CA-KER-3983	28	Flake	TU (0-20)	5.4	1,582	5.7	1,771	GYP	CO	CO	TC	5	F
CA-KER-3983	29	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	SL	TC	5	F
CA-KER-3983	30	Flake	TU (0-20)	8.6	4,656	9.0	5,214	PTO	CO	SL	TC	5	F
CA-KER-3983	31	Flake	Surface	9.5	5,865	10.0	6,568	PTO	CO	SL	TC	5	F
CA-KER-3983	32	Flake	Surface	11.7	9,509	12.3	10,649	LPL	CO	SL	TC	5	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-3983	33	UTF	Surface	10.6	7,563	11.1	8,469	LMO	CO	SL	TC	5	F
CA-KER-3983	34	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	SL	TC	5	F
CA-KER-3983	35	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	TC	5	F
CA-KER-3983	36	PF	Surface	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	5	F
CA-KER-4081	1544-42	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WS	TC	5	A
CA-KER-4081	1544-57	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	5	A
CA-KER-4081	1544-58	Flake	Surface	10.7	7,729	11.2	8,655	LMO	CO	WS	TC	5	A
CA-KER-4129	1534-10	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WCP	TC	3	B
CA-KER-4129	1534-23	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WCP	TC	3	B
CA-KER-4129	1534-32	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WCP	TC	3	B
CA-KER-4153/H	5342	HBT	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	TC	3	F
CA-KER-4153/H	5344	DSN	Surface	1.9	140	2.0	157	SHO	CO	WS	TC	3	F
CA-KER-4200	5154	Pinto	Surface	8.5	4,531	8.9	5,074	PTO	CO	WS	LD	3	F
CA-KER-4231	5460	ECN	Surface	11.1	8,416	11.7	9,425	LPL	CO	CO	LD	5	A
CA-KER-4233	1105-1	UTF	Surface	13.5	13,254	14.2	14,842	LPL	CO	WCP	LD	5	A
CA-KER-4277	37	BTF	TU (0-20)	6.2	2,179	6.5	2,440	GYP	CO	WS	TC	5	A
CA-KER-4347/H	26	BTF	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	LD	5	A
CA-KER-4368	1817-25	Flake	STP 11 (S)	7.8	3,712	8.2	4,157	PTO	CO	CO	TC	3	I
CA-KER-4400	1920-96	RSP	Surface	4.1	835	4.3	935	SSP	CO	WS	TC	1	B
CA-KER-4400	1920-174	RSP	Surface	4.0	788	4.2	883	SSP	CO	WS	TC	1	B
CA-KER-4552	1870-16	Flake	1 (20-30)	6.6	2,519	6.9	2,821	GYP	CO	WCP	LD	5	A
CA-KER-4555	1875-4	Flake	3 (S)	7.1	2,985	7.5	3,342	PTO	CO	WCP	LD	5	A
CA-KER-4564	1900-1	Flake	Surface	5.9	1,942	6.2	2,175	GYP	CO	WCP	LD	5	A
CA-KER-4565	1948-2	Flake	1 (S)	7.0	2,888	7.4	3,234	PTO	CO	WCP	TC	5	A
CA-KER-4567	1950-1	Flake	Surface	8.7	4,782	9.1	5,356	PTO	CO	WCP	TC	5	A
CA-KER-4569	1882-2	Flake	Surface	8.2	4,169	8.6	4,668	PTO	CO	WCP	LD	5	A
CA-KER-4571	11	BTF	STP 7 (S)	7.4	3,285	7.8	3,679	PTO	CO	WCP	TC	5	A
CA-KER-4600	6090	Preform	Surface	8.2	4,169	8.6	4,668	PTO	CO	SL	BC	5	A
CA-KER-4600	1991-2	Flake	Surface	11.1	8,416	11.7	9,425	LPL	CO	WCP	BC	5	A
CA-KER-4600	1991-3	Flake	Surface	6.1	2,099	6.4	2,350	GYP	CO	WCP	BC	5	A
CA-KER-4600	1991-5	Flake	Surface	4.9	1,262	5.1	1,414	GYP	CO	WCP	BC	5	A
CA-KER-4600	1991-7	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-8	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	BC	5	A
CA-KER-4600	1991-9	Flake	Surface	7.4	3,285	7.8	3,679	PTO	CO	WCP	BC	5	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-4600	1991-11	Flake	Surface	7.1	2,985	7.5	3,342	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-12	Flake	Surface	7.2	3,083	7.6	3,452	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-14	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-15	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	BC	5	A
CA-KER-4600	1991-16	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WCP	BC	5	A
CA-KER-4600	1991-22	Flake	1 (10-20)	7.8	3,712	8.2	4,157	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-222	Flake	2 (20-30)	7.6	3,495	8.0	3,914	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-224	Flake	2 (30-40)	7.6	3,495	8.0	3,914	PTO	CO	WCP	BC	5	A
CA-KER-4600	1991-228A	Flake	2 (40-50)	7.9	3,823	8.3	4,282	PTO	UNK	NS	BC	5	A
CA-KER-4600	1991-228B	Flake	2 (40-50)	5.2	1,449	5.5	1,623	GYP	UNK	NS	BC	5	A
CA-KER-4600	7083	Dart	Surface	11.3	8,772	11.9	9,823	LPL	UNK	UNK	BC	5	A
CA-KER-4651	7159	HBT	Surface	8.1	4,052	8.5	4,537	PTO	CO	WS	LD	5	A
CA-KER-4653	1993-22	Flake	1 (S)	7.9	3,823	8.3	4,282	PTO	CO	WCP	TC	5	A
CA-KER-4653	1993-38	Flake	3 (40-50)	0.0	0	0.0	0	--	UNK	NS	TC	5	A
CA-KER-4653	1993-53	Flake	3 (80-90)	6.4	2,346	6.7	2,627	GYP	UNK	NS	TC	5	A
CA-KER-4656	1996-3	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	TC	5	A
CA-KER-4656	1996-26	Flake	2 (S)	5.7	1,793	6.0	2,008	GYP	CO	WCP	TC	5	A
CA-KER-4677	7161	RSP	Surface	4.8	1,203	5.0	1,348	GYP	CO	WS	TC	3	--
CA-KER-4685	2019-169	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	TC	3	--
CA-KER-4696	5	Biface	Surface	13.3	12,803	14.0	14,337	LPL	CO	WS	TC	3	--
CA-KER-4719	6	Flake	Surface	8.2	4,169	8.6	4,668	PTO	CO	WS	TC	3	--
CA-KER-4719	7	BFF	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	--
CA-KER-4723	1-1-1	BFF	UNK	0.0	0	0.0	0	--	SM	SM	LD	3	--
CA-KER-4723	5-5-1	Flake	UNK	9.3	5,583	9.8	6,252	PTO	CO	WS	LD	3	--
CA-KER-4723	2-2-1	Flake	UNK	0.0	0	0.0	0	--	CO	WS	LD	3	--
CA-KER-4723	6-6-1	Flake	UNK	9.1	5,308	9.6	5,944	PTO	CO	WS	LD	3	--
CA-KER-4723	1-1-1	Flake	UNK	8.6	4,656	9.0	5,214	PTO	CO	WS	LD	3	--
CA-KER-4754	2159-5	Flake	Surface	3.6	617	3.8	691	SSP	CO	CO	TC	3	--
CA-KER-4754	2159-6	Flake	Surface	12.3	10,679	12.9	11,959	LPL	CO	CO	TC	3	--
CA-KER-4754	2159-10	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	CO	TC	3	--
CA-KER-4754	2159-11	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	CO	TC	3	--
CA-KER-4754	2159-12	Flake	Surface	6.1	2,099	6.4	2,350	GYP	CO	CO	TC	3	--
CA-KER-4754	2159-13	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	CO	TC	3	--
CA-KER-4754	2159-14	Flake	Surface	6.4	2,346	6.7	2,627	GYP	CO	CO	TC	3	--

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-4754	2159-15	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	CO	TC	3	—
CA-KER-4754	2159-16	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	CO	TC	3	—
CA-KER-4754	2159-17	Flake	Surface	6.2	2,179	6.5	2,440	GYP	CO	CO	TC	3	—
CA-KER-4754	2159-19	Flake	STP 4 (S)	5.2	1,449	5.5	1,623	GYP	CO	CO	TC	3	—
CA-KER-4773/H	1340-1-8	Point	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	TC	1	A
CA-KER-4773/H	1340-1-12	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	CO	TC	1	A
CA-KER-4773/H	1340-I-33	Flake	Surface	7.2	3,083	7.6	3,452	PTO	CO	WS	TC	1	A
CA-KER-4773/H	1340-1-34	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	1	A
CA-KER-4773/H	1340-1-37	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	WS	TC	1	A
CA-KER-4773/H	1340-1-174	Flake	S15/E0 Cell F (S)	7.3	3,183	7.7	3,565	PTO	CO	CO	TC	1	A
CA-KER-4773/H	1340-10-252a	Flake	N5/W15 (0-10)	5.9	1,942	6.2	2,175	GYP	CO	CO	TC	1	A
CA-KER-4773/H	1340-10-267	Point	N5/W35 (0-10)	0.0	0	0.0	0	—	CO	WS	TC	1	A
CA-KER-4773/H	1340-1-277a	Flake	N5/W35 (0-10)	6.6	2,519	6.9	2,821	GYP	CO	CO	TC	1	A
CA-KER-4773/H	1340-1-341	Flake	S4/E1 (0-10)	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	1	A
CA-KER-486	10738	BFF	Surface	6.3	2,262	6.6	2,533	GYP	CO	JR	LD	2	B
CA-KER-490	106	Flake	1 (0-10)	10.0	6,606	10.5	7,398	LMO	CO	CO	TC	3	F
CA-KER-490	106	Flake	1 (0-10)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	3	F
CA-KER-490	155	Flake	4 (10-25)	7.7	3,603	8.1	4,034	PTO	CO	CO	TC	3	F
CA-KER-490	167	Flake	4 (35-47)	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	3	F
CA-KER-490	198	Flake	6 (0-10)	10.2	6,917	10.7	7,746	LMO	CO	CO	TC	3	F
CA-KER-490	203	Flake	6 (10-20)	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	3	F
CA-KER-490	211	Flake	6 (20-40)	7.2	3,083	7.6	3,452	PTO	CO	CO	TC	3	F
CA-KER-490	215	Flake	6 (40-50)	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	3	F
CA-KER-490	224	Flake	6 (60-70)	6.1	2,099	6.4	2,350	GYP	CO	CO	TC	3	F
CA-KER-490	226	Flake	6 (60-70)	13.4	13,027	14.1	14,588	LPL	CO	CO	TC	3	F
CA-KER-4926	7696	RSP	Surface	4.2	883	4.4	989	SSP	CO	WS	TC	1	B
CA-KER-4929	2402-98	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	JR	TC	1	A
CA-KER-4929	2402-98	Flake	Surface	10.0	6,606	10.5	7,398	LMO	CO	JR	TC	1	A
CA-KER-4929	2402-119	Flake	Surface	11.8	9,699	12.4	10,861	LPL	CO	SL	TC	1	A
CA-KER-4929	2402-5	Flake	Surface	5.0	1,323	5.3	1,482	GYP	CO	WS	TC	1	A
CA-KER-4929	2402-49	Flake	Surface	6.5	2,432	6.8	2,723	GYP	CO	WS	TC	1	A
CA-KER-4953	2299-10-1	Flake	NO.8/W30 STU (0-10)	9.4	5,723	9.9	6,409	PTO	CO	CO	HE	2	A
CA-KER-4953	2299-10-1	Flake	NO.8/W30 STU (0-10)	6.9	2,793	7.2	3,128	PTO	CO	CO	HE	2	A
CA-KER-4956	2302-1-6	BFF	Surface	4.4	983	4.6	1,101	SSP	CO	CO	HE	2	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-4956	2302-1-7	Flake	Surface	15.6	18,536	16.4	20,757	LPL	CO	WS	HE	2	A
CA-KER-4956	2302-1-7	Flake	Surface	4.8	1,203	5.0	1,348	GYP	CO	WS	HE	2	A
CA-KER-4956	2302-10-14	Flake	S11.9/W32.6 STU (20-30)	9.8	6,304	10.3	7,059	PTO	CO	CO	HE	2	A
CA-KER-4956	2302-10-15	Flake	S11.9/W32.6 TU (0-10)	5.1	1,385	5.4	1,551	GYP	CO	CO	HE	2	A
CA-KER-4956	2302-10-21	Flake	S11.9/W32.6 TU (40-48)	5.1	1,385	5.4	1,551	GYP	CO	CO	HE	2	A
CA-KER-4978	1473	Flake	Surface	3.9	743	4.1	833	SSP	CO	CO	TC	2	D
CA-KER-4995	2283-1-11	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	2	D
CA-KER-4995	2283-1-19	Flake	Surface	8.1	4,052	8.5	4,537	PTO	CO	CO	TC	2	D
CA-KER-4995	2283-1-23	Flake	Surface	11.0	8,241	11.6	9,229	LPL	CO	CO	TC	2	D
CA-KER-4995	2283-1-28	Flake	Surface	7.8	3,712	8.2	4,157	PTO	CO	CO	TC	2	D
CA-KER-4995	2283-1-29	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	2	D
CA-KER-4997	2285-1-1	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	D
CA-KER-4997	2285-1-3	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	D
CA-KER-4997	2285-1-4	Flake	Surface	2.3	218	2.4	245	SHO	CO	CO	LD	2	D
CA-KER-500	190	Flake	3 (0-10)	10.7	7,729	11.2	8,655	LMO	CO	CO	TC	3	F
CA-KER-500	203	Flake	3 (40-50)	9.7	6,156	10.2	6,893	PTO	CO	CO	TC	3	F
CA-KER-500	203	Flake	3 (40-50)	7.3	3,183	7.7	3,565	PTO	CO	CO	TC	3	F
CA-KER-500	213	Flake	3 (70-80)	9.0	5,174	9.5	5,794	PTO	CO	CO	TC	3	F
CA-KER-501	11	Flake	1 (3-10)	7.9	3,823	8.3	4,282	PTO	CO	CO	TC	3	F
CA-KER-501	11	Flake	1 (3-10)	6.3	2,262	6.6	2,533	GYP	CO	CO	TC	3	F
CA-KER-501	120	Flake	1 (20-30)	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	3	F
CA-KER-501	124	Flake	1 (30-40)	8.9	5,041	9.3	5,646	PTO	CO	CO	TC	3	F
CA-KER-501	134	Flake	1 (50-60)	7.3	3,183	7.7	3,565	PTO	CO	CO	TC	3	F
CA-KER-501	184	Flake	TU 2 (60-70)	7.8	3,712	8.2	4,157	PTO	CO	CO	TC	3	F
CA-KER-501	171	Flake	2 (40-50)	7.8	3,712	8.2	4,157	PTO	CO	CO	TC	3	F
CA-KER-501	227	Flake	3 (70-80)	6.9	2,793	7.2	3,128	PTO	CO	CO	TC	3	F
CA-KER-503	236-55	Flake	SS 1 (0-5)	0.0	0	0.0	0	--	CO	WCP	LD	2	B
CA-KER-503	236-66	Flake	SS1 (0-5)	12.0	10,085	12.6	11,293	LPL	CO	WS	LD	2	B
CA-KER-503	236-40	Flake	TU 2 (40-50)	11.2	8,593	11.8	9,623	LPL	CD	LM	LD	2	B
CA-KER-505/H	1075	Flake	Surface	13.1	12,360	13.8	13,842	LPL	CO	CO	TC	2	B
CA-KER-505/H	1074	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	CO	TC	2	B
CA-KER-505/H	1074	Flake	Surface	7.7	3,603	8.1	4,034	PTO	CO	CO	TC	2	B
CA-KER-505/H	1077	Flake	Surface	15.7	18,813	16.5	21,067	LPL	CO	CO	TC	2	B
CA-KER-5143	7874	Pinto	Surface	10.8	7,898	11.3	8,844	LMO	CO	WS	TC	3	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-5143	2503-8	Flake	Surface	10.5	7,398	11.0	8,285	LMO	CO	WS	TC	3	A
CA-KER-5143	2503-9	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-10	Flake	Surface	11.9	9,891	12.5	11,076	LPL	CO	WS	TC	3	A
CA-KER-5143	2503-11	Flake	Surface	11.3	8,772	11.9	9,823	LPL	CO	WS	TC	3	A
CA-KER-5143	2503-12	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-12	Flake	Surface	7.4	3,285	7.8	3,679	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-13	Flake	Surface	10.5	7,398	11.0	8,285	LMO	CO	WS	TC	3	A
CA-KER-5143	2503-15	Flake	Surface	10.8	7,898	11.3	8,844	LMO	CO	CO	TC	3	A
CA-KER-5143	2503-16	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-17	Flake	Surface	18.6	27,876	19.5	31,217	LPL	CO	CO	TC	3	A
CA-KER-5143	2503-18	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-26	Flake	Surface	11.1	8,416	11.7	9,425	LPL	CO	CO	TC	3	A
CA-KER-5143	2503-28	Flake	Surface	10.8	7,898	11.3	8,844	LMO	CO	WS	TC	3	A
CA-KER-5143	2503-30	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-33a	Flake	Surface	9.6	6,009	10.1	6,730	PTO	CO	WS	TC	3	A
CA-KER-5143	2503-33b	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	A
CA-KER-5143	2503-76	Flake	STP 15 (0-50)	0.0	0	0.0	0	--	CO	WS	TC	3	A
CA-KER-5148	1768-3	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	4	B
CA-KER-5148	1768-3	Flake	Surface	5.6	1,721	5.9	1,927	GYP	CO	CO	TC	4	B
CA-KER-5148	1768-6	Flake	Surface	7.6	3,495	8.0	3,914	PTO	CO	CO	TC	4	B
CA-KER-5148	1768-9	Flake	Surface	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	4	B
CA-KER-5148	1768-23	Flake	1 (0-10)	7.3	3,183	7.7	3,565	PTO	CO	CO	TC	4	B
CA-KER-5148	1768-36	Flake	Surface	7.1	2,985	7.5	3,342	PTO	CO	CO	TC	4	B
CA-KER-525/H	240-41	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WCP	BC	5	A
CA-KER-525/H	240-64	PF	TU 21 (S)	6.9	2,793	7.2	3,128	PTO	CO	WS	BC	5	A
CA-KER-525/H	240-113	Flake	TU 26 (S)	6.7	2,609	7.0	2,922	GYP	CO	WCP	BC	5	A
CA-KER-525/H	240-262	Flake	TU 39 (0-10)	6.9	2,793	7.2	3,128	PTO	CO	WCP	BC	5	A
CA-KER-525/H	240-320	Flake	TU 42 (0-10)	8.0	3,937	8.4	4,408	PTO	CO	WCP	BC	5	A
CA-KER-525/H	340-329	Flake	TU 43 (S)	8.7	4,782	9.1	5,356	PTO	CO	WCP	BC	5	A
CA-KER-525/H	340-329	Flake	TU 43 (S)	6.1	2,099	6.4	2,350	GYP	CO	WCP	BC	5	A
CA-KER-525/H	240-6476	CWT	Surface	4.6	1,090	4.8	1,221	SSP	CO	WS	BC	5	A
CA-KER-5257	2618-2	Flake	Surface	10.3	7,075	10.8	7,923	LMO	CO	WS	LD	3	A
CA-KER-5257	2618-4	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	LD	3	A
CA-KER-5257	2618-5	Flake	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	LD	3	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-5257	2618-6	Flake	Surface	13.0	12,143	13.7	13,598	LPL	CO	JR	LD	3	A
CA-KER-5258	2619-1	Flake	Surface	9.2	5,444	9.7	6,097	PTO	CO	WS	LD	3	A
CA-KER-526	241	Flake	2 (90-100)	9.6	6,009	10.1	6,730	PTO	CO	CO	TC	3	G
CA-KER-526	435	Flake	9 (40-50)	8.7	4,782	9.1	5,356	PTO	CO	CO	TC	3	G
CA-KER-526	377	Flake	7 (40-50)	13.3	12,803	14.0	14,337	LPL	CO	CO	TC	3	G
CA-KER-526	543	Flake	10 (0-10)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	3	G
CA-KER-526	547	Flake	10 (10-20)	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	3	G
CA-KER-526	642	Flake	17 (0-10)	7.6	3,495	8.0	3,914	PTO	CO	CO	TC	3	G
CA-KER-5292	8	Flake	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	BC	3	I
CA-KER-5306	2555-31	Flake	2 (S)	6.8	2,700	7.1	3,024	PTO	CO	WS	BC	3	G
CA-KER-5306	2555-31	Flake	2 (S)	3.3	505	3.5	565	SHO	CO	WS	BC	3	G
CA-KER-5306	6727	ECN	Surface	3.9	743	4.1	833	SSP	CO	WS	BC	3	G
CA-KER-5306	6730	Drill	Surface	3.1	436	3.3	489	SHO	CO	WS	BC	3	G
CA-KER-5306	7989	CWT	Surface	3.0	404	3.2	453	SHO	CO	WS	BC	3	G
CA-KER-533	246-5	Flake	Surface	7.0	2,888	7.4	3,234	PTO	CO	SL	TC	3	G
CA-KER-534	5455	RSP	Surface	3.8	700	4.0	784	SSP	CO	WS	TC	3	H
CA-KER-5341	2720-1	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	SL	LD	3	A
CA-KER-5341	2720-27	Flake	Surface	9.0	5,174	9.5	5,794	PTO	UNK	UNK	LD	3	A
CA-KER-549	7222	Pinto	Surface	4.9	1,262	5.1	1,414	GYP	CO	JR	TC	5	A
CA-KER-549	8-8-1	Flake	UNK	6.4	2,346	6.7	2,627	GYP	CO	WS	TC	3	I
CA-KER-549	2-2-1	Flake	UNK	4.4	983	4.6	1,101	SSP	CO	JR	TC	3	I
CA-KER-5517	2785-1	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	LD	5	A
CA-KER-5578	2777-6	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	WCP	TC	5	F
CA-KER-5578	2777-7	Flake	Surface	8.5	4,531	8.9	5,074	PTO	CO	WCP	TC	5	F
CA-KER-5578	2777-8	Flake	1 (0-10)	10.5	7,398	11.0	8,285	LMO	CO	WCP	TC	5	F
CA-KER-5578	2777-12	Flake	4 (0-10)	8.0	3,937	8.4	4,408	PTO	CO	WCP	TC	5	F
CA-KER-5578	2777-14	Flake	5 (0-10)	9.6	6,009	10.1	6,730	PTO	CO	WCP	TC	5	F
CA-KER-5578	2777-17a	Flake	7 (S)	8.7	4,782	9.1	5,356	PTO	CO	WCP	TC	5	F
CA-KER-5578	2777-17b	Flake	7 (S)	8.4	4,408	8.8	4,937	PTO	CO	WCP	TC	5	F
CA-KER-5578	2777-23	Flake	ST 21 (0-10)	6.4	2,346	6.7	2,627	GYP	CO	WCP	TC	5	F
CA-KER-5626	2232	Flake	Surface	15.6	18,536	16.4	20,757	LPL	CO	SL	TC	5	A
CA-KER-5627	6773	Shatter	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	TC	4	B
CA-KER-5627	6774	Shatter	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	4	B
CA-KER-5661	10742	RSP	Surface	5.0	1,323	5.3	1,482	GYP	CO	WS	TC	2	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-5716	55	Flake	Surface	7.7	3,603	8.1	4,034	PTO	CO	WS	TC	5	F
CA-KER-5716	56	Flake	Surface	2.9	374	3.0	419	SHO	CO	WS	TC	5	F
CA-KER-5717	57	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	5	F
CA-KER-5717	58	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	5	F
CA-KER-5717	59	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WS	TC	5	F
CA-KER-5717	60	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	CO	TC	5	F
CA-KER-5717	61	Flake	Surface	7.1	2,985	7.5	3,342	PTO	CO	SL	TC	5	F
CA-KER-5717	62	Flake	Surface	7.1	2,985	7.5	3,342	PTO	CO	WS	TC	5	F
CA-KER-5717	63	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	TC	5	F
CA-KER-5717	64	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	TC	5	F
CA-KER-5717	65	Flake	Surface	10.9	8,068	11.4	9,035	LMO	CO	WS	TC	5	F
CA-KER-5717	66	Flake	Surface	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	5	F
CA-KER-5717	67	Biface	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	5	F
CA-KER-5717	68	Biface	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	5	F
CA-KER-5717	69	DSN	Surface	3.5	578	3.7	648	SSP	CO	WS	TC	5	F
CA-KER-5717	70	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	CO	TC	5	F
CA-KER-5717	71	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	5	F
CA-KER-5717	72	Flake	Surface	9.1	5,308	9.6	5,944	PTO	CO	WS	TC	5	F
CA-KER-5717	73	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	SL	TC	5	F
CA-KER-5756	75	Biface	Surface	7.2	3,083	7.6	3,452	PTO	CO	WS	HE	5	F
CA-KER-5756	76	Flake	STP 6 (0-20)	7.2	3,083	7.6	3,452	PTO	CO	WS	HE	5	F
CA-KER-5802	6954	Pinto	Surface	11.4	8,953	12.0	10,026	LPL	CO	WS	TC	1	A
CA-KER-5815	6952	Dart	Surface	7.0	2,888	7.4	3,234	PTO	CO	WS	LD	1	A
CA-KER-5933	3283-18	Biface	4 (S)	8.7	4,782	9.1	5,356	PTO	CO	WCP	TC	5	A
CA-KER-5933	3283-34	Flake	6 (S)	0.0	0	0.0	0	--	UNK	NS	TC	5	A
CA-KER-6029	2442-1-2	UTF	Surface	6.0	2,020	6.3	2,262	GYP	CO	WS	HE	2	A
CA-KER-6046	3122-3	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	TC	5	F
CA-KER-6046	3122-4	BFF	Surface	4.6	1,090	4.8	1,221	SSP	CO	WCP	TC	5	F
CA-KER-6046	3122-6	PF	Surface	4.6	1,090	4.8	1,221	SSP	CO	WCP	TC	5	F
CA-KER-673/H	276-336	Shatter	U 10 (50-60)	15.8	19,092	16.6	21,380	LPL	CO	CO	TC	3	F
CA-KER-6790	6864	PF	Surface	7.5	3,389	7.9	3,795	PTO	CO	SL	TC	5	A
CA-KER-6790	3	PF	Surface	9.2	5,444	9.7	6,097	PTO	CO	WCP	TC	5	A
CA-KER-6797	94	Flake	Surface	6.2	2,179	6.5	2,440	GYP	CO	WS	LD	1	A
CA-KER-6797	95	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	LD	1	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-6797	96	Flake	Surface	9.2	5,444	9.7	6,097	PTO	CO	WS	LD	1	A
CA-KER-6797	97	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	WS	LD	1	A
CA-KER-6797	98	Flake	Surface	9.2	5,444	9.7	6,097	PTO	CO	WS	LD	1	A
CA-KER-6801	5	Flake	Surface	7.9	3,823	8.3	4,282	PTO	CO	CO	TC	1	A
CA-KER-6804	6	Flake	Surface	8.5	4,531	8.9	5,074	PTO	CO	WS	LD	1	A
CA-KER-6804	6	Flake	Surface	0.0	0	0.0	0	–	CO	WS	LD	1	A
CA-KER-6812	73	Flake	Surface	7.8	3,712	8.2	4,157	PTO	CO	WS	TC	1	A
CA-KER-6812	74	Flake	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	TC	1	A
CA-KER-6812	75	Flake	Surface	0.0	0	0.0	0	–	CO	WS	TC	1	A
CA-KER-6812	76	RTF	Surface	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	1	A
CA-KER-6812	77	Flake	Surface	0.0	0	0.0	0	–	CO	WS	TC	1	A
CA-KER-6812	78	Flake	Surface	0.0	0	0.0	0	–	CO	WS	TC	1	A
CA-KER-6812	79	Flake	Surface	0.0	0	0.0	0	–	CO	WS	TC	1	A
CA-KER-6812	80	Flake	Surface	10.7	7,729	11.2	8,655	LMO	CO	WS	TC	1	A
CA-KER-6817	93	Biface	Surface	0.0	0	0.0	0	–	CO	WS	QUA	2	A
CA-KER-698/H	10691	Flake	STP 12 (S)	0.0	0	0.0	0	–	CO	WS	TC	3	A
CA-KER-7578	4188-172	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	1	A
CA-KER-7578	4188-95	Flake	Surface	8.1	4,052	8.5	4,537	PTO	CO	WS	TC	1	A
CA-KER-7578	4188-182	Flake	ST 6 (0-10)	7.7	3,603	8.1	4,034	PTO	CO	WS	TC	1	A
CA-KER-863/H	1383	CWL	Surface	0.0	0	0.0	0	–	CO	WS	BC	5	D
CA-KER-863/H	1796	Point	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	BC	5	D
CA-KER-XXXX	3	Arrow	Surface	3.3	505	3.5	565	SHO	CO	WS	TC	3	E
CA-KER-XXXX	4	Arrow	Surface	3.8	700	4.0	784	SSP	CO	WS	TC	3	E
CA-KER-XXXX	12	Arrow	Surface	5.0	1,323	5.3	1,482	GYP	CO	WS	TC	3	E
CA-KER-XXXX	16	Arrow	Surface	3.8	700	4.0	784	SSP	CO	WS	TC	3	E
CA-KER-XXXX	6	Flake	Surface	4.4	983	4.6	1,101	SSP	CO	WS	TC	3	E
CA-KER-XXXX	27	Arrow	Surface	4.6	1,090	4.8	1,221	SSP	CO	WS	TC	3	E
CA-KER-XXXX	28	Flake	Surface	5.5	1,650	5.8	1,848	GYP	CO	WS	TC	3	E
CA-KER-XXXX	14	Flake	Surface	4.5	1,036	4.7	1,160	SSP	CO	WS	TC	3	E
CA-KER-XXXX	25	Flake	Surface	4.5	1,036	4.7	1,160	SSP	CO	WS	TC	3	E
CA-KER-XXXX	7	Flake	Surface	4.0	788	4.2	883	SSP	CO	WS	TC	1	B
CA-KER-XXXX	1	ECN	Surface	8.1	4,052	8.5	4,537	PTO	CO	WS	TC	1	B
CA-KER-XXXX	14	Flake	Surface	11.6	9,322	12.2	10,439	LPL	CO	WS	LD	2	C
CA-KER-XXXX	34	Flake	Surface	18.4	27,186	19.3	30,444	LPL	CO	SL	LD	2	C

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-KER-XXXX	160	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	LD	2	C
CA-KER-XXXX	66	Flake	Surface	11.2	8,593	11.8	9,623	LPL	CO	SL	LD	2	C
CA-KER-XXXX	5	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	1	B
CA-KER-XXXX	96	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	1	B
CA-KER-XXXX	4418-113	BFF	Surface	2.2	197	2.3	221	SHO	CO	WS	TC	3	F
CA-KER-XXXX	4320-341	RTF	Surface	9.2	5,444	9.7	6,097	PTO	CO	WS	TC	3	--
CA-KER-XXXX	4311-347	Flake	Surface	12.8	11,714	13.4	13,117	LPL	CO	SL	LD	3	--
CA-KER-XXXX	4292-342	flake	STP (0-20)	11.8	9,699	12.4	10,861	LPL	CO	SL	LD	3	--
CA-KER-XXXX	4292-346	RTF	Surface	11.1	8,416	11.7	9,425	LPL	CO	SL	LD	3	--
CA-KER-XXXX	4337-20	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WS	TC	5	F
CA-KER-XXXX	4394-349	UTF	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	LD	3	F
CA-KER-XXXX	9	Flake	STU-2 (0-20)	0.0	0	0.0	0	--	CO	WS	LD	3	--
CA-KER-XXXX	10	Flake	STU-3 (20-40)	11.0	8,241	11.6	9,229	LPL	CO	WS	LD	3	C
CA-LAN-1067/H	717	Flake	Surface	10.6	7,563	11.1	8,469	LMO	CO	WCP	LD	2	C
CA-LAN-1067/H	2955.1069	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-1067/H	2955.1121	Flake	Surface	7.6	3,495	8.0	3,914	PTO	CO	WS	LD	2	C
CA-LAN-1067/H	2955.1139	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-1103	218	BTF	Surface	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	3	F
CA-LAN-1103	218	BTF	Surface	4.9	1,262	5.1	1,414	GYP	CO	WS	TC	3	F
CA-LAN-1103	219	Biface	Surface	8.3	4,288	8.7	4,802	PTO	CO	WS	TC	3	F
CA-LAN-1103	219	Biface	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	TC	3	F
CA-LAN-1103	220	Scraper	Surface	1.6	94	1.7	105	SHO	CO	WS	TC	3	F
CA-LAN-1103	242	BTF	SRU 1, Cell C (S)	14.3	15,148	15.0	16,963	LPL	CO	WS	TC	3	F
CA-LAN-1103	242	BTF	SRU 1, Cell C (S)	12.0	10,085	12.6	11,293	LPL	CO	WS	TC	3	F
CA-LAN-1103	402	BTF	SRU 3, Cell D (S)	9.7	6,156	10.2	6,893	PTO	CO	WS	TC	3	F
CA-LAN-1103	443	BTF	SRU 3, Cell G (S)	7.4	3,285	7.8	3,679	PTO	CO	WS	TC	3	F
CA-LAN-1103	511	BTF	SRU 4, Cell C (S)	7.4	3,285	7.8	3,679	PTO	CO	WS	TC	3	F
CA-LAN-1103	511	BTF	SRU 4, Cell C (S)	6.0	2,020	6.3	2,262	GYP	CO	WS	TC	3	F
CA-LAN-1103	794a	Flake	TU 3 (0-10)	8.0	3,937	8.4	4,408	PTO	CO	WS	TC	3	F
CA-LAN-1103	794a	Flake	TU 3 (0-10)	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	3	F
CA-LAN-1103	794b	Shatter	TU 3 (0-10)	4.3	932	4.5	1,044	SSP	CO	WS	TC	3	F
CA-LAN-1103	815	BTF	TU 3 (30-40)	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	3	F
CA-LAN-1103	822a	BTF	TU 3 (40-50)	7.1	2,985	7.5	3,342	PTO	CO	SL	TC	3	F
CA-LAN-1103	822b	BTF	TU 3 (40-50)	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-1103	992a	BTF	TU 8 (0-10)	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	3	F
CA-LAN-1103	992b	Flake	TU 8 (0-10)	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	3	F
CA-LAN-1103	992c	Flake	TU 8 (0-10)	8.1	4,052	8.5	4,537	PTO	CO	WS	TC	3	F
CA-LAN-1103	992c	Flake	TU 8 (0-10)	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	3	F
CA-LAN-1103	1014	BTF	TU 8 (40-50)	4.2	883	4.4	989	SSP	CO	WS	TC	3	F
CA-LAN-1148	1120	Biface	Surface	8.2	4,169	8.6	4,668	PTO	CO	WS	TC	3	F
CA-LAN-1148	1189	BTF	STP 1 (20-45)	8.0	3,937	8.4	4,408	PTO	CO	WS	TC	3	F
CA-LAN-1158	602	Shatter	Surface	9.2	5,444	9.7	6,097	PTO	CO	CO	TC	3	F
CA-LAN-1161	2-2-1	Biface	UNK	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	3	G
CA-LAN-1162	56	Pinto	Surface	4.1	835	4.3	935	SSP	CO	WS	TC	3	G
CA-LAN-1185	71	CWL	Surface	4.2	883	4.4	989	SSP	CO	WS	TC	5	D
CA-LAN-1185	393-93	Flake	SC 4 (S)	3.9	743	4.1	833	SSP	CO	WCP	TC	5	D
CA-LAN-1185	393-123	Flake	1 (S)	6.2	2,179	6.5	2,440	GYP	CO	WCP	TC	5	D
CA-LAN-1185	393-124	Flake	2 (S)	4.4	983	4.6	1,101	SSP	CO	WCP	TC	5	D
CA-LAN-1185	393-126	Flake	4 (S)	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	5	D
CA-LAN-1185	393-129	Flake	7 (S)	0.0	0	0.0	0	-	UNK	NS	TC	5	D
CA-LAN-1185	393-130	Flake	8 (S)	7.7	3,603	8.1	4,034	PTO	CO	WCP	TC	5	D
CA-LAN-1189/H	83	HBT	Surface	6.4	2,346	6.7	2,627	GYP	CO	WS	TC	5	D
CA-LAN-1189/H	38	Drill	Surface	7.2	3,083	7.6	3,452	PTO	UNK	NS	TC	5	D
CA-LAN-1189/H	194	Flake	TU 2 (20-30)	5.5	1,650	5.8	1,848	GYP	UNK	NS	TC	5	D
CA-LAN-1189/H	202	Flake	TU 2 (40-50)	4.4	983	4.6	1,101	SSP	UNK	NS	TC	5	D
CA-LAN-1189/H	261	Flake	TU 4 (10-20)	4.5	1,036	4.7	1,160	SSP	UNK	NS	TC	5	D
CA-LAN-1189/H	289	Flake	TU 4 (40-50)	4.6	1,090	4.8	1,221	SSP	UNK	NS	TC	5	D
CA-LAN-1189/H	308	Flake	TU 5 (30-56)	4.5	1,036	4.7	1,160	SSP	UNK	NS	TC	5	D
CA-LAN-1189/H	400-42	HBT	Surface	9.1	5,308	9.6	5,944	PTO	CO	WS	TC	5	D
CA-LAN-1189/H	400-22	Dart	121 (0-5)	7.2	3,083	7.6	3,452	PTO	CD	LM	TC	5	D
CA-LAN-1189/H	400-46	PF	Surface	6.0	2,020	6.3	2,262	GYP	CO	WS	TC	5	D
CA-LAN-1190/H	401-81	Flake	8 (S)	5.7	1,793	6.0	2,008	GYP	CO	WCP	TC	3	G
CA-LAN-1190/H	401-85	PF	PP 4 (S)	6.0	2,020	6.3	2,262	GYP	CO	WCP	TC	3	G
CA-LAN-1190/H	401-86	PF	PP 5 (S)	11.4	8,953	12.0	10,026	LPL	CO	WS	TC	3	G
CA-LAN-1193	77	Flake	Surface	7.2	3,083	7.6	3,452	PTO	CO	WS	LD	5	D
CA-LAN-1207	288-3	PF	PP 3 (S)	3.6	617	3.8	691	SSP	CO	WCP	TC	3	G
CA-LAN-1207	288-5	Flake	OBS 1 (S)	5.2	1,449	5.5	1,623	GYP	CO	WCP	TC	3	G
CA-LAN-1207	288-6	Flake	OBS A (S)	7.0	2,888	7.4	3,234	PTO	CO	WCP	TC	3	G

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-1207	288-7	Flake	OBS B (S)	0.0	0	0.0	0	–	CO	WCP	TC	3	G
CA-LAN-1207	288-8	Flake	OBS C (S)	8.7	4,782	9.1	5,356	PTO	CO	WCP	TC	3	G
CA-LAN-1207	288-27	Flake	A 19 (S)	7.8	3,712	8.2	4,157	PTO	CO	WCP	TC	3	G
CA-LAN-1227	527-1	DSN	Surface	2.7	317	2.8	355	SHO	CO	WS	TC	3	G
CA-LAN-1227	527-5	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	WS	TC	3	G
CA-LAN-1243/H	1425	BTF	Surface	7.0	2,888	7.4	3,234	PTO	CO	JR	BC	3	F
CA-LAN-1243/H	1425	BTF	Surface	7.0	2,888	7.4	3,234	PTO	CO	JR	BC	3	F
CA-LAN-1243/H	1428	BTF	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	BC	3	F
CA-LAN-1243/H	1543	BTF	TU 3 (10-20)	6.9	2,793	7.2	3,128	PTO	CO	WCP	BC	3	F
CA-LAN-1243/H	1547	BTF	TU 3 (20-30)	5.9	1,942	6.2	2,175	GYP	CO	WCP	BC	3	F
CA-LAN-1243/H	1566a	BTF	TU 3 (50-60)	6.0	2,020	6.3	2,262	GYP	CO	WS	BC	3	F
CA-LAN-1243/H	1566b	BTF	TU 3 (50-60)	6.0	2,020	6.3	2,262	GYP	CO	WS	BC	3	F
CA-LAN-1243/H	1571	BTF	TU 3 (60-70)	6.6	2,519	6.9	2,821	GYP	CO	WS	BC	3	F
CA-LAN-1283	630-136	Flake	Surface	3.9	743	4.1	833	SSP	CO	WS	TC	3	F
CA-LAN-1283	630-144	Flake	Surface	7.4	3,285	7.8	3,679	PTO	CO	WS	TC	3	F
CA-LAN-1283	630-146	Flake	Surface	5.9	1,942	6.2	2,175	GYP	CO	WS	TC	3	F
CA-LAN-1283	630-154	Dart	Surface	6.1	2,099	6.4	2,350	GYP	CO	WS	TC	3	F
CA-LAN-1283	630-160	Arrow	Surface	6.0	2,020	6.3	2,262	GYP	CO	JR	TC	3	F
CA-LAN-1283	630-164	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	WS	TC	3	F
CA-LAN-1283	630-171	Flake	21 (0-10)	6.9	2,793	7.2	3,128	PTO	CO	WS	TC	3	F
CA-LAN-1283	630-175	Flake	20 (S)	5.8	1,867	6.1	2,091	GYP	CO	WS	TC	3	F
CA-LAN-1283	630-177	Flake	20 (S)	6.6	2,519	6.9	2,821	GYP	CO	WS	TC	3	F
CA-LAN-1283	630-180	Flake	20 (S)	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	3	F
CA-LAN-1283	1819	Flake	Surface	6.1	2,099	6.4	2,350	GYP	CO	WS	TC	3	G
CA-LAN-1286/H	1	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CD	SR	TC	3	G
CA-LAN-1286/H	2	BFF	Surface	5.1	1,385	5.4	1,551	GYP	CO	SL	TC	3	G
CA-LAN-1286/H	3	Flake	Surface	5.3	1,515	5.6	1,696	GYP	CO	CO	TC	2	D
CA-LAN-1289/H	4738	ESN	Surface	8.2	4,169	8.6	4,668	PTO	CO	WS	TC	2	D
CA-LAN-1289/H	4738	ESN	Surface	4.7	1,146	4.9	1,283	GYP	CO	WS	TC	2	D
CA-LAN-1289/H	2956-1-7	Flake	Surface	5.6	1,721	5.9	1,927	GYP	CO	CO	TC	2	D
CA-LAN-1289/H	2956-1-9	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	CO	TC	2	D
CA-LAN-1289/H	2956-1-9	Flake	Surface	4.1	835	4.3	935	SSP	CO	CO	TC	2	D
CA-LAN-1289/H	2956-1-35	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	2	D
CA-LAN-1289/H	2956-1-46	Flake	Surface	9.9	6,454	10.4	7,228	PTO	CO	CO	TC	2	D

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-1289/H	2956-1-65	Flake	S153/E25 Cell F (S)	0.0	0	0.0	0	--	CO	WS	TC	2	D
CA-LAN-1289/H	2956-1-113	Flake	S55/W23 Cell E (S)	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	2	D
CA-LAN-1289/H	2956-1-121	Flake	S55/W23 Cell G (S)	8.4	4,408	8.8	4,937	PTO	CO	CO	TC	2	D
CA-LAN-1289/H	2956-1-201	Flake	S21/E44 Cell A (S)	5.8	1,867	6.1	2,091	GYP	CO	CO	TC	2	D
CA-LAN-1289/H	2956-1-209	Flake	S21/E44 Cell B (S)	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	2	D
CA-LAN-1289/H	2956-10-232	Flake	S2/E47 STU (0-10)	5.2	1,449	5.5	1,623	GYP	CO	CO	TC	2	D
CA-LAN-1289/H	2956-10-252	Flake	S2/E47 STU (90-100)	4.3	932	4.5	1,044	SSP	CO	CO	TC	2	D
CA-LAN-1295	472	Flake	U1 (10-20)	8.9	5,041	9.3	5,646	PTO	CO	CO	TC	3	G
CA-LAN-1296/H	2149	CWT	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	BC	3	F
CA-LAN-1296/H	2149	CWT	Surface	3.3	505	3.5	565	SHO	CO	WS	BC	3	F
CA-LAN-1296/H	2205	BFF	Surface	0.0	0	0.0	0	--	CO	WS	BC	3	F
CA-LAN-1296/H	037b	Flake	U4 (0-10)	3.9	743	4.1	833	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	430	UNK	Surface	7.6	3,495	8.0	3,914	PTO	CO	CO	BC	3	F
CA-LAN-1296/H	261	Shatter	U29 (0-10)	5.2	1,449	5.5	1,623	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	050b	Flake	U7 (0-10)	2.6	290	2.7	325	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	050a	BTF	U7 (S)	3.2	470	3.4	526	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	076	Shatter	U8 (S)	5.9	1,942	6.2	2,175	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	606	Shatter	U8 (S)	10.5	7,398	11.0	8,285	LMO	CO	CO	BC	3	F
CA-LAN-1296/H	510	Flake	U9 (0-10)	3.4	541	3.6	606	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	537c	Flake	U10 (10-20)	2.8	345	2.9	386	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	537a	Flake	U10 (10-20)	3.0	404	3.2	453	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	537b	Flake	U10 (10-20)	3.4	541	3.6	606	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	612	BFF	U10 (S)	1.9	140	2.0	157	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	615	Flake	U10 (S)	4.8	1,203	5.0	1,348	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	611	BFF	U10 (S)	5.2	1,449	5.5	1,623	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	608	BFF	U10 (S)	5.6	1,721	5.9	1,927	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	616	BFF	U10 (S)	5.6	1,721	5.9	1,927	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	618	BFF	U10 (S)	7.3	3,183	7.7	3,565	PTO	CD	CD	BC	3	F
CA-LAN-1296/H	619	Biface	U11 (S)	2.5	265	2.6	297	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	082	Shatter	U11 (S)	3.5	578	3.7	648	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	080	BFF	U11 (S)	5.0	1,323	5.3	1,482	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	117	Flake	U12 (S)	4.7	1,146	4.9	1,283	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	158	FT	U13 (S)	3.6	617	3.8	691	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	172	Shatter	U14 (0-10)	5.2	1,449	5.5	1,623	GYP	CO	CO	BC	3	F

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-1296/H	170b	Flake	U14 (S)	3.5	578	3.7	648	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	170a	Flake	U14 (S)	5.4	1,582	5.7	1,771	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	182	Flake	U15 (S)	2.4	241	2.5	270	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	202	Shatter	U18 (0-10)	5.1	1,385	5.4	1,551	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	198a	BTF	U18 (S)	2.8	345	2.9	386	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	198b	Flake	U18 (S)	3.7	658	3.9	737	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	623	BFF	U18 (S)	3.7	658	3.9	737	SSP	QU	QU	BC	3	F
CA-LAN-1296/H	624	Shatter	U18 (S)	4.5	1,036	4.7	1,160	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	598	BFF	U34 (S)	3.0	404	3.2	453	SHO	CO	CO	BC	3	F
CA-LAN-1296/H	309	BFF	U34 (S)	4.8	1,203	5.0	1,348	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	627	UNK	U45 (S)	5.9	1,942	6.2	2,175	GYP	CO	CO	BC	3	F
CA-LAN-1296/H	431	PF	Surface	4.5	1,036	4.7	1,160	SSP	CO	CO	BC	3	F
CA-LAN-1296/H	604	BTF	U69 (S)	6.9	2,793	7.2	3,128	PTO	CO	CO	BC	3	F
CA-LAN-1307	616-1	RSP	Surface	3.6	617	3.8	691	SSP	CO	WS	TC	3	G
CA-LAN-1310/H	744-150	Flake	11 (0-10)	4.8	1,203	5.0	1,348	GYP	CO	WS	TC	3	F
CA-LAN-1310/H	744-197	BFF	Surface	6.7	2,609	7.0	2,922	GYP	CO	WS	TC	3	F
CA-LAN-1310/H	744-220	CWT	Surface	3.8	700	4.0	784	SSP	CO	WS	TC	3	F
CA-LAN-1310/H	744-295	Flake	14 (40-50)	6.7	2,609	7.0	2,922	GYP	CO	WS	TC	3	F
CA-LAN-1316	1316-195-147	Point	Surface	0.0	0	0.0	0	--	CO	WCP	TC	2	C
CA-LAN-1316	195-7	BTF	Surface	13.2	12,580	13.9	14,088	LPL	CO	SL	TC	2	C
CA-LAN-1316	195-42L	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	2	C
CA-LAN-1316	195-80L	Flake	Surface	14.2	14,903	14.9	16,689	LPL	CO	SL	TC	2	C
CA-LAN-1316	195-111	BTF	Surface	9.2	5,444	9.7	6,097	PTO	CO	SL	TC	2	C
CA-LAN-1317	6	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	2	D
CA-LAN-1317	7	Biface	Surface	8.6	4,656	9.0	5,214	PTO	UNK	UNK	TC	2	D
CA-LAN-1317	8	Flake	STU 19 (20-40)	7.8	3,712	8.2	4,157	PTO	CO	CO	TC	2	D
CA-LAN-1317	9	Flake	STU 28 (0-20)	11.1	8,416	11.7	9,425	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-57	Flake	Surface	12.1	10,281	12.7	11,513	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-58	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-58	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-77	Flake	Surface	9.5	5,865	10.0	6,568	PTO	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-82	Flake	Surface	12.0	10,085	12.6	11,293	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-83	Flake	Surface	10.5	7,398	11.0	8,285	LMO	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-84	Flake	Surface	11.5	9,137	12.1	10,232	LPL	CO	CO	TC	2	D

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-1317/H	860-1-85	Flake	Surface	14.0	14,420	14.7	16,149	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-85	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-86	Flake	Surface	22.1	41,586	23.2	46,571	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-86	Flake	Surface	19.3	30,371	20.3	34,011	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-88	Flake	Surface	11.0	8,241	11.6	9,229	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-90	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-90	Flake	Surface	7.7	3,603	8.1	4,034	PTO	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-91	Flake	Surface	13.1	12,360	13.8	13,842	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-91	Flake	Surface	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	2	D
CA-LAN-1317/H	860-1-131	Flake	S197.5/E242.5 Cell A (S)	13.9	14,183	14.6	15,882	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	860-1-146	Flake	S292/E206 Cell D (S)	11.6	9,322	12.2	10,439	LPL	CO	CO	TC	2	D
CA-LAN-1317/H	1085	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	2	D
CA-LAN-1318/H	7542	RSP	Surface	12.8	11,714	13.4	13,117	LPL	CO	SL	TC	2	D
CA-LAN-1318/H	7542	RSP	Surface	9.9	6,454	10.4	7,228	PTO	CO	SL	TC	2	D
CA-LAN-1318/H	4	Flake	Surface	11.0	8,241	11.6	9,229	LPL	CO	WS	TC	2	D
CA-LAN-1318/H	5	Flake	Surface	6.7	2,609	7.0	2,922	GYP	CD	SR	TC	2	D
CA-LAN-1318/H	5	Flake	Surface	4.4	983	4.6	1,101	SSP	CD	SR	TC	2	D
CA-LAN-1318/H	1414	Flake	Surface	10.8	7,898	11.3	8,844	LMO	CO	CO	TC	2	D
CA-LAN-1329	870-1912	Elko	Surface	6.1	2,099	6.4	2,350	GYP	CO	WS	TC	3	G
CA-LAN-1329	43-28-2	RSP	UNK	5.3	1,515	5.6	1,696	GYP	CO	WS	TC	3	G
CA-LAN-1329	75-25-3a	Flake	UNK	0.0	0	0.0	0	--	CO	WS	TC	3	G
CA-LAN-1329	75-25-3b	Flake	UNK	0.0	0	0.0	0	--	CO	WS	TC	3	G
CA-LAN-1329	7-7-1	Flake	UNK	0.0	0	0.0	0	--	CO	WS	TC	3	G
CA-LAN-1409	888-1-5	BFF	Surface	7.0	2,888	7.4	3,234	PTO	CO	WS	TC	2	D
CA-LAN-1409	888-1-46	Flake	Surface	5.8	1,867	6.1	2,091	GYP	CO	WS	TC	2	D
CA-LAN-1409	888-1-61	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	2	D
CA-LAN-1465/H	4024	Flake	Surface	9.6	6,009	10.1	6,730	PTO	CO	WS	ISO	2	C
CA-LAN-1585	1040-12	Flake	OBS 1 (S)	9.3	5,583	9.8	6,252	PTO	CO	WCP	TC	3	G
CA-LAN-1585	1040-13	Flake	OBS 1 (S)	9.5	5,865	10.0	6,568	PTO	CO	WCP	TC	3	G
CA-LAN-1585	1040-13	Flake	OBS 1 (S)	3.4	541	3.6	606	SSP	CO	WCP	TC	3	G
CA-LAN-1585	1040-14	Flake	OBS 3 (S)	8.1	4,052	8.5	4,537	PTO	CO	WCP	TC	3	G
CA-LAN-1585	1040-15	Scraper	Uniface 1 (S)	5.8	1,867	6.1	2,091	GYP	CO	WCP	TC	3	G
CA-LAN-1585	1040-15	Scraper	Uniface 1 (S)	3.7	658	3.9	737	SSP	CO	WCP	TC	3	G
CA-LAN-1585	1040-51	BFF	Biface 7 (S)	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	3	G

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-1705/H	99	Flake	Surface	7.9	3,823	8.3	4,282	PTO	CO	WS	LD	2	C
CA-LAN-1798	5892	CWT	Surface	3.7	658	3.9	737	SSP	CO	WS	TC	5	D
CA-LAN-1805	1047-1	Flake	OBS 1 (S)	7.8	3,712	8.2	4,157	PTO	CO	WCP	TC	3	G
CA-LAN-1805	1147-2	Flake	OBS 2 (S)	9.1	5,308	9.6	5,944	PTO	CO	WCP	TC	3	G
CA-LAN-1805	1147-4	Flake	OBS 4 (S)	6.5	2,432	6.8	2,723	GYP	CO	WCP	TC	3	G
CA-LAN-1805	1147-28	Flake	SU 2 (S)	3.3	505	3.5	565	SHO	BM	BM	TC	3	G
CA-LAN-1805	1147-51	Flake	STP 1 (0-10)	6.9	2,793	7.2	3,128	PTO	CO	WCP	TC	3	G
CA-LAN-2254	220-3	Flake	Surface	4.0	788	4.2	883	SSP	CO	WS	TC	3	G
CA-LAN-2271	1694-1-2	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	TC	2	C
CA-LAN-2271	1694-1-3	Flake	Surface	11.4	8,953	12.0	10,026	LPL	CO	WS	TC	2	C
CA-LAN-2271	1694-1-3	Flake	Surface	11.1	8,416	11.7	9,425	LPL	CO	WS	TC	2	C
CA-LAN-2271	1694-1-4	Flake	Surface	13.0	12,143	13.7	13,598	LPL	CO	CO	TC	2	C
CA-LAN-2271	1694-1-5	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	2	C
CA-LAN-2286	1710-1-1	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2286	1710-1-2	Flake	Surface	11.2	8,593	11.8	9,623	LPL	CO	CO	LD	2	C
CA-LAN-2286	1710-1-2	Flake	Surface	4.9	1,262	5.1	1,414	GYP	CO	CO	LD	2	C
CA-LAN-2286	1710-1-3	Flake	Surface	4.8	1,203	5.0	1,348	GYP	CO	CO	LD	2	C
CA-LAN-2286	1710-1-4	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2286	1710-10-18	Flake	N48.5/E6 STU (0-10)	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2302	10	Flake	Surface	2.3	218	2.4	245	SHO	CO	CO	TC	2	C
CA-LAN-2303	1721-1-3	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	2	C
CA-LAN-2303	1721-10-74	Flake	N2/W5 STU (40-50)	14.0	14,420	14.7	16,149	LPL	CO	CO	TC	2	C
CA-LAN-2303	1721-10-105	Flake	N2/W4.5 TU (40-50)	5.4	1,582	5.7	1,771	GYP	CO	CO	TC	2	C
CA-LAN-2303	1721-10-115	Flake	N2/W4.5 TU (50-60)	10.5	7,398	11.0	8,285	LMO	CO	CO	TC	2	C
CA-LAN-2303	1721-10-127A	Flake	N2/W4.5 TU (70-80)	10.6	7,563	11.1	8,469	LMO	CO	CO	TC	2	C
CA-LAN-2303	1721-10-127A	Flake	N2/W4.5 TU (70-80)	9.6	6,009	10.1	6,730	PTO	CO	CO	TC	2	C
CA-LAN-2303	1721-10-127B	Flake	N2/W4.5 TU (70-80)	9.6	6,009	10.1	6,730	PTO	CO	CO	TC	2	C
CA-LAN-2303	1721-10-127C	Flake	N2/W4.5 TU (70-80)	9.9	6,454	10.4	7,228	PTO	CO	CO	TC	2	C
CA-LAN-2303	1721-10-127C	Flake	N2/W4.5 TU (70-80)	8.3	4,288	8.7	4,802	PTO	CO	CO	TC	2	C
CA-LAN-2397	2021-27b	Flake	ST 2 (S)	4.6	1,090	4.8	1,221	SSP	CO	WS	TC	3	G
CA-LAN-2397	2021-2	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	3	G
CA-LAN-2397	2021-13	Flake	Surface	9.2	5,444	9.7	6,097	PTO	CO	WS	TC	3	G
CA-LAN-2397	2021-22	Flake	Surface	9.6	6,009	10.1	6,730	PTO	CO	WS	TC	3	G
CA-LAN-2397	2021-27a	Flake	ST 2 (S)	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	G

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-2399	8045	AB	Surface	9.8	6,304	10.3	7,059	PTO	CO	WS	TC	3	G
CA-LAN-2399	8045	AB	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	3	G
CA-LAN-2421	2131-1-21	Flake	S8/E15 Cell A (S)	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2422	2132-1-6	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	2	C
CA-LAN-2422	2132-1-7	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	2	C
CA-LAN-2422	2132-1-8	Flake	N0/E0 (S)	0.0	0	0.0	0	--	CO	CO	TC	2	C
CA-LAN-2422	2132-191	Flake	N0/E10 (S)	0.0	0	0.0	0	--	CO	CO	TC	2	C
CA-LAN-2423	2133-1-1	Flake	N0/E0 Cell A (S)	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2423	2133-1-2	Flake	N0/E0 Cell A (S)	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2423	2133-1-4	Flake	N0/E0 Cell B (S)	2.2	197	2.3	221	SHO	CO	CO	LD	2	C
CA-LAN-2423	2133-1-7	Flake	N0/E0 Cell B (S)	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2423	2133-1-12A	Flake	N0/E0 Cell E (S)	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-2432	2145-10-55	Flake	N18/E10 TU (40-50)	9.7	6,156	10.2	6,893	PTO	CO	CO	LD	2	C
CA-LAN-2440	7498	Pinto	Surface	8.0	3,937	8.4	4,408	PTO	UNK	UNK	TC	2	C
CA-LAN-2493	7543	Arrow	Surface	8.2	4,169	8.6	4,668	PTO	CO	WS	LD	2	D
CA-LAN-2503	2171-1-3	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	CO	TC	2	D
CA-LAN-2503	2171-1-4	Flake	Surface	7.2	3,083	7.6	3,452	PTO	CO	CO	TC	2	D
CA-LAN-2503	2171-1-21	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	CO	TC	2	D
CA-LAN-2503	2171-10-70	Flake	S7/E14.5 STU (10-20)	8.0	3,937	8.4	4,408	PTO	CO	CO	TC	2	D
CA-LAN-2503	2171-10-72A	Flake	S7/E14.5 STU (20-30)	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	2	D
CA-LAN-2503	2171-10-72B	Flake	S7/E14.5 STU (20-30)	7.4	3,285	7.8	3,679	PTO	CO	CO	TC	2	D
CA-LAN-2503	2171-10-99	Flake	N5.5/E186 STU (10-20)	0.0	0	0.0	0	--	CO	CO	TC	2	D
CA-LAN-2511	2267-10-112B	Flake	N0/W24 TU (30-40)	10.0	6,606	10.5	7,398	LMO	CO	CO	TC	2	D
CA-LAN-2511	2267-10-112C	Flake	N0/W24 TU (30-40)	10.3	7,075	10.8	7,923	LMO	CO	WS	TC	2	D
CA-LAN-2511	2267-10-116	Flake	N0/W24 TU (50-60)	9.9	6,454	10.4	7,228	PTO	CO	CO	TC	2	D
CA-LAN-2511	2267-10-123	Flake	N0/W24 TU (70-80)	11.0	8,241	11.6	9,229	LPL	CO	WS	TC	2	D
CA-LAN-2511	2267-10-135	Flake	S2/W21.5 TU (20-30)	11.0	8,241	11.6	9,229	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-138A	Flake	S2/W21.5 TU (30-40)	12.3	10,679	12.9	11,959	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-138A	Flake	S2/W21.5 TU (30-40)	11.1	8,416	11.7	9,425	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-138B	Flake	S2/W21.5 TU (30-40)	11.4	8,953	12.0	10,026	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-138B	Flake	S2/W21.5 TU (30-40)	8.8	4,911	9.2	5,499	PTO	CO	CO	TC	2	D
CA-LAN-2511	2267-10-140A	Flake	S2/W21.5 TU (40-50)	11.1	8,416	11.7	9,425	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-140B	Flake	S2/W21.5 TU (40-50)	12.0	10,085	12.6	11,293	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-140C	Flake	S2/W21.5 TU (40-50)	10.0	6,606	10.5	7,398	LMO	CO	CO	TC	2	D

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-2511	2267-10-143A	Flake	S2/W21.5 TU (50-60)	12.3	10,679	12.9	11,959	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-143A	Flake	S2/W21.5 TU (50-60)	10.0	6,606	10.5	7,398	LMO	CO	CO	TC	2	D
CA-LAN-2511	2267-10-143B	Flake	S2/W21.5 TU (50-60)	12.1	10,281	12.7	11,513	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-158	Flake	S8/W28 TU (30-40)	9.0	5,174	9.5	5,794	PTO	CO	CO	TC	2	D
CA-LAN-2511	2267-10-165	Flake	S8/W28 TU (60-70)	13.4	13,027	14.1	14,588	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-168A	Flake	S8/W28 TU (70-80)	13.6	13,483	14.3	15,098	LPL	CO	CO	TC	2	D
CA-LAN-2511	2267-10-168B	Flake	S8/W28 TU (70-80)	12.3	10,679	12.9	11,959	LPL	CO	CO	TC	2	D
CA-LAN-2634	2374	Shatter	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	F
CA-LAN-2661	2775-31	Flake	2 (20-30)	3.4	541	3.6	606	SSP	CO	WS	LD	3	F
CA-LAN-3394	23	BFT	Surface	0.0	0	0.0	0	--	CO	WS	TC	2	C
CA-LAN-3406	11	BFT	Surface	7.6	3,495	8.0	3,914	PTO	CO	SL	TC	3	F
CA-LAN-3406	12	BFF	Surface	5.1	1,385	5.4	1,551	GYP	CO	WS	TC	3	F
CA-LAN-3406	13	BFF	Surface	2.8	345	2.9	386	SHO	CO	WS	TC	3	F
CA-LAN-3406	14	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	3	F
CA-LAN-3406	15	Flake	Surface	3.3	505	3.5	565	SHO	CO	CO	TC	3	F
CA-LAN-3406	16	Flake	Surface	7.0	2,888	7.4	3,234	PTO	CO	CO	TC	3	F
CA-LAN-3406	17	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	TC	3	F
CA-LAN-3406	18	Flake	Surface	5.9	1,942	6.2	2,175	GYP	CO	WS	TC	3	F
CA-LAN-3406	19	Flake	Surface	3.7	658	3.9	737	SSP	CO	WS	TC	3	F
CA-LAN-3406	20	Flake	Surface	6.4	2,346	6.7	2,627	GYP	CO	CO	TC	3	F
CA-LAN-3406	21	Flake	STU 48 (0-20)	6.2	2,179	6.5	2,440	GYP	CO	CO	TC	3	F
CA-LAN-3410	22	Flake	Surface	11.3	8,772	11.9	9,823	LPL	CO	CO	TC	2	C
CA-LAN-3472	7	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	LD	2	C
CA-LAN-3472	8	Flake	Surface	12.9	11,927	13.5	13,356	LPL	CO	WS	LD	2	C
CA-LAN-3472	9	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	10	Flake	Surface	12.7	11,502	13.3	12,881	LPL	CO	CO	LD	2	C
CA-LAN-3472	11	Flake	Surface	12.1	10,281	12.7	11,513	LPL	CO	WS	LD	2	C
CA-LAN-3472	12	Flake	Surface	2.1	177	2.2	198	SHO	CO	CO	LD	2	C
CA-LAN-3472	13	Flake	Surface	12.7	11,502	13.3	12,881	LPL	CO	CO	LD	2	C
CA-LAN-3472	13	Flake	Surface	7.7	3,603	8.1	4,034	PTO	CO	CO	LD	2	C
CA-LAN-3472	14	Flake	Surface	17.4	23,880	18.3	26,742	LPL	CO	SL	LD	2	C
CA-LAN-3472	15	Flake	Surface	0.0	0	0.0	0	--	CO	WCP	LD	2	C
CA-LAN-3472	16	Flake	Surface	6.2	2,179	6.5	2,440	GYP	CO	WS	LD	2	C
CA-LAN-3472	17	Flake	Surface	1.5	81	1.6	91	SHO	CO	WS	LD	2	C

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-3472	18	Flake	Surface	12.9	11,927	13.5	13,356	LPL	CO	JR	LD	2	C
CA-LAN-3472	19	Flake	Surface	10.9	8,068	11.4	9,035	LMO	CO	JR	LD	2	C
CA-LAN-3472	20	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	WS	LD	2	C
CA-LAN-3472	21	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	22	Flake	Surface	3.6	617	3.8	691	SSP	CO	WS	LD	2	C
CA-LAN-3472	23	Flake	Surface	3.6	617	3.8	691	SSP	CO	CO	LD	2	C
CA-LAN-3472	24	Flake	Surface	11.1	8,416	11.7	9,425	LPL	CO	CO	LD	2	C
CA-LAN-3472	25	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	26	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	27	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	28	Flake	Surface	10.9	8,068	11.4	9,035	LMO	CO	WS	LD	2	C
CA-LAN-3472	29	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	30	Flake	Surface	2.3	218	2.4	245	SHO	CO	CO	LD	2	C
CA-LAN-3472	31	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	32	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	33	Flake	Surface	6.1	2,099	6.4	2,350	GYP	CO	WS	LD	2	C
CA-LAN-3472	34	Flake	Surface	0.0	0	0.0	0	--	CO	WCP	LD	2	C
CA-LAN-3472	35	Flake	Surface	4.8	1,203	5.0	1,348	GYP	CO	WS	LD	2	C
CA-LAN-3472	37	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	38	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	39	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	CO	LD	2	C
CA-LAN-3472	40	Flake	Surface	5.4	1,582	5.7	1,771	GYP	CO	CO	LD	2	C
CA-LAN-3472	41	Flake	Surface	9.4	5,723	9.9	6,409	PTO	CO	WS	LD	2	C
CA-LAN-3472	42	Flake	Surface	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
CA-LAN-3472	43	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	44	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	WS	LD	2	C
CA-LAN-3472	45	Flake	Surface	11.5	9,137	12.1	10,232	LPL	CO	CO	LD	2	C
CA-LAN-3472	46	Flake	Surface	0.0	0	0.0	0	--	CO	SL	LD	2	C
CA-LAN-3472	47	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	48	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	WCP	LD	2	C
CA-LAN-3472	49	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	50	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	51	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	52	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-3472	53	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	54	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	2	C
CA-LAN-3472	55	Flake	Surface	3.5	578	3.7	648	SSP	CO	WS	LD	2	C
CA-LAN-3472	56	Flake	Surface	12.1	10,281	12.7	11,513	LPL	CO	WS	LD	2	C
CA-LAN-3472	57	Flake	Surface	2.4	241	2.5	270	SHO	CO	WS	LD	2	C
CA-LAN-3472	58	Flake	Surface	12.9	11,927	13.5	13,356	LPL	CO	CO	LD	2	C
CA-LAN-3472	59	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	60	Flake	Surface	12.9	11,927	13.5	13,356	LPL	CO	WS	LD	2	C
CA-LAN-3472	61	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	LD	2	C
CA-LAN-3472	62	Flake	Surface	11.8	9,699	12.4	10,861	LPL	CO	WS	LD	2	C
CA-LAN-3472	63	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	64	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	65	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	66	Flake	Surface	10.8	7,898	11.3	8,844	LMO	CO	WS	LD	2	C
CA-LAN-3472	67	Flake	Surface	0.0	0	0.0	0	--	CO	WCP	LD	2	C
CA-LAN-3472	68	Flake	Surface	0.0	0	0.0	0	--	CO	WCP	LD	2	C
CA-LAN-3472	69	Flake	Surface	14.4	15,394	15.1	17,239	LPL	CO	WCP	LD	2	C
CA-LAN-3472	70	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	71	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
CA-LAN-3472	72	Flake	Surface	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
CA-LAN-4053	2046	Shatter	Surface	9.9	6,454	10.4	7,228	PTO	CO	WS	TC	3	F
CA-LAN-4055	2114	Biface	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	LD	3	F
CA-LAN-4055	2119	BTF	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	LD	3	F
CA-LAN-4055	2120	BTF	Surface	10.0	6,606	10.5	7,398	LMO	CO	WS	LD	3	F
CA-LAN-4055	2121	Shatter	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	LD	3	F
CA-LAN-4055	2236	BTF	STP 3 (40-60)	7.0	2,888	7.4	3,234	PTO	CO	WS	LD	3	F
CA-LAN-4055	2242	BTF	STP 4 (0-20)	8.8	4,911	9.2	5,499	PTO	CO	WS	LD	3	F
CA-LAN-4055	2260	BTF	STP 6 (20-40)	7.8	3,712	8.2	4,157	PTO	CO	WS	LD	3	F
CA-LAN-4055	2260	BTF	STP 6 (20-40)	6.9	2,793	7.2	3,128	PTO	CO	WS	LD	3	F
CA-LAN-4055	2263	BTF	STP 6 (40-60)	8.0	3,937	8.4	4,408	PTO	CO	WS	LD	3	F
CA-LAN-4055	2263	BTF	STP 6 (40-60)	7.0	2,888	7.4	3,234	PTO	CO	WS	LD	3	F
CA-LAN-715	180.1	Flake	Surface	2.5	265	2.6	297	SHO	CO	WS	TC	2	C
CA-LAN-715	180.222	Flake	TU-B (20-30)	0.0	0	0.0	0	--	CO	WS	TC	2	C
CA-LAN-715	180.235	Shatter	TU-B (60-70)	5.1	1,385	5.4	1,551	GYP	CO	WS	TC	2	C

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-LAN-715	10658	BFF	Surface	5.9	1,942	6.2	2,175	GYP	CO	WS	TC	2	C
CA-LAN-716	10818	Flake	Surface	4.8	1,203	5.0	1,348	GYP	SA	SV	TC	2	C
CA-LAN-716	10819	Flake	Surface	6.3	2,262	6.6	2,533	GYP	SA	SV	TC	2	C
CA-LAN-769/H	732	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WCP	TC	3	F
CA-LAN-769/H	733	Flake	Surface	9.1	5,308	9.6	5,944	PTO	CO	WCP	TC	3	F
CA-LAN-769/H	734	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	TC	3	F
CA-LAN-769/H	735	Flake	Surface	7.1	2,985	7.5	3,342	PTO	UNK	NS	TC	3	F
CA-LAN-769/H	823	LSD	Surface	0.0	0	0.0	0	--	CO	WS	TC	3	F
CA-LAN-769/H	958	DSN	Surface	5.1	1,385	5.4	1,551	GYP	CO	WS	TC	3	F
CA-LAN-828/H	38	RSP	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	BC	3	F
CA-LAN-828/H	1074	CWT	Surface	3.4	541	3.6	606	SSP	OB	OB	BC	3	F
CA-LAN-863	166	Biface	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	BC	5	D
CA-LAN-863	165	Biface	Surface	2.9	374	3.0	419	SHO	CO	WS	BC	5	D
CA-LAN-863	167	Biface	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	BC	5	D
CA-LAN-863	167	Biface	Surface	6.5	2,432	6.8	2,723	GYP	CO	WS	BC	5	D
CA-LAN-863	585	BTF	4 (20-30)	8.5	4,531	8.9	5,074	PTO	CO	WS	BC	5	D
CA-LAN-863	214	Flake	1 (20-30)	6.4	2,346	6.7	2,627	GYP	CO	CO	BC	5	D
CA-LAN-863	6	Flake	3 (10-20)	11.0	8,241	11.6	9,229	LPL	CO	CO	BC	5	D
CA-LAN-863	201-2022	Flake	A22 (S)	9.0	5,174	9.5	5,794	PTO	CO	WS	BC	5	D
CA-LAN-863	201-2009	Flake	A9 (S)	8.5	4,531	8.9	5,074	PTO	CO	WCP	BC	5	D
CA-LAN-863	201-2028	Flake	A28 (S)	8.9	5,041	9.3	5,646	PTO	CO	WCP	BC	5	D
CA-LAN-863	201-2044	Flake	A44 (S)	8.9	5,041	9.3	5,646	PTO	CO	WCP	BC	5	D
CA-LAN-863	201-2050	Flake	A50 (S)	9.1	5,308	9.6	5,944	PTO	CO	WCP	BC	5	D
CA-LAN-863	201-2512	Flake	12A STP (0-10)	7.5	3,389	7.9	3,795	PTO	UNK	NS	BC	5	D
CA-LAN-863/H	729	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	BC	5	D
CA-LAN-863/H	730	Flake	Surface	9.7	6,156	10.2	6,893	PTO	UNK	NS	BC	5	D
CA-LAN-863/H	731	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	BC	5	D
CA-LAN-863/H	91	ESN	Surface	6.6	2,519	6.9	2,821	GYP	CO	WS	BC	5	D
CA-LAN-XXXX	4392-160	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	3	F
CA-SBR-4052	715	Scraper	Surface	10.7	7,729	11.2	8,655	LMO	CO	WCP	LD	5	B
CA-SBR-4052	702	Scraper	Surface	0.0	0	0.0	0	--	UNK	NS	LD	5	B
CA-SBR-5088	5769	ESN	Surface	9.9	6,454	10.4	7,228	PTO	CO	CO	LD	5	B
CA-SBR-5088	5771	BTF	Surface	7.3	3,183	7.7	3,565	PTO	CO	CO	LD	5	B
CA-SBR-5173	464	LSD	Surface	9.7	6,156	10.2	6,893	PTO	CO	WCP	LD	5	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-SBR-5321/H	1	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	TC	5	B
CA-SBR-5321/H	2	Biface	Surface	5.2	1,449	5.5	1,623	GYP	CO	SL	TC	5	B
CA-SBR-5789	202-2	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	5	B
CA-SBR-5789	202-3	Flake	Surface	11.2	8,593	11.8	9,623	LPL	CO	WS	TC	5	B
CA-SBR-5789	202-4	Flake	Surface	8.2	4,169	8.6	4,668	PTO	CO	S2F	TC	5	B
CA-SBR-5789	202-6	Flake	Surface	10.0	6,606	10.5	7,398	LMO	CO	WS	TC	5	B
CA-SBR-5789	202-7	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	TC	5	B
CA-SBR-5789	202-10	Flake	Surface	12.5	11,086	13.1	12,415	LPL	CO	WS	TC	5	B
CA-SBR-5789	202-12	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	5	B
CA-SBR-5789	202-73	Flake	SSU 9 (0-5)	3.5	578	3.7	648	SSP	CO	WS	TC	5	B
CA-SBR-5789	202-151	Flake	Surface	10.5	7,398	11.0	8,285	LMO	CO	WS	TC	5	B
CA-SBR-5789	202-152A	Flake	Surface	10.7	7,729	11.2	8,655	LMO	CO	WS	TC	5	B
CA-SBR-5789	202-1	Flake	Surface	0.0	0	0.0	0	--	CO	CO	LD	5	B
CA-SBR-5789	202-5	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	5	B
CA-SBR-5789	202-8	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	5	B
CA-SBR-5789	202-9	UTF	Surface	0.0	0	0.0	0	--	CO	JR	LD	5	B
CA-SBR-5789	202-152B	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	5	B
CA-SBR-5789	202-153	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	5	B
CA-SBR-6151	3	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	5	B
CA-SBR-6151	4	Flake	Surface	0.0	0	0.0	0	--	CO	WS	TC	5	B
CA-SBR-6151	5	Flake	Surface	9.0	5,174	9.5	5,794	PTO	CO	JR	TC	5	B
CA-SBR-6151	6	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	TC	5	B
CA-SBR-6151	7	Tool	Surface	0.0	0	0.0	0	--	CO	WS	TC	5	B
CA-SBR-6151	8	Preform	Surface	8.6	4,656	9.0	5,214	PTO	CO	WS	TC	5	B
CA-SBR-6151	9	Flake	Surface	7.1	2,985	7.5	3,342	PTO	CO	SL	TC	5	B
CA-SBR-6151	10	Flake	TU (S)	5.1	1,385	5.4	1,551	GYP	CO	CO	TC	5	B
CA-SBR-6151	11	Flake	Surface	9.6	6,009	10.1	6,730	PTO	CO	JR	TC	5	B
CA-SBR-6151	12	Flake	Surface	8.2	4,169	8.6	4,668	PTO	CO	WS	TC	5	B
CA-SBR-6151	13	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	TC	5	B
CA-SBR-6151	14	Flake	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	TC	5	B
CA-SBR-6151	15	Flake	Surface	14.5	15,644	15.2	17,518	LPL	CO	CO	TC	5	B
CA-SBR-6151	16	Flake	Surface	4.6	1,090	4.8	1,221	SSP	CO	CO	TC	5	B
CA-SBR-6151	17	Flake	Surface	14.9	16,663	15.6	18,660	LPL	CO	WS	TC	5	B
CA-SBR-6151	17	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	5	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-SBR-6151	18	Preform	Surface	9.7	6,156	10.2	6,893	PTO	CO	WS	TC	5	B
CA-SBR-6151	19	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	5	B
CA-SBR-6151	20	Flake	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	5	B
CA-SBR-6151	21	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	TC	5	B
CA-SBR-6151	22	Point	Surface	8.0	3,937	8.4	4,408	PTO	CO	SL	TC	5	B
CA-SBR-6151	23	Preform	Surface	7.7	3,603	8.1	4,034	PTO	CO	WS	TC	5	B
CA-SBR-6151	24	Biface	Surface	9.0	5,174	9.5	5,794	PTO	CO	WS	TC	5	B
CA-SBR-6151	25	Point	Surface	7.3	3,183	7.7	3,565	PTO	CO	WS	TC	5	B
CA-SBR-8034	39	Flake	Surface	10.0	6,606	10.5	7,398	LMO	CO	WS	LD	5	C
CA-SBR-8034	40	Flake	Surface	7.8	3,712	8.2	4,157	PTO	CO	WS	LD	5	C
CA-SBR-8034	41	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	LD	5	C
CA-SBR-8034	42	Flake	Surface	10.1	6,761	10.6	7,571	LMO	CO	WS	LD	5	C
CA-SBR-8034	43	Flake	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	LD	5	C
CA-SBR-8034	44	Flake	Surface	10.7	7,729	11.2	8,655	LMO	CO	CO	LD	5	C
CA-SBR-8155	5672	Flake	Surface	12.1	10,281	12.7	11,513	LPL	CO	CO	TC	5	C
CA-SBR-8155	5672	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	CO	TC	5	C
CA-SBR-8155	5681	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	CO	TC	5	C
CA-SBR-8159	5686	Flake	Surface	0.0	0	0.0	0	--	CO	CO	TC	5	C
CA-SBR-8159	5689	Flake	Surface	9.7	6,156	10.2	6,893	PTO	CO	CO	TC	5	C
CA-SBR-8159	5685	Pinto	Surface	7.5	3,389	7.9	3,795	PTO	CO	WS	TC	5	C
CA-SBR-8160	5763	BFF	Surface	10.3	7,075	10.8	7,923	LMO	CO	CO	TC	5	C
CA-SBR-8160	119	Scraper	Surface	15.3	17,719	16.1	19,843	LPL	UNK	NS	TC	5	C
CA-SBR-8160	119	Scraper	Surface	7.4	3,285	7.8	3,679	PTO	UNK	NS	TC	5	C
CA-SBR-8160	158	Flake	TU 1 (10-20)	6.4	2,346	6.7	2,627	GYP	UNK	CO	TC	5	C
CA-SBR-8183	5750	Flake	Surface	10.1	6,761	10.6	7,571	LMO	CO	CO	LD	5	C
CA-SBR-8197	28	BTF	SSU 1 (0-5)	6.4	2,346	6.7	2,627	GYP	CO	SL	TC	5	B
CA-SBR-8204	6	Flake	SSU 1 (0-5)	9.0	5,174	9.5	5,794	PTO	CO	WCP	TC	5	C
CA-SBR-8204	6	Flake	SSU 1 (0-5)	6.4	2,346	6.7	2,627	GYP	CO	WCP	TC	5	C
CA-SBR-8216	45	Scraper	Surface	8.0	3,937	8.4	4,408	PTO	CO	WS	LD	5	C
CA-SBR-8219	5795	Core	Surface	14.0	14,420	14.7	16,149	LPL	CO	CO	LD	5	B
CA-SBR-8222	5652	BTF	Surface	8.5	4,531	8.9	5,074	PTO	CO	CO	LD	5	B
CA-SBR-8222	38	Flake	Surface	8.1	4,052	8.5	4,537	PTO	CO	WS	LD	5	B
CA-SBR-8304	5780	Biface	Surface	8.2	4,169	8.6	4,668	PTO	CO	CO	LD	5	C
CA-SBR-8306	5793	BTF	Surface	9.6	6,009	10.1	6,730	PTO	CO	CO	TC	5	C

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
CA-SBR-8852	7969	Dart	Surface	3.9	743	4.1	833	SSP	CO	WS	TC	4	A
CA-SBR-9507	46	Flake	Surface	11.6	9,322	12.2	10,439	LPL	CO	WCP	TC	5	B
CA-SBR-9507	47	Flake	Surface	8.8	4,911	9.2	5,499	PTO	CO	WS	TC	5	B
CA-SBR-9507	48	Flake	Surface	6.3	2,262	6.6	2,533	GYP	CO	WS	TC	5	B
CA-SBR-9507	49	Biface	Surface	13.7	13,714	14.4	15,357	LPL	CO	WCP	TC	5	B
CA-SBR-9507	50	Biface	Surface	8.7	4,782	9.1	5,356	PTO	CO	WS	TC	5	B
CA-SBR-9507	51	UTF	Surface	8.7	4,782	9.1	5,356	PTO	CO	WS	TC	5	B
CA-SBR-9507	52	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WCP	TC	5	B
CA-SBR-9507	53	Flake	Surface	10.2	6,917	10.7	7,746	LMO	CO	WS	TC	5	B
CA-SBR-9507	54	Flake	Surface	8.2	4,169	8.6	4,668	PTO	CO	SL	TC	5	B
CA-SBR-9770	2707-5	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	5	B
CA-SBR-9770	2707-6	Flake	Surface	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	5	B
CA-SBR-9770	2707-26a	Flake	TU 11 (0-10)	8.7	4,782	9.1	5,356	PTO	CO	WS	TC	5	B
CA-SBR-9770	2707-26a	Flake	TU 11 (0-10)	6.8	2,700	7.1	3,024	PTO	CO	WS	TC	5	B
CA-SBR-9770	2707-26b	Flake	TU 11 (0-10)	10.1	6,761	10.6	7,571	LMO	CO	CO	TC	5	B
CA-SBR-9770	2707-67	Flake	TU 18 (0-10)	10.3	7,075	10.8	7,923	LMO	CO	WS	TC	5	B
CA-SBR-9770	2707-72	Flake	STP 23 (0-50)	6.9	2,793	7.2	3,128	PTO	CO	WS	TC	5	B
CA-SBR-9891	74	Biface	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	TC	5	E
ISO	327	Flake	Surface	6.6	2,519	6.9	2,821	GYP	CO	WCP	ISO	5	A
ISO	397	Point	Surface	0.0	0	0.0	0	--	UNK	NS	ISO	3	F
ISO	418	Flake	Surface	7.8	3,712	8.2	4,157	PTO	CO	WCP	ISO	5	A
ISO	827	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	WCP	ISO	5	A
ISO	828	Flake	Surface	9.8	6,304	10.3	7,059	PTO	UNK	NS	ISO	5	A
ISO	426	Flake	Surface	0.0	0	0.0	0	--	UNK	NS	ISO	3	F
ISO	832	Flake	Surface	0.0	0	0.0	0	--	CO	WCP	ISO	3	F
ISO	303	Flake	Surface	9.1	5,308	9.6	5,944	PTO	CO	WCP	ISO	5	B
ISO	102	RSP	Surface	4.3	932	4.5	1,044	SSP	CO	WS	ISO	3	F
ISO	124	HBT	Surface	4.7	1,146	4.9	1,283	GYP	CO	WS	ISO	3	E
ISO	2047	HBT	Surface	5.4	1,582	5.7	1,771	GYP	CO	WS	ISO	5	A
ISO	4561	Arrow	Surface	0.0	0	0.0	0	--	CO	WS	ISO	2	C
ISO	5745	EDF	Surface	10.9	8,068	11.4	9,035	LMO	CO	CO	ISO	5	B
ISO	7029	SLP	Surface	7.8	3,712	8.2	4,157	PTO	CO	JR	ISO	5	A
ISO	7136	LMO	Surface	8.5	4,531	8.9	5,074	PTO	CO	WS	ISO	5	B
ISO	6769	Flake	Surface	7.4	3,285	7.8	3,679	PTO	CO	WS	ISO	5	A

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
ISO	6775	Shatter	Surface	13.5	13,254	14.2	14,842	LPL	CO	WS	ISO	4	B
ISO	7458	Dart	Surface	7.8	3,712	8.2	4,157	PTO	CO	WS	ISO	4	A
ISO	8294	Dart	Surface	0.0	0	0.0	0	--	CO	WS	ISO	2	E
ISO	8783	Flake	Surface	8.4	4,408	8.8	4,937	PTO	CO	WS	ISO	1	A
ISO	8784	Flake	Surface	9.3	5,583	9.8	6,252	PTO	CO	WS	ISO	1	A
ISO	8785	Flake	Surface	6.9	2,793	7.2	3,128	PTO	CO	WS	ISO	1	A
ISO	8786	Flake	Surface	8.9	5,041	9.3	5,646	PTO	CO	WS	ISO	1	A
ISO	10716	Flake	Surface	0.0	0	0.0	0	--	CO	WS	ISO	2	B
TBD	4461.265	Flake	Surface	12.7	11,502	13.3	12,881	LPL	CO	WS	LD	2	C
TBD	4461.503	Flake	TU A (50-60)	0.0	0	0.0	0	--	CO	WS	LD	2	C
TBD	6332.1739	Dart	Surface	11.3	8,772	11.9	9,823	LPL	CO	WS	LD	2	C
TBD	6332.1743	Flake	Surface	13.4	13,027	14.1	14,588	LPL	CO	WS	LD	2	C
TBD	6332.1743	Flake	Surface	9.2	5,444	9.7	6,097	PTO	CO	WS	LD	2	C
TBD	10600	Flake	Surface	4.1	835	4.3	935	SSP	CO	WS	LD	2	C
TBD	6341.14	Flake	Surface	12.4	10,882	13.0	12,186	LPL	CO	WS	LD	2	C
TBD	6341.24	Flake	TU A (S)	0.0	0	0.0	0	--	CO	WS	LD	2	C
TBD	6348.699	Flake	Surface	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
TBD	6348.745	Flake	Surface	11.7	9,509	12.3	10,649	LPL	CO	WS	LD	2	C
TBD	6348.778	Flake	Surface	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
TBD	6348.817	Flake	TU B (10-20)	4.0	788	4.2	883	SSP	CO	WS	LD	2	C
TBD	6348.856	Flake	SRU 1 (S)	0.0	0	0.0	0	--	CD	CD	LD	2	C
TBD	6348.879	Flake	SRU 1 (S)	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
TBD	6348.906	Flake	SRU 1 (S)	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
TBD	10638	Flake	Surface	0.0	0	0.0	0	--	UNK	UNK	LD	2	C
TBD	6354.565	Flake	Surface	5.7	1,793	6.0	2,008	GYP	CO	WS	LD	2	C
TBD	6358.1369	Flake	Surface	2.3	218	2.4	245	SHO	CO	WS	LD	2	C
TBD	6358.1370	Flake	Surface	2.5	265	2.6	297	SHO	CO	WS	LD	2	C
TBD	6358.1391	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
TBD	10649	Flake	Surface	14.3	15,148	15.0	16,963	LPL	CO	WS	LD	2	C
TBD	6359.1312	Flake	Surface	11.9	9,891	12.5	11,076	LPL	CO	WS	LD	2	C
TBD	6359.1325	Flake	Surface	0.0	0	0.0	0	--	CO	SL	LD	2	C
TBD	6359.1337	Flake	Surface	0.0	0	0.0	0	--	CO	WS	LD	2	C
TBD	10654	BFF	Surface	15.0	16,924	15.8	18,952	LPL	CO	WCP	LD	2	C
TBD	10721	BFF	Surface	14.9	16,663	15.6	18,660	LPL	CO	WS	LD	1	B

Trinomial	Cat No.	Artifact	Unit (Depth)	Raw Microns	Raw Years BP	Adjusted Microns	Adjusted Years BP	Time Period	Source	Sub-source	Site Type	MR	MA
TBD	10727	LMO	Surface	11.9	9,891	12.5	11,076	LPL	CO	WS	LD	2	C
TBD	10729	Flake	STP 13 (S)	0.0	0	0.0	0	--	CO	WS	TC	2	C
TBD	10735	BFF	Surface	8.1	4,052	8.5	4,537	PTO	CO	WS	TC	2	B

General notes:
ISO=Isolate
TBD=To be determined
UNK=Unknown

Artifact notes:
BTF=Biface thinning flake
CWB=Cottonwood base
CWL=Cottonwood leafshaped
CWT=Cottonwood triangular
CWU=Cottonwood unifacial
DSN=Desert side notched
ECN=Elko corner notched
EDF=Edge damaged flake
ESN=Elko side notched
LSD=Leaf shaped dart
RTF=Retouched flake
UTF=Utilized flake

Unit notes:
S=Surface
SC=Surface collection
SCU=Surface collection unit
SRU=Surface recordation unit
SSU=Surface scrape unit
STP=Shovel test pit
TS=Transit shot
TU=Test unit
U=Unit

Time period notes:
GYP=Gypsum
LMO=Lake Mojave
LPL=Late Pliestocene
PTO=Pinto
SHO=Shoshonean
SSP=Saratoga Springs

Source and Subsource notes:
BM = Bristol Mountain
CD = Casa Diablo
CO = Coso
FS = Fish Spring
JR = Joshua Ridge
LM = Lookout Mountain
MO = Mono
NS = Not sourced
OB = Obsidian Butte
QU = Queen
S2F = Site 2 Flow
SA = Saline
SL = Sugarloaf Mountain
SM = Shoshone Mountain
SR = Sawmill Ridge
SV = Saline Valley
WCP = West Cactus Peak
WS = West Sugarloaf

Site type notes:
BC = Base camp
HE = Hearth
LD = Lithic deposit
QUA = Quarry
RS = Rock shelter
TC = Temporary camp

APPENDIX C

SUPPLEMENTAL OBSIDIAN LOCATION MAPS

EAFB-2402-5
EAFB-2402-49
EAFB-2402-98
EAFB-2402-119
EAFB-2402-183

EAFB-4188-95
EAFB-4188-172
EAFB-4188-182

SOLEDAD MT, CALIF
N3452.5 - W11807.5/7.5
1973
CONTOUR INTERVAL 10 FEET

BISSELL, CALIF.
34118-H1-TF-024
1973
CONTOUR INTERVAL 10 FEET

Miles
0   0.15 0.3   0.6   0.9   1.2

Kilometers
0   0.25 0.5   1   1.5   2

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ROGERS LAKE SOUTH, CALIF.
N34117-G7-TF-024
1992
CONTOUR INTERVAL 20 FEET

EAFB-246-5

Miles
0   0.15 0.3   0.6   0.9   1.2

Kilometers
0   0.25 0.5   1   1.5   2

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APPENDIX D

SUPPLEMENTAL OBSIDIAN SOURCING AND

HYDRATION REPORTS

Geochemical Research Laboratory Letter Report 2016-91

Energy Dispersive X-ray Fluorescence Analysis of Obsidian Artifacts from 22 Archaeological Sites Within Edwards Air Force Base, California

November 29, 2016

Mr. Richard G. Bark
Applied Archaeology Program
CSU San Bernardino
3026 Neary Court
Rosamond, CA 93560

Dear Mr. Bark:

This letter contains tables and a figure reporting the results of energy dispersive x-ray fluorescence (edxrf) analysis of 40 obsidian artifacts from 22 archaeological sites within Edwards Air Force Base, California. This research was conducted pursuant to Edwards Project # 2016-E. Laboratory equipment and instrumentation, calibration, artifact-to-source (geochemical type) attribution procedures, element-specific measurement resolution, and literature references applicable to analysis of these samples (except as noted) are the same as I reported for artifacts from EAFB 3793 (Hughes 2006) and other sites located within the confines of the base (Hughes 2016).

Figure 1

Fe/Mn vs. Zr/Nb Plots for Obsidian Artifacts from Edwards Air Force Base, California

Dashed lines represent range of variation in regionally significant obsidian source samples. Filled triangles plot the specimens listed in Table 1, open triangles plots artifacts in Table 2. *Note*: values for artifacts 236–40 and 400-22 plot off the chart at this scale.

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Twenty-nine of the artifacts you sent were large enough to generate reliable quantitative composition estimates. Edxrf data in Table 1 and Figure 1 indicate that 25 artifacts were made from Coso Volcanic Field obsidians (West Sugarloaf, n= 24; and Joshua Ridge, n= 1 each; cf. Hughes 1988). Two artifacts were made from Lookout Mountain obsidian from the Casa Diablo area (Hughes 1994) and two others were fashioned from Saline Valley volcanic glass.

Table 2

Integrated Net Count Rate Data for Small/Thin Obsidian Artifacts from Edwards Air Force Base Sites

	Element Intensities							**Intensity Ratios**							Obsidian Source
Cat. no.	Rb	Sr	Zr	ΣRb,Sr,Zr	Rb%	Sr%	Zr%	Fe/Mn	Rb/Sr	Zr/Y	Y/Nb	Zr/Nb	Sr/Y	(Chemical Type)
236-55	729	5	449	1183	.616	.004	.380	45.0	145.8	2.2	.8	1.8	<.1	West Cactus Peak
236-66	578	21	506	1105	.523	.019	.458	42.9	27.5	3.1	.9	2.8	.1	West Sugarloaf
383-4820	592	16	491	1099	.539	.015	.447	44.3	37.0	3.1	.9	2.7	.1	West Sugarloaf
426-5	560	12	409	981	.571	.012	.417	38.6	46.7	2.7	.9	2.3	.1	Sugarloaf Mountain
559-1	611	20	545	1176	.520	.017	.463	45.6	30.6	3.3	.9	2.8	.1	West Sugarloaf
559-12	654	19	541	1214	.539	.016	.446	45.1	34.4	3.1	.8	2.8	.1	West Sugarloaf
2021-27b	586	23	516	1125	.521	.020	.459	42.6	25.5	3.0	.9	2.7	.1	West Sugarloaf
2402-98	506	24	612	1142	.443	.021	.536	52.1	21.1	4.3	1.0	4.1	.2	Joshua Ridge
2402-119	523	8	414	945	.553	.009	.438	39.7	65.3	3.1	.8	2.5	.1	Sugarloaf Mountain
2402-183	4	19	4	27	.148	.704	.148	nc	nc	nc	nc	nc	2.5	Not Obsidian
4188-172	625	17	563	1205	.519	.014	.467	49.3	36.8	3.5	.8	2.9	.1	West Sugarloaf

Elemental intensities (peak counts/second above background) generated at 40 seconds livetime. nc= not computed.

I typically report trace element measurements in quantitative units (i.e. ppm) and make artifact-to-source attributions on the basis of correspondences in diagnostic trace element concentration values (e.g. those presented in Table 1), but 11 of the specimens you sent were too small and thin to generate x-ray counting statistics adequate for proper conversion from background-corrected intensities to quantitative concentration estimates (i.e., ppm). I analyzed all 11 artifacts to generate integrated net count (intensity) data for the elements Rb, Sr, Y, Zr, Nb, Fe and Mn. After background subtraction, the intensities (counts per second) were converted to percentages. The counting data and derived ratios appear in Table 2, and the plotted values appear in Figure 1. Source assignments were made by comparing the plots for various element intensity ratios for artifacts against the parameters of known source types identified in my extensive in-house reference collection. Further discussion of this laboratory analysis protocol appears in Hughes (2010). The Fe/Mn vs. Zr/Nb plots for the small specimens in Table 2 (see Figure 1) effectively identify all ten obsidian artifacts as matching the profile of Coso Volcanic Field obsidian (West Sugarloaf, n= 6; Sugarloaf Mountain, n =2; West Cactus Peak and Joshua Ridge, n= 1 each). One specimen (2402-183) was made from a non-obsidian parent material.

Combining the results of quantitative composition estimates (n= 29; Table 1) and integrated net peak intensity analysis (n= 11; Table 2) shows that 35 artifacts were made from Coso Volcanic Field obsidians (West Sugarloaf, n= 30; Sugarloaf Mountain and Joshua Ridge, n= 2 each; and West Cactus Peak, n= 1). Two artifacts were made from Lookout Mountain (Casa Diablo area) volcanic glass, and two others were fashioned from obsidian of the Saline Valley chemical type. The remaining artifact was manufactured from a non-obsidian parent material.

I hope this information will help in your analysis and interpretation of the significance of these artifacts. Please contact me at my laboratory (phone: [650] 851-1410; e-mail: rehughes@silcon.com) if I can provide any further assistance or information. As you requested I have forwarded the specimen to Tom Origer for obsidian hydration analysis.

Sincerely,

Richard Hughes

Richard E. Hughes, Ph.D., RPA
Director, Geochemical Research Laboratory

References

Hughes, Richard E.

1988   The Coso Volcanic Field Reexamined: Implications for Obsidian Sourcing and Hydration Dating Research. **Geoarchaeology** 3: 253-265.

1994   Intrasource Chemical Variability of Artefact-Quality Obsidians from the Casa Diablo Area, California. **Journal of Archaeological Science** 21: 263-271.

2006   Energy Dispersive X-ray Fluorescence Analysis of Three Obsidian Artifacts from Archaeological Site EAFB 3793, Edwards Air Force Base, California. Geochemical Research Laboratory Letter Report 2006-109 submitted to James Johannesmeyer, JT3/CH2M Hill, November 20, 2006.

2010   Determining the Geologic Provenance of Tiny Obsidian Flakes in Archaeology Using Nondestructive EDXRF. **American Laboratory** 42 (7): 27-31.

2016   Energy Dispersive X-ray Fluorescence Analysis of Obsidian Artifacts from Archaeological Sites Within Edwards Air Force Base, California. Geochemical Research Laboratory Letter Report 2016-40 submitted to Richard Bark, Environmental Assets Program, JT3/CH2M Hill, May 9, 2016.

Table 1

Quantitative Composition Estimates for Obsidian Artifacts from Sites Within Edwards Air Force Base, CA
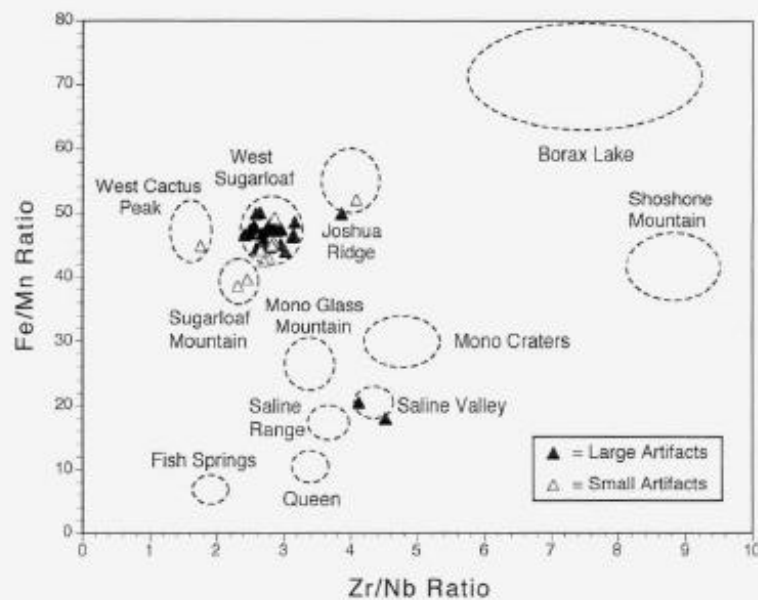
| Site/Cat. Number | Trace and Selected Minor Element Concentrations | | | | | | | | | | | Ratio | Obsidian Source (Chemical Type) |
	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba	Ti	Mn	Fe₂O₃ᵀ	Fe/Mn	
EAFB 181, 10818	nm	nm	155 ±4	90 ±4	24 ±3	138 ±4	39 ±3	265 ±26	nm	nm	nm	21	Saline Valley
EAFB 181, 10819	nm	nm	141 ±4	89 ±4	25 ±3	131 ±4	32 ±3	273 ±19	nm	nm	nm	18	Saline Valley
EAFB 221, 10738	nm	nm	210 ±5	12 ±2	50 ±3	160 ±4	46 ±3	nm	nm	nm	nm	50	Joshua Ridge, Coso Volcanic Field
EAFB 236, 236-40	nm	nm	138 ±4	93 ±4	20 ±3	181 ±4	13 ±2	1008 ±21	nm	nm	nm	50	Lookout Mountain, Casa Diablo area
EAFB 283, 10691	nm	nm	268 ±5	6 ±2	60 ±3	137 ±4	55 ±3	nm	nm	nm	nm	45	West Sugarloaf, Coso Volcanic Field
EAFB 296, 5396	nm	nm	250 ±5	9 ±2	56 ±3	140 ±4	52 ±3	nm	nm	nm	nm	44	West Sugarloaf, Coso Volcanic Field
EAFB 296, 5397	nm	nm	235 ±5	6 ±2	55 ±3	122 ±4	52 ±3	nm	nm	nm	nm	45	West Sugarloaf, Coso Volcanic Field
EAFB 296, 5400	nm	nm	261 ±5	6 ±2	60 ±3	139 ±4	56 ±3	nm	nm	nm	1.22 ±.02	45	West Sugarloaf, Coso Volcanic Field
EAFB 383, 4819	nm	nm	270 ±5	6 ±2	60 ±3	137 ±4	55 ±3	4 ±17	nm	nm	nm	48	West Sugarloaf, Coso Volcanic Field
EAFB 400, 400-22	nm	nm	152 ±4	94 ±4	20 3	184 ±4	15 ±2	1001 ±24	nm	nm	nm	46	Lookout Mountain, Casa Diablo area
EAFB 400, 400-46	nm	nm	212 ±5	10 ±2	51 ±3	140 ±4	49 ±3	nm	nm	nm	nm	46	West Sugarloaf, Coso Volcanic Field
EAFB 616, 516-1	nm	nm	272 ±5	8 ±2	60 ±3	135 ±4	60 ±3	nm	nm	nm	nm	48	West Sugarloaf, Coso Volcanic Field
EAFB 713, 4024	nm	nm	262 ±5	8 ±2	58 ±3	136 ±4	56 ±3	19 ±16	nm	nm	1.26 ±.02	45	West Sugarloaf, Coso Volcanic Field
EAFB 857, 6836	nm	nm	231 ±5	11 ±2	53 ±3	140 ±4	50 ±3	nm	nm	nm	1.29 ±.02	47	West Sugarloaf, Coso Volcanic Field
EAFB 1225, 4823	nm	nm	247 ±5	6 ±2	55 ±3	126 ±4	54 ±3	nm	nm	nm	nm	48	West Sugarloaf, Coso Volcanic Field
EAFB 2021, 2021-2	nm	nm	270 ±6	6 ±2	60 ±3	138 ±4	55 ±3	nm	nm	nm	nm	47	West Sugarloaf, Coso Volcanic Field
EAFB 2021, 2021-13	nm	nm	268 ±6	11 ±2	60 ±3	134 ±4	56 ±3	nm	nm	nm	nm	45	West Sugarloaf, Coso Volcanic Field

Values in parts per million (ppm) except total iron (in weight percent) and Fe/Mn ratios; ± = two σ estimate (in ppm) of x-ray counting uncertainty and regression fitting error at 120-240 seconds livetime; nm = not measured.

Table 1

Quantitative Composition Estimates for Obsidian Artifacts from Sites Within Edwards Air Force Base, CA

Site/Cat. Number			Trace and Selected Minor Element Concentrations									Ratio	Obsidian Source
	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba	Ti	Mn	Fe₂O₃ᵀ	Fe/Mn	(Chemical Type)
EAFB 2021, 2021-22	nm	nm	260 ±5	8 ±2	61 ±3	140 ±4	55 ±3	nm	nm	nm	nm	47	West Sugarloaf, Coso Volcanic Field
EAFB 2021, 2021-27a	nm	nm	261 ±5	6 ±2	60 ±3	134 ±4	55 ±3	nm	nm	nm	nm	46	West Sugarloaf, Coso Volcanic Field
EAFB 2402, 2402-5	nm	nm	261 ±5	8 ±2	53 ±3	132 ±4	56 ±3	nm	nm	nm	1.21 ±.02	50	West Sugarloaf, Coso Volcanic Field
EAFB 2402, 2402-49	nm	nm	247 ±5	7 ±2	59 ±3	131 ±4	52 ±3	nm	nm	nm	nm	48	West Sugarloaf, Coso Volcanic Field
EAFB 2926, 10742	nm	nm	271 ±5	7 ±2	63 ±3	138 ±4	62 ±3	nm	nm	nm	nm	47	West Sugarloaf, Coso Volcanic Field
EAFB 4188, 4188-95	nm	nm	265 ±5	8 ±2	61 ±3	136 ±4	60 ±3	nm	nm	nm	1.27 ±.02	50	West Sugarloaf, Coso Volcanic Field
EAFB 4188, 4188-182	nm	nm	256 ±5	8 ±2	55 ±3	133 ±4	56 ±3	nm	nm	nm	nm	47	West Sugarloaf, Coso Volcanic Field
EAFB 4381, 10721	nm	nm	234 ±5	10 ±2	55 ±3	140 ±4	52 ±3	nm	nm	nm	1.23 ±.02	49	West Sugarloaf, Coso Volcanic Field
EAFB 4846, 10727	nm	nm	253 ±5	12 ±2	55 ±3	141 ±4	56 ±3	nm	nm	nm	nm	48	West Sugarloaf, Coso Volcanic Field
EAFB 4848, 10729	nm	nm	263 ±5	9 ±2	60 ±3	137 ±4	60 ±3	nm	nm	nm	1.29 ±.02	45	West Sugarloaf, Coso Volcanic Field
EAFB 4860, 10735	nm	nm	244 ±5	7 ±2	57 ±3	126 ±4	56 ±3	nm	nm	nm	nm	48	West Sugarloaf, Coso Volcanic Field
IF, 10716	nm	nm	270 ±5	8 ±2	53 ±3	131 ±4	50 ±3	nm	nm	nm	nm	47	West Sugarloaf, Coso Volcanic Field
U.S. Geological Survey Reference Standard													
RGM-1 (measured)	nm	nm	148 ±4	111 ±3	28 ±3	222 ±4	10 ±3	820 ±21	nm	nm	1.85 ±.02	63	Glass Mtn., CA
RGM-1 (recommended)	nm	nm	149	108	25	219	9	807	1600	279	1.86	nr	Glass Mtn., CA

Values in parts per million (ppm) except total iron (in weight percent) and Fe/Mn ratios; ± = two σ estimate (in ppm) of x-ray counting uncertainty and regression fitting error at 120-240 seconds livetime; nm = not measured.

ORIGER'S OBSIDIAN LABORATORY

P.O. BOX 1531
ROHNERT PARK, CALIFORNIA 94927
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ORIGER@ORIGER.COM

December 30, 2016

Richard Bark
California State University, San Bernardino
3026 Neary Court
Rosamond, California 93560

Dear Mr. Bark:

I write to report the results of obsidian hydration band analysis of 39 specimens from multiple sites within the Edwards Air Force Base in Kern County, California. This work was completed following source determination by Richard Hughes, Geochemical Research Laboratory, who forwarded the specimens to us on your behalf.

Procedures typically used by our lab for preparation of thin sections and measurement of hydration bands are described here. Specimens are examined to find two or more surfaces that will yield edges that will be perpendicular to the microslides when preparation of each thin section is done. Generally, two parallel cuts are made at an appropriate location along the edge of each specimen with a four-inch diameter circular saw blade mounted on a lapidary trimsaw. The cuts result in the isolation of small samples with a thickness of about one millimeter. The samples are removed from the specimens and mounted with Lakeside Cement onto etched glass micro-slides.

The thickness of the sample was reduced by manual grinding with a slurry of #600 silicon carbide abrasive on plate glass. Grinding was completed in two steps. The first grinding is stopped when the samples thickness is reduced by approximately one-half. This eliminates micro-flake scars created by the saw blade during the cutting process. The slide is then reheated, which liquefies the Lakeside Cement, and the sample is inverted. The newly exposed surfaces are then ground until proper thickness is attained.

Correct thin section thickness is determined by the "touch" technique. A finger is rubbed across the slide, onto the sample, and the difference (sample thickness) is "felt." The second technique used to arrive at proper thin section thickness is the "transparency" test where the micro-slide is held up to a strong source of light and the translucency of each sample is observed. The sample is reduced enough when it readily allows the passage of light. A cover glass is affixed over the sample when grinding is completed. The slide and paperwork are on file at the offices of Origer's Obsidian Laboratory under File No. OOL-1033.

The hydration bands were measured with a strainfree 60-power objective and a Bausch and Lomb 12.5-power filar micrometer eyepiece mounted on a Nikon Labophot-Pol polarizing microscope. Hydration band measurements have a range of $\pm$ 0.2 microns due to normal equipment limitations. Six measurements are taken at several locations along the edge of the thin section, and the mean of the measurements are calculated and listed on the enclosed data pages.

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Four specimens failed to yield hydration band measurements. Two of the four specimens (Lab Nos. 24 and 33) were marked by diffuse hydration (DH), and one (Lab No. 33) had weathered surfaces. One of the four specimens (Lab No. 32) was marked by no visible band (NVB), and it also had weathered surfaces. The last of the four specimens (Lab No. 36) was marked by hydration of variable width (VW) and weathered surfaces. The remaining 35 specimens yielded normal hydration band measurements.

Do not hesitate to contact me with any questions.

Sincerely,

Thomas M. Origer
Director

Site	Lab#	Sample#	Description	Unit	Depth	Remarks	Measurements	Mean	Source
CA-KER-1161	1	5396	Debitage			Weathered	10.1 10.2 10.2 10.3 10.5 10.5	10.3	
CA-KER-1161	2.1	5397	Debitage			Band 1; Weathered	9.5 9.5 9.6 9.8 9.9 9.9	9.7	
CA-KER-1161	2.2	5397	Debitage			Band 2; Crack	14.3 14.3 14.4 14.4 14.4 14.6	14.4	
CA-KER-1161	3	5400	Debitage				10.6 10.7 10.7 10.9 10.9 11.0	10.8	
CA-KER-1881	4	4819	Debitage		Surface		6.7 6.7 6.7 6.7 6.8 7.0	6.8	
CA-KER-1881	5	4820	Debitage		Surface	Weathered	8.6 8.6 8.7 8.8 8.9 9.1	8.8	
CA-KER-2154	6	6836	Debitage		Surface	Weathered	8.0 8.1 8.3 8.4 8.4 8.6	8.3	
CA-KER-3273	7	4823	Debitage		Surface		4.7 4.7 4.7 4.8 4.9 5.0	4.8	
CA-LAN-716/H	8	10818	Debitage		Surface		4.7 4.8 4.8 4.8 4.9 5.0	4.8	
CA-LAN-716/H	9	10819	Debitage		Surface		6.2 6.2 6.3 6.4 6.4 6.4	6.3	
CA-LAN-1189/H	10	400-22	Biface Frag.	121	0-5		7.0 7.0 7.2 7.3 7.3 7.5	7.2	
CA-LAN-1189/H	11	400-46	Projectile Point Frag.		Surface		5.8 5.8 6.0 6.0 6.1 6.2	6.0	
CA-LAN-1307	12	616-01	Projectile Point		Surface		3.5 3.6 3.6 3.6 3.6 3.6	3.6	
CA-LAN-1465	13	4024	Debitage		Surface	Weathered	9.3 9.3 9.5 9.6 9.8 9.8	9.6	
CA-LAN-1465	14	1 (559-1)	Debitage		Surface	Weathered	8.8 8.8 9.0 9.1 9.2 9.2	9.0	
CA-LAN-1465	15	2 (2021-2)	Debitage		Surface	Weathered	7.4 7.4 7.4 7.5 7.6 7.8	7.5	
CA-LAN-1465	16	5 (2402-5)	Debitage		Surface		4.8 4.9 5.0 5.0 5.1 5.1	5.0	
CA-LAN-1465	17	5 (426-5)	Debitage		Surface		6.8 6.9 6.9 7.0 7.2 7.2	7.0	
CA-LAN-1465	18	12 (559-12)	Debitage	ST A			4.4 4.5 4.5 4.5 4.7 4.7	4.6	
CA-LAN-1465	19	13 (2021-13)	Debitage		Surface	Weathered	8.9 9.1 9.2 9.4 9.5	9.2	
CA-LAN-1465	20	22 (2021-22)	Debitage		Surface	Weathered	9.4 9.5 9.6 9.8 9.9	9.6	
CA-LAN-1465	21	27A (2021-27)	Debitage	ST 2		Weathered	9.6 9.8 9.8 9.9 10.1	9.8	
CA-LAN-1465	22	40 (236-40)	Debitage	TU 2		Weathered	10.9 11.0 11.0 11.2 11.3 11.5	11.2	
CA-LAN-1465	23	46 (2402-49)	Debitage		Surface		6.4 6.4 6.6 6.7 6.7	6.5	

DH = Diffuse Hydration

NVB = No Visible Band

VW = Variable Width

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Site	Lab#	Sample#	Description	Unit	Depth	Remarks	Measurements	Mean	Source
CA-LAN-1465	24	55 (236-55)	Debitage	SS 1				DH	
CA-LAN-1465	25	66 (236-66)	Debitage	SS 1			11.7 11.7 11.9 12.0 12.2 12.3	12.0	
CA-LAN-1465	26	95 (4188-95)	Debitage		Surface	Weathered	7.8 7.9 8.0 8.2 8.2 8.4	8.1	
CA-LAN-1465	27.1	98 (2402-98)	Debitage		Surface	Band 1	8.8 8.8 8.8 8.9 9.1 9.2	8.9	
CA-LAN-1465	27.2	98 (2402-98)	Debitage		Surface	Band 2: Weathered	9.8 9.9 9.9 10.0 10.1 10.3	10.0	
CA-LAN-1465	28	119 (2402-119)	Debitage		Surface	Weathered	11.6 11.6 11.7 11.8 11.9 12.0	11.8	
CA-LAN-1465	29	172 (4188-172)	Debitage		Surface		6.6 6.7 6.7 6.8 7.0 7.0	6.8	
CA-LAN-1465	30	182 (4188-182)	Debitage	ST 6			7.5 7.6 7.6 7.8 7.9 7.9	7.7	
CA-LAN-1465	31	183 (2402-183)	Debitage		Surface	Not Obsidian	-	-	
CA-LAN-1465	32	10691	Debitage	STP 12	Surface	Weathered		NVB	
CA-LAN-1465	33	10716	Debitage		Surface	Weathered		DH	
CA-LAN-1465	34	10721	Tool	STP 13	Surface		14.6 14.7 14.7 14.9 15.0 15.2	14.9	
CA-LAN-1465	35	10727	Projectile Point	STP 13	Surface	Weathered	11.7 11.7 11.8 11.9 12.0 12.2	11.9	
CA-LAN-1465	36	10729	Debitage	STP 13	Surface	Weathered		VW	
CA-LAN-1465	37	10735	Debitage		Surface		8.0 8.0 8.0 8.1 8.2 8.4	8.1	
CA-LAN-1465	38	10738	Biface Frag.		Surface		6.2 6.2 6.3 6.3 6.3 6.4	6.3	
CA-LAN-1465	39	10742	Projectile Point	TU 1	Surface		4.8 4.8 4.9 5.0 5.1 5.1	5.0	
CA-LAN-1465	40	27B (2021-27)	Debitage	ST 2		Weathered	4.4 4.5 4.5 4.7 4.7 4.7	4.6	

Lab Accession No: OOL-1033

Technician: Thomas M. Origer

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DH = Diffuse Hydration

NVB = No Visible Band

VW = Variable Width

SOURCE ANALYSIS CONDUCTED BY JIMMY DANIELS

ID	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Predicted	Probability	Other Possible Source
1000-735	1021.58	12845.56	93.41	398.71	11.08	68.77	188.22	66.72	W Cactus Peak	1	
1040-12	838.38	9508.57	44.97	325.79	5.27	63.46	163.35	60.03	W Cactus Peak	1	
1040-13	1050.88	11648.75	60.04	362.22	7.89	64.37	168.54	64.5	W Cactus Peak	1	
1040-14	815.71	10090.58	57.48	324	5.39	60.26	167.15	56.91	W Cactus Peak	1	
1040-15	778.65	9541.18	57.33	318.59	4.65	58.58	155.04	56.75	W Cactus Peak	1	
1040-51	568.92	8603.29	52.72	247.2	8.14	49.97	165.2	47.73	West Sugarloaf	1	
1065-69	513.89	9404.85	43.12	298.54	4.05	57.27	145.07	54.93	W Cactus Peak	1	
1105-1	1	8594.84	55.7	301.03	5.25	59.58	150.84	55.26	W Cactus Peak	1	
1121-15	950.39	11165.82	69.48	360.42	7.5	65.38	168.24	61.99	W Cactus Peak	1	
1121-7	682.51	10244.89	47.84	303.34	6.5	58.42	164.13	54.42	W Cactus Peak	1	
1147-1	910.17	11016.44	66.24	362.81	6.54	67.1	171.47	61.25	W Cactus Peak	1	
1147-2	1	7967.38	48.47	279.01	3.38	58.46	148.07	54.95	W Cactus Peak	1	
1147-28	1	7733.5	34.7	200.6	141.37	17.52	134.26	25.14	Bristol Mountains	1	
1147-4	1350.62	17700.98	96.17	461.2	10.59	74.46	192.21	73.42	W Cactus Peak	1	
1147-51	675.99	10877.5	59.19	281.37	8.59	53.79	165.27	50.92	W Cactus Peak	0.5242	West Sugarloaf 0.48
1534-10	963.13	11524.01	74.74	342.49	9.65	63.75	178.3	64.78	W Cactus Peak	1	
1534-23	959.68	10080.93	46.66	342.83	9.81	61.09	168.4	65	W Cactus Peak	1	
1534-32	1203.23	17697.25	103.76	427.2	12.67	64.76	204.68	71.11	W Cactus Peak	1	
1828-28	586.2	10657.72	22.49	236.23	45.14	39.12	183.14	30.91	Sugarloaf Mtn	0.7674	West Sugarloaf 0.23
1831-158	972.43	10992.29	72.05	367.79	7.05	65	167.32	66.72	W Cactus Peak	1	
1870-16	1075.25	14265.15	75.69	359.08	8.37	66.82	171.59	60.58	W Cactus Peak	1	
1875-4	946.99	11322.67	57.3	363.78	5.74	67.34	170.81	66.72	W Cactus Peak	1	
1882-2	842.83	10682.15	62.41	321.39	8.84	57.87	172.33	56.32	W Cactus Peak	1	
1885-11	1	9646.51	43.38	300.03	5.01	58.41	158.78	54.79	W Cactus Peak	1	
1900-1	1099.31	15646.68	84.69	452.54	10.89	71.11	192.32	70.82	W Cactus Peak	1	
1905-6	1	8443.5	45.55	292.59	4.6	56.56	148.29	56.03	W Cactus Peak	1	
191-732	779.58	9110.15	50.21	322.53	4.01	60.19	160.8	58.54	W Cactus Peak	1	
191-733	999.91	11849.42	58.02	376.43	8.91	67.05	180.92	64.26	W Cactus Peak	1	
1948-2	1041.49	13015.1	79.39	400.6	8.91	72.79	180.12	68.28	W Cactus Peak	1	
1950-1	1081.12	11179.02	58.76	312.56	4.46	59.32	143.34	55.06	W Cactus Peak	1	
1991-11	842.2	10997.24	53.61	353.69	8.38	69.7	173.89	68.27	W Cactus Peak	1	
1991-12	822.52	10233.62	48.09	300.33	10.16	60.03	177.75	55.3	W Cactus Peak	1	
1991-14	532	9181.47	45.46	284.48	6.67	52.76	158.11	52.78	W Cactus Peak	0.9997	
1991-16	964.17	11777.93	66.76	397.49	8.35	65.54	179.2	67.14	W Cactus Peak	1	
1991-2	669.29	9730.13	51.3	316.27	6.86	58.12	169.95	58.3	W Cactus Peak	1	

ID	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Predicted	Probability	Other Possible Source
1991-22	896.26	10214.74	39.16	349.87	7.15	60.21	166.99	63.25	W Cactus Peak	1	
1991-222	1047.64	11635.01	55.39	363.08	8.52	68.83	176.15	62.91	W Cactus Peak	1	
1991-224	1095.7	12796.38	72.54	339.33	11.5	64.87	192.13	62.02	W Cactus Peak	1	
1991-3	866.65	9347.27	50.74	342.92	6.64	62.26	164.42	58.48	W Cactus Peak	1	
1991-5	972.91	10469.66	60.63	365.82	7.2	71.96	592.47	63.89	W Cactus Peak	1	
1991-7	1053.98	11620	60.25	318.19	9.52	64.59	178.62	58.14	W Cactus Peak	1	
1991-9	1147.45	15235.41	80.34	408.43	11.86	65.5	201.48	70.17	W Cactus Peak	1	
1993-22	778.47	10234.64	64.41	317.76	6.65	60.84	161	56.86	W Cactus Peak	1	
1996-26	574.38	10169.13	52.38	306.05	6.11	59.64	154.42	56.93	W Cactus Peak	1	
201-2009	774.94	9755.51	46.76	334.93	4.72	62.94	159.76	56.65	W Cactus Peak	1	
201-2022	1	7436.96	42.26	271.04	4.2	57.83	145.41	50.09	West Sugarloaf	0.9998	
201-2028	846.98	9847.08	58.74	336.92	5.16	63.94	162.61	62.04	W Cactus Peak	1	
201-2044	712.69	9405.61	60.17	291.46	6.33	53.77	162.13	53.16	W Cactus Peak	1	
201-2050	1066.35	13422.05	56.86	415.13	8.35	71.35	216.44	69.3	W Cactus Peak	1	
201-731	1	8386.83	47.7	224.42	9.63	46.14	163.92	44.05	West Sugarloaf	0.8879	Sugarloaf Mtn 0.11
240-113	824.19	11396.88	61.11	372.89	6.08	62.37	167.71	66.81	W Cactus Peak	1	
240-262	865.14	10893.8	76.94	375.56	7.89	65.65	172.82	63.55	W Cactus Peak	1	
240-320	1081.86	17436.61	105.62	459.69	10.92	71.36	196.74	74.83	W Cactus Peak	1	
240-329	1015.28	10524.88	49.54	347.2	6.19	66.84	163.58	61.95	W Cactus Peak	1	
240-41	1135.33	13264.63	90.71	402.91	10.18	66.97	176.63	70.75	W Cactus Peak	1	
240-64	591.99	7035.4	31.54	248.08	1	47.16	109.56	47.7	West Sugarloaf	0.9997	
2776-1	1018.7	10300.94	60.2	321.82	4.6	58.51	141.23	55.64	W Cactus Peak	1	
2776-15	921.27	9954.89	54.32	318.81	5.19	62.72	138.11	58.89	W Cactus Peak	1	
2776-2	580.14	9425.66	56.84	311.27	4.5	64.68	160.29	54.35	W Cactus Peak	1	
2777-12	950.08	9465.67	60.87	341.09	5.87	69.69	167.02	61.66	W Cactus Peak	1	
2777-12	937.38	11232.64	75.88	372.58	6.76	65.14	175.44	67.82	W Cactus Peak	1	
2777-14	921.41	10913.19	81.21	367.88	7.52	65.05	170.04	66.44	W Cactus Peak	1	
2777-17a	1	9563.51	60	296.98	5.45	51.89	146.18	53.91	W Cactus Peak	1	
2777-17b	817.45	9887.49	42.12	329.94	4.38	59.34	161.42	59.65	W Cactus Peak	1	
2777-23	851.73	9883.39	69.08	332.92	5.68	63.93	163.32	61.72	W Cactus Peak	1	
2777-6	1011.42	9813.9	45.58	335.25	3.46	64.13	209.69	62.12	W Cactus Peak	1	
2777-7	877.27	12326.75	71.46	356.27	8.25	61.13	171.81	65.86	W Cactus Peak	1	
2777-8	709.32	9335.71	53.43	319.06	5.21	62.28	160.18	56.81	W Cactus Peak	1	
288-27	816.38	9822.52	54	334.63	7.15	61.08	158.09	61.09	W Cactus Peak	1	
288-3	968.58	11683.15	60.03	376.54	6.85	70.52	180.01	65.24	W Cactus Peak	1	

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ID	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Predicted	Probability	Other Possible Source
288-5	1	9934.63	61.26	308.93	3.87	61.06	152.48	53.62	W Cactus Peak	1	
288-6	1094.77	16569.02	105.82	426.3	13.16	63.42	194.94	66.57	W Cactus Peak	1	
288-7	1	8923.38	40.34	287.66	5.58	56.35	146.34	52.67	W Cactus Peak	0.9993	
288-8	747.44	10872.04	60.65	354.17	6.59	63.52	175.12	63.97	W Cactus Peak	1	
303-IF	919.92	11448.23	62.96	371.22	8.46	66.3	177.59	66.02	W Cactus Peak	1	
3109-3	1	8429.52	47.63	291.37	5.32	57.43	146.12	51.4	W Cactus Peak	0.9395	
3122-4	523.24	11420.92	74.17	358.27	6.14	61.83	171.03	60.36	W Cactus Peak	1	
3122-6	1	7129.61	47.95	278.1	3.89	53.52	144.58	53.35	W Cactus Peak	0.9995	
327-IF	740.79	10147.44	57.44	328.02	5.19	58.76	159.64	60.15	W Cactus Peak	1	
3283-18	497.61	11293.92	222.39	348.99	5.93	65.21	171.1	58.82	W Cactus Peak	1	
333-947	640.86	9163.99	52.73	260.32	10.29	51.4	184.1	50.45	West Sugarloaf	0.9978	
333-948	868.31	10989.45	54.24	282.92	11.1	56.67	193.33	52.64	W Cactus Peak	0.9997	
333-950	975.55	12092.02	74.1	374.06	7.62	60.43	172.83	64.5	W Cactus Peak	1	
393-123	1160.24	14800.78	71.44	427.17	11.18	66.73	178.36	72.78	W Cactus Peak	1	
393-124	646.6	7985.05	47.49	291.68	4.06	59.16	150.61	54.37	W Cactus Peak	1	
393-126	1	11242.29	60.8	230.08	6.93	50.68	170.38	43.09	West Sugarloaf	0.9899	
393-130	790.54	8037.1	31.41	290.5	1	52.91	125.92	53.36	W Cactus Peak	0.9999	
393-93	672.29	10209.57	52.78	318.13	7.98	59.44	176.24	58.94	W Cactus Peak	1	
401-81	1242.91	17386.97	94.58	342.92	14.27	57.57	206.92	55.73	W Cactus Peak	1	
401-85	1	6672.58	41.23	276.11	4.77	56.88	148.54	53.23	W Cactus Peak	0.9982	
401-86	1	8229.36	41.05	222.75	5.8	46.22	181.93	41.15	West Sugarloaf	0.716	Sugarloaf Mtn 0.28
418-IF	1079.74	9000.5	45.56	317.7	5.63	63.02	160.02	58.59	W Cactus Peak	1	
423-1016	1032.55	10430.04	63.05	370.57	5.54	60.84	170.71	68.71	W Cactus Peak	1	
423-1017	1552.64	7141.87	47.1	230.57	18.7	26.67	157.15	50.6	Fish Springs	1	
423-172	728.42	9855.22	51.15	332.98	5.2	58.19	158.96	60.64	W Cactus Peak	1	
423-267	1117.31	12163.04	67.96	346.27	11.82	62.58	185.23	60.86	W Cactus Peak	1	
423-276	820.65	9349.79	44.85	266.3	5.78	51.09	117.19	48.1	West Sugarloaf	1	
423-279	1	6733.07	31.51	280.97	4.55	55.98	146.43	54.41	W Cactus Peak	1	
423-291	798.64	9746.77	58.45	336.51	5.21	59.75	159.63	61.58	W Cactus Peak	1	
423-294	687.36	194.95	1	1	36.42	1	2.97	4.1	Casa Diablo Lookout Mtn	1	
423-332	2310.8	12728.3	116.43	304.14	29.14	30.17	186.9	60.24	W Cactus Peak	1	
423-342	728.72	9867.91	51.06	305.91	6.06	57.5	152.37	56.88	W Cactus Peak	1	
423-841	1216.95	19589.95	56.51	261.2	131.26	20.04	250.91	29.54	Bristol Mountains	1	
423-920	732.86	9006.31	48.2	332.02	6.89	65.59	162.84	64.94	W Cactus Peak	1	
715-IF	979.04	9517.34	79.3	398.52	1	79.39	136.17	88.44	W Cactus Peak	1	

ID	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Predicted	Probability	Other Possible Source
717-IF	683.62	9323.9	61.01	307.21	6.16	61.58	156.83	55.68	W Cactus Peak	1	
718-IF	698.68	10235.22	46.92	326	5.78	58.72	156.41	60.46	W Cactus Peak	1	
720-IF	790.32	12794.23	79.17	375.35	7.25	64.46	177.99	68.23	W Cactus Peak	1	
721-IF	865.19	10322.62	63.2	354.41	6.39	66.51	165.47	62.56	W Cactus Peak	1	
724-IF	1	8619.45	50.33	295.77	6.36	54.82	151	56.49	W Cactus Peak	1	
725-IF	752.51	9799.09	65.54	318.57	2.64	54.14	130.73	57.53	W Cactus Peak	1	
726-IF	835.25	9883.22	63.52	325.15	4.23	62.64	162.01	60.29	W Cactus Peak	1	
727-IF	813.77	10131.33	54.33	345.38	6.3	55.39	163.42	63.26	W Cactus Peak	1	
827-IF	720.97	8841.58	59.2	319.92	5.06	58.54	166.26	57.94	W Cactus Peak	1	
832-IF	768.89	10589.71	63.77	326.79	4.66	65.96	166.17	56.57	W Cactus Peak	1	
920-2	760.7	10089.13	54.38	336.23	5.43	66.37	170.01	61.08	W Cactus Peak	1	
921-51	1025.53	11527.9	55.36	370.93	8.64	62.69	170.83	64.68	W Cactus Peak	1	
921-54	893.45	12628.82	64.88	371.29	7.19	70.03	175.58	66.3	W Cactus Peak	1	
921-54b	1214.82	20808.92	99.16	332.82	25.31	83.11	247.83	59.57	W Cactus Peak	1	

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