Fingerprints in The Great Basin

The Nellis Air Force Base
Regional Obsidian Sourcing Study

Fingerprints In The Great Basin:
The Nellis Air Force Base
Regional Obsidian Sourcing Study

by

Lynn Haarklau
Lynn Johnson
and
David L. Wagner

with contributions by

Richard E. Hughes
Craig E. Skinner
Jennifer J. Thatcher
and
Keith Myhrer

January 2005

Cover Illustration:
Design: Sandra L. Hannum
Background: Southwest face of Obsidian Butte, Nevada. Photo courtesy of Lynn Haarklau.
Insert: Detail of Ishi manufacturing an Obsidian hunting point, from *Hunting with a Bow and Arrow* by S. T. Pope, page 34, Sylvan Toxophilite Classics, 2000.

Research and publication of this book were funded
by the U.S. Army Corps of Engineers, Fort Worth District,
under contract DACA63-00-D-0006.

Printed in the United States of America
at Morgan Printing, Austin, Texas.
January 2005

TABLE OF CONTENTS

CHAPTER 6: RESULTS OF THE REGIONAL OBSIDIAN PROJECTILE POINT SOURCING STUDY

CHAPTER 7: SUMMARY AND RECOMMENDATIONS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

We are deeply indebted to a number of people who provided fundamental support throughout the project. Dr. Paul Green, ACC Cultural Resources Program Manager; Ms. Eloisa Hopper, Chief Environmental Flight, 99 CES; and Ms. Deborah Stockdale, Chief Cultural/Natural Resources Division, 99 CES/CEV, recognized the value of this study for both the Air Force and regional archaeologists. LtCol (Ret) Rick Scarine, TSgt Rich Blomquist, and Mr. Roger Schoffield, 98 RANW/XPL, provided access to the study area and enthusiastically participated in field research. Ms. Deborah Miller, Arcata Corporation, “translated” geological data, producing GIS maps that guided us during our aerial reconnaissance. As always, D. J. Haarklau, security escort, endured many lengthy field days, interminable archaeology debates, and remains the champion “biggest obsidian nodule” discoverer.

In addition to contract management, Jay Newman, U.S. Army Corps of Engineers, provided obsidian lore, which contributed to maintaining enthusiasm during the study’s longest hours. Karen Gardner, vice-president of Prewitt and Associates,Inc., kept the research road well-lit. Helicopter pilots Tom Schaus and John Seward, Sundance Helicopters, safely navigated the airways, carrying us to the most remote of obsidian outcrops, patiently waiting while we hiked the canyons stalking obsidian. Lalovi Miller, *Moapa* Paiute Band, and Joe Kennedy, *Timbisha* Shoshone Tribe, the Native American project monitors, provided insightful environmental observations and cultural and historical anecdotes during field research.

Several overtaxed regional cultural resources professionals graciously took the time to make available their obsidian artifact collections. Thank you Melanie Spoo, Joshua Tree National Park; Blair Davenport, Death Valley National Park; Jean Hengesbaugh, Kathy Kankainen, and Andy Yentch of the Utah Museum of Natural History, University of Utah; Barbara Frank, Southern Utah University; Kenny Wintch, State of Utah School and Institutional Trust Administration; Lorann Pendleton Thomas and Matt Sanger of the American Museum of Natural History; Lisa Dietz, University of California, Davis; Alanah Woody, Nevada State Museum, Carson City; and Dave Rhode, Desert Research Institute, Reno. Great appreciation for providing critical site data go to Susan Rigby, BLM Tonopah Field Station; Kellie Green, U.S. Forest Service Tonopah District; Susan Murphy, Harry Reid Center for Environmental Studies, UNLV, and Mark Henderson, BLM Ely Field Office. It is through the help of all of you that we were able to meet our research objectives.

We would like to thank Brian Hausback, Professor of Geology, California State University, Sacramento, for providing unpublished geologic maps and aerial photographs of the Tolicha Peak 15-minute quadrangle, as well as sharing his knowledge of the Obsidian Butte area.

To Jane Sevier, Prewitt and Associates, who enthusiastically embraced the task of editing and formatting the final document, we are grateful to you for tidying up our prose and making this document look a lot better. To Sandy Hannum, Prewitt and Associates, thank you for your creativity and patience in designing the cover for us. And finally, we greatly appreciate all of the Nellis AFB Native American Program participants who have shared so much of their knowledge with us through the years. We have been quite privileged to have been educated by you.

Thank you all for contributing to the success of this research.

GLOSSARY

Alluvium:	Unconsolidated gravel, sand, silt, and clay deposited in basins and lowlands.
Apache Tear:	Name given to pebbles and nodules of obsidian; also called marekanite.
Aphyric:	A texture in volcanic rocks characterized by a fine-grained groundmass with no phenocryts.
Archaeometry:	An archaeological discipline that applies chemical or other analytical techniques to determine the age or source of artifacts.
Ash-flow tuff:	A volcanic rock composed of ash-sized particles that emplaced from an airborne, hot ash cloud.
Bishop Tuff:	A ash-flow tuff erupted from the Long Valley Caldera about 760,000 years ago.
Comendite:	A volcanic rock, usually rhyolitic, in which the alumina content is slightly higher than the alkali content.
Great Basin:	An area of the western United States that does not have any drainage outlet to the ocean. It was bounded on the west by the Sierra Nevada and on the east by the Wasatch Front and the Colorado Plateau.
Ignimbrite:	A class of volcanic rock that was erupted into the atmosphere and later settles on the earth's surface.
Lava:	Molten rock that was erupted in the earth's surface.
Lithic:	Refers to rock fragments occurring as sedimentary or volcanic rocks.
Ma:	*Mega annum*, synonym for millions of years ago.
Magma:	Molten rock beneath the surface of the earth.
Magma chamber:	A body of magma surrounded by rock.
Magmatism:	Refers to the formation and movement of magma.
Marekanite:	Obsidian pebbles or nodules; also called Apache Tears.
Obsidian:	A silicic volcanic glass.
Perlite:	Hydrated volcanic glass characterized by spheroidal texture.
Phenocryst:	Crystals in igneous rocks that can be easily seen without magnification that are set in a finer-grained matrix or groundmass.
Rhyolite:	A volcanic rock composed of quartz and feldspar that is greater then 69 percent SiO_2 by weight.
Syenite:	A crystalline rock composed mostly of feldspar. Similar to granite except that is very poor in silica so there is no quartz present.
Vitrophyre:	A glassy zone in silicic lava or ash-flow tuff caused by welding or compaction. Usually the glass is hydrated to form pitchstone, a black crumbly material.
Volcanic center:	An area of volcanic activity where magma has been erupted.

PURPOSE AND RESEARCH DESIGN

1

Keith Myhrer and Lynn Haarklau

THE NELLIS MISSION

Nellis Air Force Base (Nellis AFB), assigned to the Air Combat Command (ACC) of the United States Air Force, manages 3 million acres of withdrawn land for fighter pilot graduate training on the Nevada Test and Training Range (NTTR). Adjoining NTTR are 1.5 million acres of the Nevada Test Site (NTS), the location of under- and above-ground nuclear testing. The Nellis AFB and NTS cultural resources programs share scientific efforts to enhance management of similar landscapes. The massive land base is larger than most eastern states. The dominating purpose of all Nellis AFB cultural resources projects is to assist in accomplishing *mission* objectives. Training fighter pilots is the *mission,* and the process involves constructing targets and associated facilities in zones that are primarily situated in valley bottoms and on or adjoining dry lakes.

Results from 10 percent sample inventories of 750,000 acres in 1979, 1998, 1999, and 2000 indicate that the target zones have the lowest potential for locating complex sites that show multi-use activities, and the seven mountain ranges and canyon systems, areas with least potential for the presence of complex sites, have the highest potential. The mountain and canyon areas are used minimally for pilot training, and with restricted access to all NTTR lands for safety and security, the properties are protected. Because 90 percent of the targets are reconstructed without new surface disturbance, Nellis AFB staff met compliance Section 106 for 75 percent of new federal actions. Most funding was and continues to be invested in methods to characterize the archaeological and cultural nature of all NTTR lands, addressing the Section 110 identification and preservation objectives that include scientific research to assist in evaluating significance.

OBSIDIAN SOURCING AND THE MISSION

The responsibility to conduct scientific research on federal lands is mandated in several federal laws, including the American Antiquities Act of 1906 and the National Historic Preservation Act (NHPA) of 1966. Studies are costly, and taxpayers and the Congress limit the funds available for all programs, including cultural resources. In most federal agencies, archaeology compliance inventory, required under Section 106 of NHPA for all federal actions, is the only type of research afforded. Section 106 consultation allows federal entities to consult with State Historic Preservation Officer (SHPO) to determine applicable levels of inventory for differing project types and areas. SHPOs generally encourage sampling methods. Where a particular site type is common in a region and a sufficient amount of research is completed to justify the concept of *redundancy*, SHPO and the Air Force can agree to justify a reduction of field work for that type site in that area. This reduction could save funds that may be redirected into sampling research in areas that are not proposed for surface disturbance.

During compliance inventories in the Tolicha Peak area of the north NTTR, Lynn Haarklau, Nellis assistant archaeologist, noted substantial work was invested in recording sites—obsidian flake scatters with no diagnostics—that she believed were similar in morphology. In 1999, Haarklau (2001) proposed a scientific test to determine if the flake scatters were created from

Obsidian Butte raw material and the obsidian raw material was procured when people obtained food resources, such as Indian ricegrass, on Pahute Mesa. If so, recording and evaluation efforts for this site type could be reduced, saving time and funds. Nellis AFB contracted Richard Hughes of Geochemical Research Laboratory to assist Haarklau in collecting and evaluating raw material and artifacts. Native Americans participated in fieldwork. Study results supported Haarklau's (2001) proposition, and Nellis AFB submitted the documentation to the Nevada SHPO with a request for concurrence on reducing efforts for the site type at Tolicha Peak. The SHPO concurred on 28 September 1999 with a request for a programmatic agreement (PA).

To support the work involved in developing a PA, Nellis AFB determined that the area of research should be expanded for the entire north NTTR, 2 million acres, a region of intense volcanism. In 2000, the Air Force funded a large-scale scientific investigation of obsidian and its human associations on 2 million acres on the NTTR, the largest study done in terms of acreage and numbers of artifacts analyzed.

THE AIR FORCE AND CULTURAL RESOURCES

Americans have placed high values on scientific, Native American, and preservation studies. Since 1906, 10 federal laws, executive orders, and memoranda have been passed to address these issues. Euro-Americans occupied the NTTR region comparatively late. Prime reasons for the delay of historic intrusion include the scarcity of water sources and relatively rough geographic conditions that inhibited development of routes such as the Old Spanish Trail (Myhrer et al. 1990) that was 25 to 125 miles east of the NTTR borders. Since the 1940s, NTTR commanders have restricted public use of NTTR. Thus, this portion of the southern Great Basin and Eastern Mojave Desert was protected from disturbances common to most regions in the United States. Because traditional Native American use continued on NTTR to the 1940s, the descendents of those who inhabited the region since the beginning of time lived on ancestral lands until recently.

In 1996, Nellis AFB initiated a Native American Interaction Program and compiled its Cultural Resources Management Plan (NAFB 1998) to integrate the objectives of archaeology, Native American interests, and ethnography. Beginning in 1997, Nellis AFB incorporated Native Americans on all archaeology projects, including composing archaeology document chapters, and are escorted to ancestral areas on the NTTR, a region restricted from their access for 50 years. Ethnographers also use archaeology data to assist in interpretations in Native American research.

In the mid-1990s, ACC established goals not only for a perfect compliance record but also an increased level of scientific research. Thus, additional funds for all environmental programs were directed in a discretionary manner into the cultural resource programs at its 23 bases. Nellis AFB committed to increasing its research under Section 110 of NHPA, in which efforts must be taken to identify, study, and preserve significant resources on all lands. Nellis AFB also initiated a Native American Program in 1996 as a foundation for government-to-government consultation, guided by Executive Order 13007. The order requires consultation but does not provide direction on the methods to achieve that goal or on when the level is adequate. Thus, Nellis AFB conducts routine discussions between tribal members and Air Force officials to determine the level of efforts that, year-by-year will realistically address changing degrees for consultation. Compared to regional federal agencies and military institutions, Nellis AFB's commitments to Native American consultation are substantially higher. The Air Force anticipates incorporating Native American methods to increase the effectiveness of environmental management.

RESEARCH THEMES AND OBJECTIVES

The objectives and questions that guide the north NTTR 2-million-acre obsidian study have a scientific and cultural basis. Locating obsidian procurement areas, which are prolific on Pahute Mesa, an area used intensively by the Air Force for mission activities, will address Section 110 of the NHPA. Studying the distribution of Great Basin artifacts manufactured from the NTTR obsidians will assist cultural resource management Section 106 issues by determining the regional significance of these sources. The study could also be considered analogous to contemporary military studies and planning. Rural areas of modern countries appear to share some networking attributes with ethnohistoric southern Great Basin peoples. Their primary mode of travel is walking, people live in settlements that overlap in economic and cultural settings, and even without possessing the technology for rapid communication, they developed efficient systems to coordinate activities among individuals and families. Figure 1.1 provides a geologic time scale for placing report data in context.

Research Theme One: Defining the Obsidian Resource Base of the NTTR. The foundation of this research is the analysis of obsidian artifacts. *How do researchers determine the locations where raw materials were removed that resulted in manufacture of tools?* The study of the geologic properties of obsidian yields information on the culture of the Great Basin inhabitants. Locating, mapping, and sampling obsidian sources and geochemically analyzing obsidian source samples determine the locations where raw materials that people used to form tools were procured. These data can be used to interpret the places and distances that people traveled in past millennia and the exchange systems that linked cultural groups.

A large portion of the Southwestern Nevada Volcanic Field (Noble et al. 1991) is situated in the north NTTR. Of note is the Obsidian Butte Volcanic Center source, which produced a relatively large amount of raw obsidian that is of excellent quality for the manufacture of tools. Previous research (Hughes 2001) on the south and east boundaries of the Obsidian Butte Volcanic Center source indicates the eruptive history of the landform is complex, resulting in the deposition of many obsidian outcrops on the western edge of Pahute Mesa. The study also indicated that other obsidian sources on and adjoining the NTTR that appear in NTTR artifact samples are virtually unknown. Thus, knowledge of the places where people procured

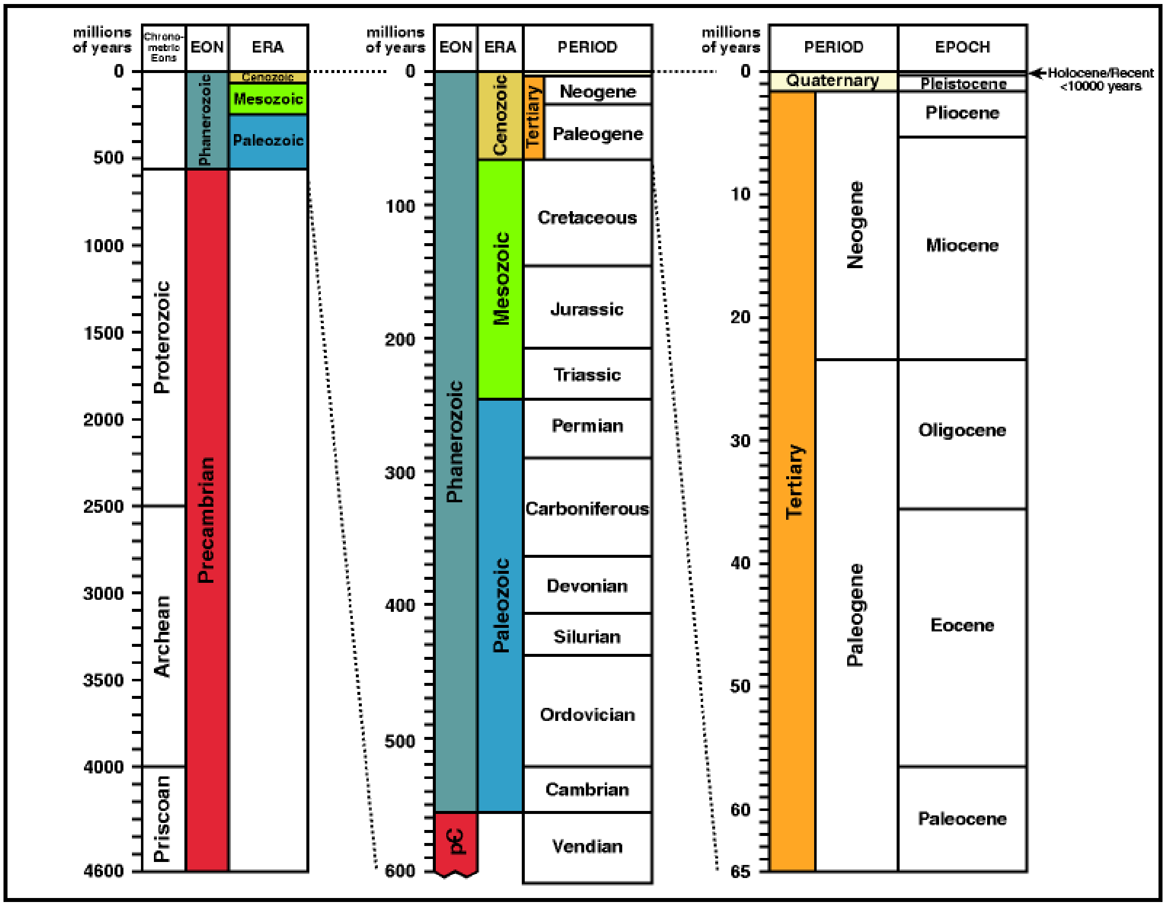


Figure 1.1. Geologic time scale showing geologic time nomenclature. From the University of Chicago.

obsidian is the foundation on which this study is built. Research theme one can be summarized with one question. *Where are the local sources from which prehistoric peoples using the NTTR procured their toolstone obsidian?*

Research Theme Two: Evaluating Steward's 1930s Field Research. Previous research (Haarklau 1999; 2001) indicates that procurement of obsidian toolstone was linked to food procurement among the indigenous NTTR peoples. They presumably would have maintained a population size commensurate with the amount of available food and were specialists in adjusting to minor changes in climate. The portion of the Great Basin under study was the homeland of the ethnohistoric Western Shoshone, Southern Paiute, and Northern Paiute peoples. During the 1930s, anthropologist Julian Steward conducted ethnographic reconnaissance among these Native Americans, whom he referred to collectively as the Basin-Plateau Peoples. He recorded a great deal of data derived from the collective memories of these Native Americans to reconstruct their lives before the socioeconomic and sociopolitical changes that occurred as a result of Western settlers populating the area (Steward 1997 [1938], 1941).

Assumptions: Steward's (1997 [1938], 1941) documentation of the subsistence travels, settlement patterns, and group interrelationships of the NTTR peoples are accurate; ethnohistoric Great Basin peoples of the NTTR used obsidian to manufacture chipped stone tools; NTTR ethnohistoric peoples procured obsidian raw material used to manufacture tools during their subsistence travels; some trade occurred during annual fall festivals; and obsidian was among the items exchanged during annual festivals. Scientific Method Question: if Steward's (1997 [1938], 1941) data are accurate, then the obsidian sources used by the NTTR peoples will be accurately predicted.

Research Theme Three: Obsidian Point Typologies. Assigning artifacts to general time periods in the Holocene has been a major goal for a century of archaeology. A variety of methods have been used to support particular typologies, including identifying changes in projectile point shapes in levels of buried deposits from cave sites. This is partly based on an assumption that the morphology of these tools evolved over 10,000 years within the Holocene Period in the Great Basin. Assuming evolutionary, broad-scaled regional change took place, the presence of specific point types within stratified archaeological sites would help construct a strong interpretive foundation. Assumptions for change include alterations in long-term cultural boundaries and environmental shifts that changed the desirability of resource areas that also included obsidian sources.

The general reasons offered for differing point shapes is changes in climate and food resources. *Assumption*: point morphologies reflect evolutionary changes over time. *Scientific method question*: if environmental or cultural shifts occurred during the Holocene, then there should be corresponding diachronic changes in access to obsidian sources. *Limitations*: the scope of this study does not focus on describing any environmental or cultural changes but rather seeks to associate point types by source locations and chronological assignments to identify patterns. Methods include obtaining sizable point samples from Great Basin regions that previous obsidian source research (Haarklau 2001) indicates were linked to the NTTR, subjecting the tools to one typology analysis, and associating these data with the sourcing data.

Research Theme Four: The Importance of Obsidian Butte and Other NTTR Sources. The Air Force and Native Americans perceive Obsidian Butte as having strategic and cultural values. Contemporary Native Americans identify the mountain as high in importance for its raw material. *Assumption: valued possessions, including stone tool material and tools, will be moved in an exchange network. The further the distance Obsidian Butte-derived artifacts are found from the mountain, the higher the value that was placed on that source.* Scientific method question: if Obsidian Butte artifacts are found in other zones where obsidian is available, then it may be considered to have a higher than normal level of importance. Analysis of the raw material and tools will provide the data to address the methods.

Chapters 2 and 3 address Research Theme One, defining the obsidian resource base. Chapter 2 focuses on the eruptive history and procurement localities of Obsidian Butte obsidians, and Chapter 3 describes other NTTR sources. Chapter 4 addresses Research Theme Two, Evaluating Steward's 1930s Western Shoshone Research on the NTTR. Research Theme Three, which requires metric evaluation of Great

Basin obsidian point samples, is discussed in Chapter 5. Chapter 6 presents the results of the geochemical analyses of the obsidian points, which addresses Research Theme Four: The Importance of Obsidian Butte and Other NTTR. Descriptions of obsidian raw material collection localities and raw data from metric evaluation and geochemical analyses of obsidian points and obsidian sources are presented in Appendices A through D.

REFERENCES CITED

Haarklau, L.

2001 *Investigation of Geochemical Variability in Obsidian Raw Material And Artifact Sources on the North Nellis Air Force Range, Nevada*. Prewitt & Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA63-95-D-0051. Copies available from 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

1999 A Class III Inventory of 640 Acres for the FAC Bravo Borrow Pit, Tolicha Peak Electronic Combat Range, Nevada Test and Training Range, Nye County, Nevada. Report No. NAFB 99-01. 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

Hughes, R. E.

2001 Chapter 4: Geochemical Characterization of Obsidian from Outcrops on the Eastern and Southern Flanks of Obsidian Butte, Nellis Air Force Range, Nevada. In *Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada*. Prewitt and Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Con-tract No. DACA63-95-D-0051. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Myhrer, K., W. G. White, and S. D. Rolf

1990 Archaeology of the Old Spanish Trail/Mormon Road from Las Vegas, Nevada to the California Border. *Bureau of Land Management Technical Report* No.17.

NAFB

1998 Nellis Air Force Base Cultural Resources Management Plan. Prepared for the U.S. Air Force, Air Combat Command. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Noble, D. C., S. I. Weiss, and E. H. McKee

1991 Magmatic and Hydrothermal Activity, Caldera Geology, and Regional Extension in the Western Part of the Southwestern Nevada Volcanic Field. In *Geology and Ore Deposits of the Great Basin, Symposium Proceedings*, Volume 2, edited by G. L. Raines, R. E. Lisle, R. W. Schafer, and W. H. Wilkinson, pp.913-934. Geological Society of Nevada, Reno.

Steward, J. H.

1997[1938] *Basin-Plateau Aboriginal Sociopolitical Groups*. University of Utah Press, Salt Lake City. [United States Government Printing Office, Washington, D.C.]

1941 Culture Element Distributions: XIII Nevada Shoshone. In *Anthropological Records* 4:2, edited by A. L. Kroeber, R. H. Lowie, R. L. Olson, and E. W. Gifford, pp.209-359. University of California Press, Berkeley.

GEOLOGIC OVERVIEW OF THE NEVADA TEST AND TRAINING RANGE AND ADJACENT AREAS

2

David L. Wagner

For 9 million years, cycles of explosive eruption, collapse and resurgence occurred in a region geologists call the Southwestern Nevada Volcanic Field (SWNVF). Eight million years after the eruptions ceased, Native Americans found the volcanic glass, obsidian, eroding from the mountains to be an optimal material for manufacturing tools. Geologists and archaeologists consider the SWNVF a significant area for addressing a wide variety of research questions. Most of the NTTR lies within the SWNVF. This chapter is intended to provide an overview of the volcanic geology of southern Nevada because it pertains to the study of archeologically significant obsidian on or near the NTTR. Tertiary volcanic rocks, most of which are ash-flow tuff sheets, occur throughout Nevada. Voluminous ash-flow tuff erupted in central and northern Nevada in pre-Miocene time. Volcanism then shifted to southern Nevada beginning about 18 million years ago.

The NTTR lies in the southern Great Basin, where there is a thick accumulation of Tertiary age volcanic rocks overlying a basement consisting of Precambrian, Paleozoic sedimentary formations and minor granitic rocks. Though earlier volcanism did occur, well-defined east-west trending belts of magmatism formed in earliest Miocene time (Christiansen and Yeats 1992, Plate 7) and swept southward, terminating in a belt of magmatism that was active from about 15 to 6 Ma. Volcanic centers within this belt include the Caliente Caldera near the Utah-Nevada border, the Kane Springs Wash Caldera, the Southwestern Nevada Volcanic Field, and possibly the Monte Cristo and Montezuma ranges near Goldfield and Tonopah respectively. Magmatism swept westward in later times, apparently following the migrating boundary of the Great Basin. The Saline Range Volcanic Field erupted during the Pliocene and Pleistocene (Ross 1970; Elliott et al., 1984; Sternlof 1988). Along the western edge of the Great Basin, the Coso Volcanics erupted in the Pleistocene (Bacon et al., 1981), as did the Long Valley Caldera which produced the Bishop Tuff (Hildreth 1979, 1981). Holocene rhyolite was erupted from the Mono-Inyo Craters (Bailey et al., 1976) and this magmatism remains active.

Volcanism in Nevada coincided with extension that caused crustal thinning during development of the Great Basin. Although much of the volcanic rock of southern Nevada is rhyolitic, the volcanism is considered "fundamentally basaltic" (Christiansen and Lipman, 1972). As the crust thinned, basaltic magma rose from the earth's mantle into the lower crust, providing the heat necessary to melt crustal material.

This melted crust, along with the normal petrologic evolution of the basalt, formed great volumes of rhyolitic magma that eventually erupted as ash-flow tuff. Though details of the timing of volcanism and crustal extension have been debated, recent research does indicate that in the SWNVF at least, intense episodes of extension and volcanism do coincide (Sawyer et al., 1994).

Throughout southern Nevada, volcanic terranes are composed of thick, widespread ash-flow tuff sheets, thick piles of lava flows, and ash flows interbedded with sediments. Ash-flow tuff is by far the most common type and occurs in regionally extensive sheets that may extend more than a 100 km from their sources with volumes measured in several to hundreds to thousands of cubic kilometers (Smith, 1979). These volcanic rocks were erupted from calderas and volcanic centers that are shown in Figure 2.1.

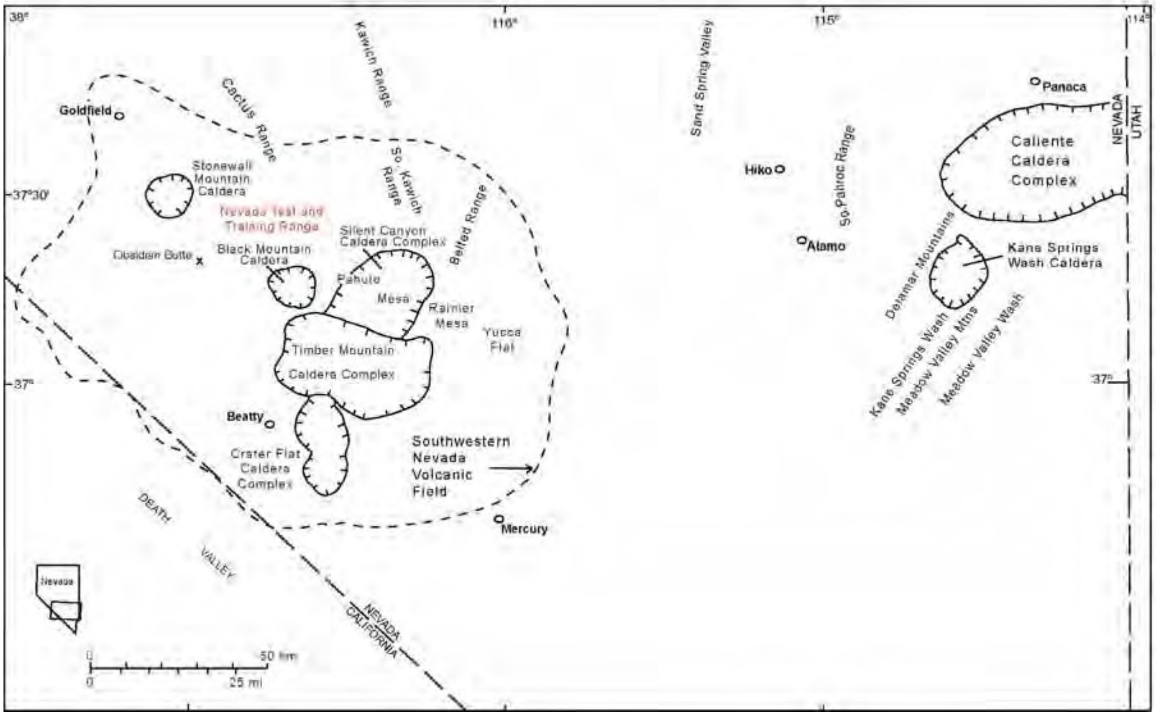


Figure 2.1 Map showing distribution of volcanic centers and calderas in southern Nevada.

THE CALDERA CYCLE

Large volume silica-rich volcanic centers, such as those in southern Nevada, typically go through a four-stage sequence. (1) Initial eruptions occur when magma, rising along faults (Figure 2.2a), encounters ground water near the surface and explodes, leaving craters (see Figure 2.1). (2) As more magma forces its way to the surface, volcanic domes and lava flows form. Rhyolite lavas are very viscous and tend to plug the volcanic plumbing system (Figure 2.2b). (3) When pressure builds to a critical point in the plugged up system, a huge explosive eruption occurs, expelling hundreds to thousands of cubic kilometers of rock and ash in a geologic instant (Figures 2.3 and 2.4), forming a caldera. A caldera is a circular depression formed when the roof of the magma chamber collapses after it contents are erupted (Figure 2.5). (4) Lavas are erupted into the caldera, and if eruptions continue long enough, the caldera is filled and lava spills over the walls of the depression and forms a volcanic mountain. This is called resurgence.

Figure 2.6 shows a cross section of the active Long Valley Caldera in California that illustrates the elements of a caldera. The Black Mountain Caldera is one of the few calderas in the Southwestern Nevada Volcanic Field that shows distinct caldera morphology (Figure 2.7).

Sometimes, the late, very hot resurgent magma can melt the older precaldera volcanic rocks and form new smaller magma chambers that are chemically distinct from the main magmatic system. This phenomenon has been documented for the Kane Springs Wash Caldera (Novak, 1984, 1985; Novak and Mahood, 1986) and may have occurred at Obsidian Butte as well.

SOUTHWESTERN NEVADA VOLCANIC FIELD

The SWNVF was a persistent source of ash-flows and lava flows lasting nearly 9 million years. At least 13,600 km^3 of magma were erupted (Sawyer et al., 1994), covering an area more than 11,000 km^2 (Christiansen et al. 1977) to depths as much as 4400 m (Orkild et al., 1968). Ash-flow tuffs were erupted from a series of nested calderas centered on the Timber Mountain Caldera Complex (see Figure 2.1). Some of the older calderas are buried by the younger ones and are known only from drill holes (see Figure 2.5). Since the 1950s, geologic mapping and related studies have been conducted in the SWNVF because of nuclear testing, military

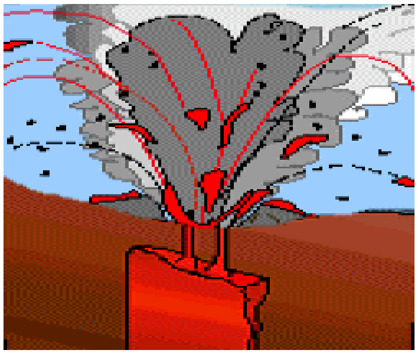


Figure 2.2a. The initial stage of the caldera cycle along the Inyo Domes in California. Rising magma encounters ground water and explodes from craters such as the Inyo Craters (see Figure 2.1). From U.S. Geological Survey.

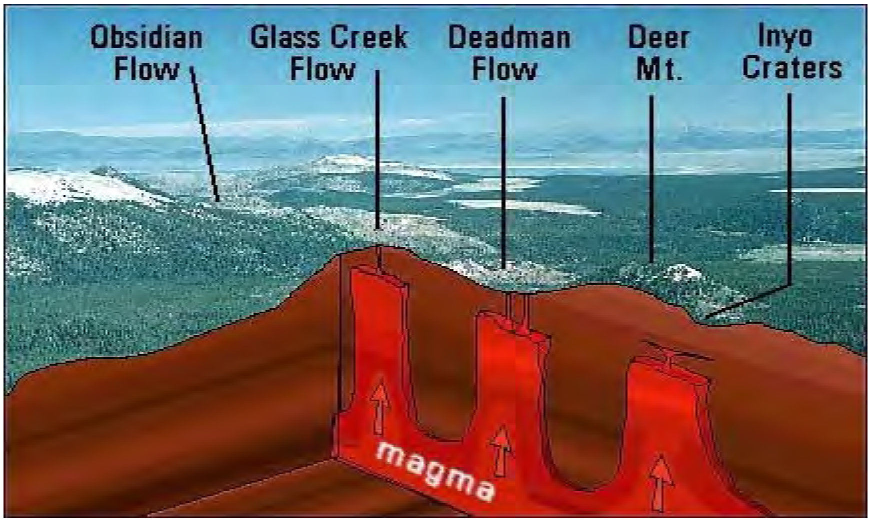


Figure 2.2b. As more magma rises along fractures (faults) resulting from the earth's crust being pulled apart, rhyolite domes form. Rhyolite lava is very viscous and plugs up the volcanic plumbing system, which can lead to explosive, caldera-forming eruptions. From U.S. Geological Survey.

training, and, more recently, development of the nuclear-waste repository at Yucca Mountain (Byers et al., 1989; Sawyer and others 1994).

Byers et al. (1989) described in detail the evolution of understanding of the SWNVF from a simple layer-cake volcanic sequence to a complex, long-lived magmatic system of nested volcanic centers with lava flows and regionally extensive ash-flow sheets emanating from those centers. Noble et al. (1991) divided the volcanism in the SWNVF into three magmatic stages: the Main Magmatic Stage (15.2 to 12.8 Ma), the Timber Mountain Magmatic Stage, (11.5 to 10.0 Ma) and the Late Magmatic Stage (9.0 to 7.0 Ma). The Timber Mountain Stage is superposed on and obscures much of the Main Stage. The Silent Canyon Caldera Complex, the oldest confirmed group of calderas within the SWNVF, formed during the main stage about 13 to 14 Ma. (Figure 2.8) At the same time, the Kane Springs Wash Caldera was forming to the east (see Figure 2.1). The Late Stage lies to the west along the western boundary of the NTTR and includes the Black Mountain and Stonewall Mountain calderas. In the most recent major paper on the SWNVF, Sawyer et al. (1994), made significant revisions in the stratigraphy of the SWNVF based on new $^{40}Ar/^{39}Ar$ dates, which are more

Figure 2.3. Inyo Craters near Mammoth Lakes, California. Theses craters formed when rising magma encountered groundwater and exploded. Courtesy of Allen Glazner.

Figure 2.4. Mount Saint Helens erupting in 1980. Although it was not a caldera-forming eruption, it illustrates the violent expulsion of ash flow tuff. From the U.S. Geological Survey.

precise than K/Ar dating methods used previously. Table 2.1 is from this paper and summarizes the major stratigraphic units of the SWNVF.

The units on Table 2.1 that will be discussed are the Tub Spring Tuff, the Comendite of Split Ridge, the Grouse Canyon Tuff, and the Dead Horse Formation. The Tub Spring Tuff, a member of the Belted Range Tuff along with the Grouse Canyon Tuff, was removed from the Belted Range Tuff because it is 1.2 million years older than the Grouse Canyon Tuff and apparently erupted from a different, as of yet unknown, source (Saywer et al., 1994). The Comendite of Split Ridge is a rhyolite flow previously called the rhyolite of Split Ridge that is related to the overlying Grouse Canyon Tuff. The Grouse Canyon Tuff is widespread ash-flow tuff, originally covering about 7800 km^2 (Sawyer and Sargent, 1989). Also related to the Grouse Canyon Tuff but overlying it are rhyolite lava flows and tuffs of the Dead Horse Formation of Sawyer et al. (1994). The Dead Horse Formation contains lava flows and tuff referred to on

Figure 2.5. Aniakchak Caldera in Alaska. Aniakchak Caldera formed during an explosive eruption that expelled more than 50 km^3 of material about 3,450 years ago. It is 10 km across and 500 to 1000 m deep. Removing large volumes of magma results in the loss of support of the overlying rock causing collapse. Later eruptions formed resurgent domes and cinder cones on the caldera floor. Aniakchak is an excellent modern analog of calderas that formed in southern Nevada during the Miocene. Photo by M. Williams, National Park Service, 1977.

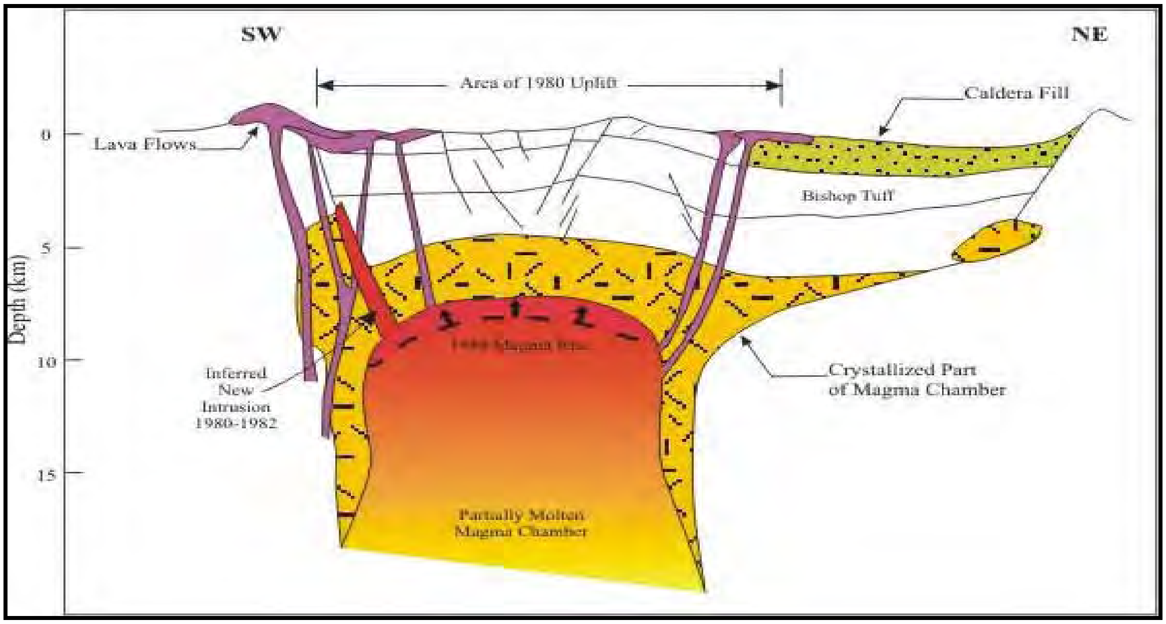


Figure 2.6. Cross section showing the slements and architecture of the Long Valley Caldera.

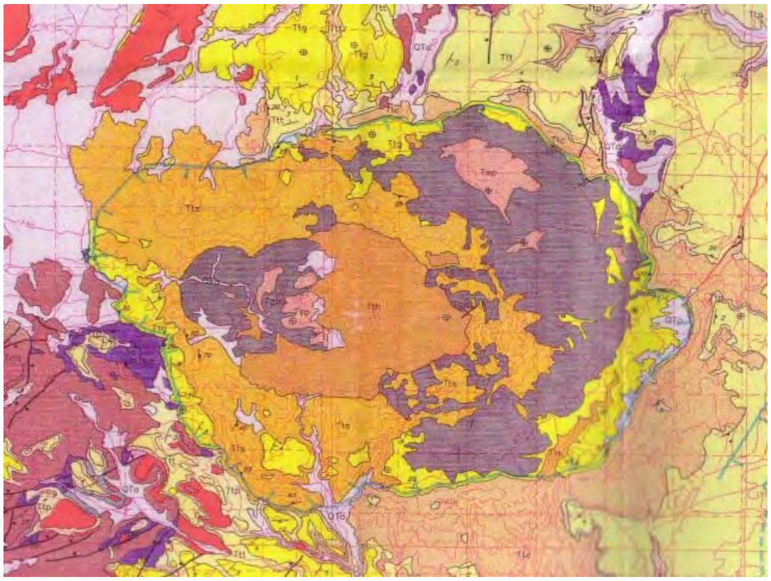


Figure 2.7. A geologic map of the Black Mountain Caldera. One of the few in the SWNVF where the caldera depression is readily observable. The green hachured line marks the rim of the caldera. The colored polygons within the green line are intracaldera lava flows and tuff. At least one rhyolite flow of the Thirsty Canyon Group (Tts on the map; also see Table 2.1) flowed out of the caldera. From Minor et al. (1993).

Table 2.1. Summary of major stratigraphic units of the Southwestern Nevada volcanic field

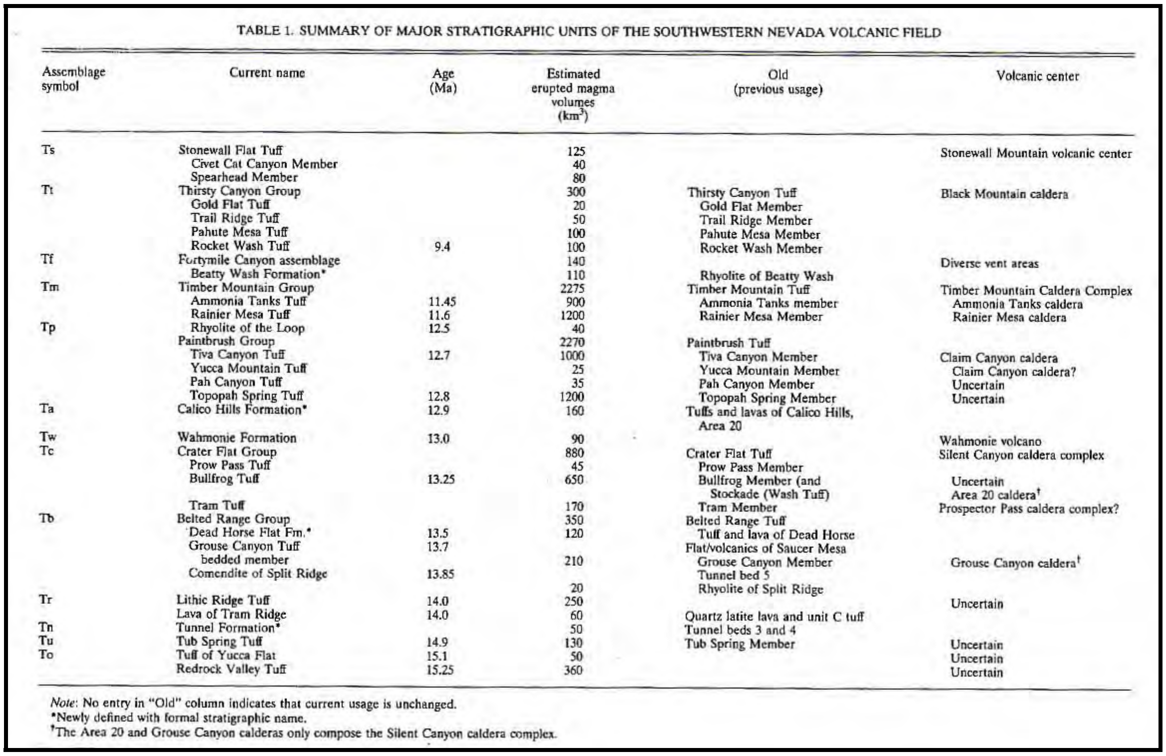


TABLE 1. SUMMARY OF MAJOR STRATIGRAPHIC UNITS OF THE SOUTHWESTERN NEVADA VOLCANIC FIELD

Assemblage symbol	Current name	Age (Ma)	Estimated erupted magma volumes (km^3)	Old (previous usage)	Volcanic center
Ts	Stonewall Flat Tuff		125		Stonewall Mountain volcanic center
	Civet Cat Canyon Member		40		
	Spearhead Member		80		
Tt	Thirsty Canyon Group		300	Thirsty Canyon Tuff	Black Mountain caldera
	Gold Flat Tuff		20	Gold Flat Member	
	Trail Ridge Tuff		50	Trail Ridge Member	
	Pahute Mesa Tuff		100	Pahute Mesa Member	
	Rocket Wash Tuff	9.4	100	Rocket Wash Member	
Tf	Fortymile Canyon assemblage		140		Diverse vent areas
	Beatty Wash Formation*		110	Rhyolite of Beatty Wash	
Tm	Timber Mountain Group		2275	Timber Mountain Tuff	Timber Mountain Caldera Complex
	Ammonia Tanks Tuff	11.45	900	Ammonia Tanks member	Ammonia Tanks caldera
	Rainier Mesa Tuff	11.6	1200	Rainier Mesa Member	Rainier Mesa caldera
Tp	Rhyolite of the Loop	12.5	40		
	Paintbrush Group		2270	Paintbrush Tuff	
	Tiva Canyon Tuff	12.7	1000	Tiva Canyon Member	Claim Canyon caldera
	Yucca Mountain Tuff		25	Yucca Mountain Member	Claim Canyon caldera?
	Pah Canyon Tuff		35	Pah Canyon Member	Uncertain
	Topopah Spring Tuff	12.8	1200	Topopah Spring Member	Uncertain
Ta	Calico Hills Formation*	12.9	160	Tuffs and lavas of Calico Hills, Area 20	
Tw	Wahmonie Formation	13.0	90		Wahmonie volcano
Tc	Crater Flat Group		880	Crater Flat Tuff	Silent Canyon caldera complex
	Prow Pass Tuff		45	Prow Pass Member	
	Bullfrog Tuff	13.25	650	Bullfrog Member (and Stockade (Wash Tuff)	Uncertain Area 20 caldera†
	Tram Tuff		170	Tram Member	Prospector Pass caldera complex?
Tb	Belted Range Group		350	Belted Range Tuff	
	Dead Horse Flat Fm.*	13.5	120	Tuff and lava of Dead Horse	
	Grouse Canyon Tuff	13.7		Flat/volcanics of Saucer Mesa	
	bedded member		210	Grouse Canyon Member	Grouse Canyon caldera†
	Comendite of Split Ridge	13.85		Tunnel bed 5	
			20	Rhyolite of Split Ridge	
Tr	Lithic Ridge Tuff	14.0	250		Uncertain
	Lava of Tram Ridge	14.0	60	Quartz latite lava and unit C tuff	
Tn	Tunnel Formation*		50	Tunnel beds 3 and 4	
Tu	Tub Spring Tuff	14.9	130	Tub Spring Member	Uncertain
To	Tuff of Yucca Flat	15.1	50		Uncertain
	Redrock Valley Tuff	15.25	360		Uncertain

Note: No entry in "Old" column indicates that current usage is unchanged.
*Newly defined with formal stratigraphic name.
†The Area 20 and Grouse Canyon calderas only compose the Silent Canyon caldera complex.

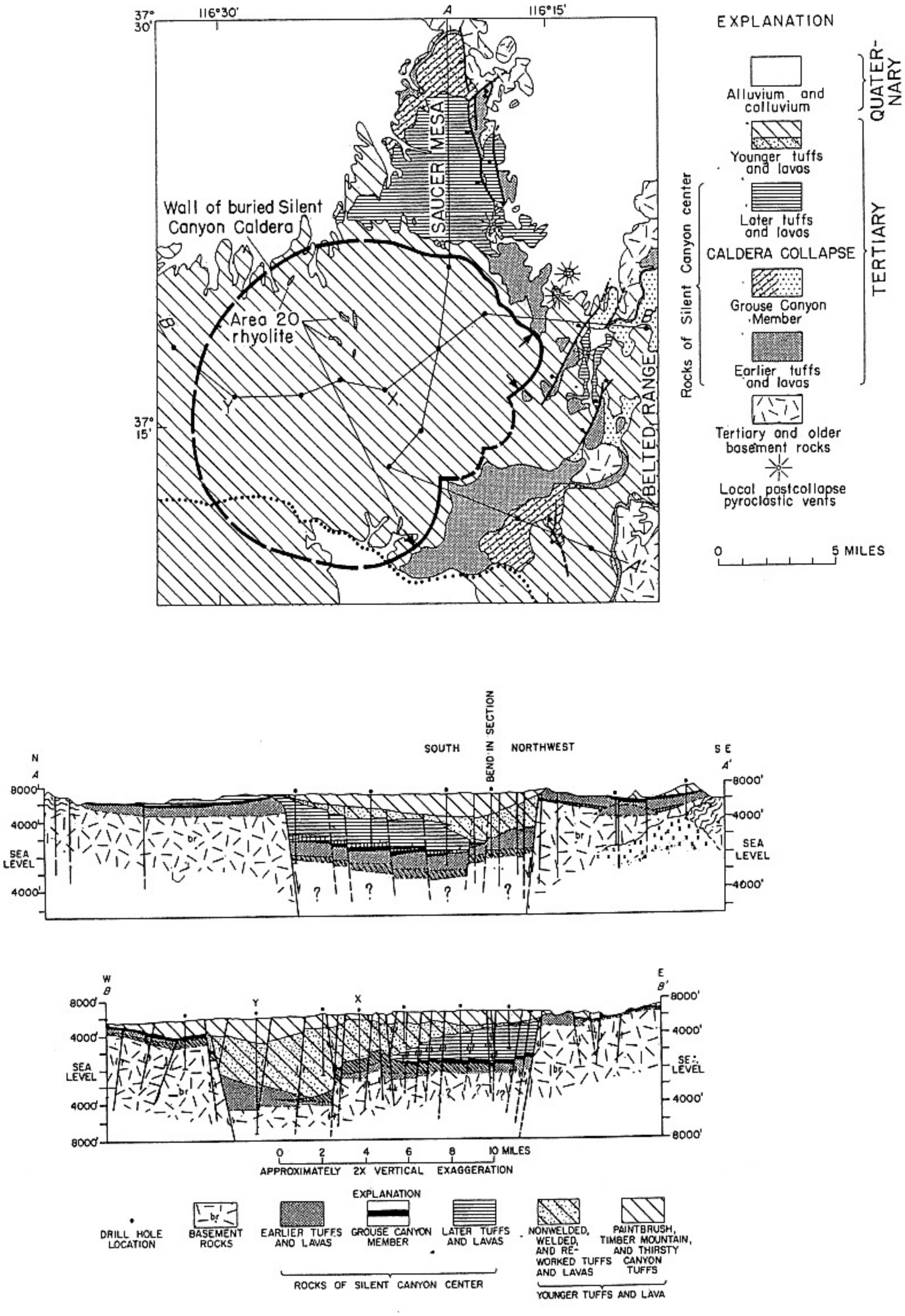


Figure 2.8. Geologic map and cross sections of the Silent Canyon Caldera. The caldera is buried by younger deposits and is known only from extensive drilling. The cross sections are drawn along lines A-A' and B-B' on the geologic map. Geologic map is from Noble et al. (1968), and the cross section is from Orkild et al. (1968).

geologic maps (eg., Orkild et al., 1969) as the "lava and tuff of Dead Horse Flat" and the "volcanics of Saucer Mesa." All three of these units were erupted from the Grouse Canyon caldera, one of the calderas within the Silent Canyon Caldera Complex. This is significant because obsidian from these units can be expected to be chemically similar varieties.

The long-lived, widespread volcanism that resulted in large volumes of rhyolite emplaced over thousands of square kilometers complicates obsidian sourcing studies. Obsidian sourcing archaeometry was developed in California, where sources are relatively restricted and approximate point sources. None of the California sources approach the eruptive volumes of the major volcanic centers of southern Nevada. In Nevada, ash-flow tuff sheets of the same composition covered hundreds to thousands of square kilometers. After faulting formed the characteristic basin and range topography, we can find the same tuff with the same obsidian in several ranges. In contrast, a single volcano, such as Obsidian Butte (see The Obsidian Butte Story below), yields five chemically distinct varieties.

The obsidian-bearing alluvial deposits derived from the regionally extensive rhyolite sheets also present problems. Most of the early sampling in southern Nevada was from these secondary deposits. The obsidian in the alluvial deposits can be mixed with other varieties from the same volcanic system or mixed with obsidian from different magmatic system.

METHODOLOGY AND APPROACH

Obsidian was collected from several localities within the SWNVF including Obsidian Butte, Shoshone Mountain, the South Kawich Range, and Oak Spring Butte. Areas outside the SWNVF visited as part of this project include Kane Springs Wash, Delamar Mountains, Meadow Valley Wash Mountains, Sand Spring Valley (Tempiute), South Pahroc Range, Goldfield Hills, and Monte Cristo Range.

The authors' technique for sampling, analyzing, and interpreting obsidian sources was developed during an investigation of the Saline Range Volcanic Field, a relatively small rhyolitic volcanic center in the northwestern portion of Death Valley National Park, California (Wagner and Johnson, 2002). In one small area of the range, obsidian occurs in lava flows, ash-flow tuffs, and intrusive rhyolite. Careful sampling and analysis revealed that obsidian from each type of rhyolite is a chemically distinct variety. Scatter plots of barium (Ba) versus strontium (Sr) clearly differentiated between the varieties of obsidian from each type of deposit. Hildreth (1979, 1981) presented a definitive discussion of chemical gradients in silicic magma chambers. He showed that many trace elements in volcanic glass from the Bishop Tuff are either enriched or depleted consistently upward or downward in silicic magma chambers. Hildreth's model allowed an interpretation of intrasource variation in the Saline Range rhyolites. Ba and Sr are strongly depleted in the uppermost part of Great Basin magma chambers and become enriched downward; that trend will be reversed in the rock sequence after eruption. Early eruptions of a magmatic system tap the uppermost part of the magma chamber where the liquid is depleted in Sr and Ba, so the eruptives are low in Ba and Sr, generally less than 40 parts per million (ppm) for Ba and less than 20 ppm for Sr; some samples are devoid of Sr or Ba. As lower parts of the magma chamber are tapped, concentrations of Ba increase in later eruptives to 800 to 1000 ppm or more, and Sr concentrations increase to several hundred ppm. Chemical gradients in magma chambers and the eruptive rock sequences provide a basis for recognizing and interpreting intrasource variation, as well as aiding in the search for sources for so-called unknown obsidians. In light of the foregoing discussion, it should be apparent that Ba and Sr alone should not be used to differentiate between sources.

Major elements are also zoned in Great Basin magma chambers (Smith 1979). Most important to the occurrence of obsidian is the silica concentration. The highest silica (SiO_2) concentrations will occur in the upper part of the magma chamber, so the earliest eruptions in a given magma system will be high-silica (>75 percent) rhyolite, which have high potential for artifact-grade obsidian.

Geologic maps and reports are good sources of information to interpret obsidian sources and to help locate unknown geologic sources of obsidian. Map units identified as rhyolite, particularly high-silica rhyolite, are promising if they contain vitrophyres (glassy zones). Geologic maps often do not mention obsidian even if it does exist in a rhyolite, but usually the presence of vitrophyres is mentioned. Most vitrophyric material is not artifact-grade glass, but it sometimes contains nodules (Apache tears or marekanites) of good, workable obsidian. Geologic reports and papers that contain chemical analyses are also good sources of information because obsidian is often the preferred material to analyze because it is supercooled magmatic liquid that is a chemical snapshot of the evolving magma. Crystalline material (i.e., rocks) records the crystallization history of the magma chamber but does not provide information about the residual liquid that is quenched to form volcanic glass. When coordinates of the localities that geologists sampled are provided, this information can be used to locate sources of obsidian identified in the archaeological record.

After promising geologic units have been identified from geologic maps, it is time for field work. The same technique used by early prospectors to locate ore deposits is used in prospecting for obsidian. Stream courses carrying detritus from promising geologic units are checked to see if obsidian is present. If it is present, the stream course is followed until the source of the obsidian is found. It usually helps to collect one or two 10-specimen samples from the stream gravel to determine if there is intrasource variability. If there is variability, this sample size will usually pick it up. Once obsidian is found in outcrop, it is sampled intensively. Although it is tedious and time-consuming, care should be taken to extract obsidian from the outcrop. Loose nodules could be transported down slope from higher outcrops that may be chemically distinct.

THE OBSIDIAN BUTTE STORY

Obsidian Butte is on Pahute Mesa near the western boundary of the north NTTR, about 16 km east of Scotty's Junction in Nye County, Nevada (see Figure 2.1). Artifact-grade obsidian occurs as nodules measuring from less than 1 cm to 15 cm in diameter in glassy, welded zones (Figure 2.9) at the bottoms of lava flows and along the margins of intrusive bodies of the rhyolite of Obsidian Butte (Minor et al., 1993). The rhyolite of Obsidian Butte is a tan to gray, sometimes brown, rhyolite with contorted flow laminations. This voluminous, rather monotonous rhyolite covers an area of about 35 to 45 square miles (Frizzell and Hausback, unpublished data). In places the rhyolite is conspicuously spherulitic (Figure 2.10). Noble et al. (1991) obtained a radiometric date of 8.8 Ma on obsidian from the south flank Obsidian Butte, indicating it was erupted during what they term the Late Magmatic Stage of the Southwestern Nevada Volcanic Field. Magmatism at Obsidian Butte is transitional in time and space between magmatism at the Black Mountain Caldera that produced the Thirsty Canyon Tuff 8.5 to 9.0 million years ago and the magmatism at Stonewall Mountain Caldera that produced the Stonewall Flat Tuff 7.4 to 7.6 million years ago (Noble et al., 1991).

Obsidians now known to derive from primary outcrops on and near Obsidian Butte were initially characterized based on geochemical analyses of geologic specimens collected from alluvial deposits in the vicinity of Obsidian Butte, along Tolicha Wash (Hughes 2001b), and on Sarcobatus Flat (Sappington 1981) by a number of other researchers. This original classification has resulted in a proliferation of names for the glass types found in this area that include Obsidian Butte Variety H-3, Obsidian Butte Variety H-5, Sarcobatus Flat A, Sarcobatus Flat B, Tolicha Wash, and Scotty's Junction (Hughes 2001; Moore 1995; Sappington 1981; Skinner and Thatcher 2000; Appendix A, Table A-4-1).

During field reconnaissance that Lynn Haarklau and Richard Hughes conducted between 1999 and 2003, several localities comprising primary sources for the obsidian nodules collected from secondary contexts by earlier researchers were identified (Haarklau 2001; Hughes 2001b; Hughes and Haarklau 2002). The localities investigated during the 1999 field season are described in Hughes (2001), and descriptions of the localities visited in 2001 and 2003 are in Appendix B.

Obsidian was collected from Obsidian Butte and another area several miles to the north, informally referred to as North Obsidian Butte. Analysis of trace elements barium and strontium indicates obsidian collected from Obsidian Butte and North Obsidian Butte was erupted from the same magma chamber because the trend shown by these trace elements is typical of other Great Basin magma chambers.

Figure 2.11 is a scatter plot of concentrations

Figure 2.9. Gray vitrophyre at the base of a rhyolite lava flow in Tolicha Wash near Obsidian Butte. Sample DW-04-OB-07 was collected from this location. A vitrophyre is a glassy zone usually found on the bottoms and tops of lava flows and ash-flow tuffs where cooling is so rapid that crystals are unable to form. The tan zone above the gray zone is crystalline rhyolite rock.

of strontium plotted against those of barium showing there are at least five chemically distinct obsidian varieties in this area. During earlier investigations, obsidian sampled from secondary or otherwise uncertain contexts was identified as comprising three chemically distinct varieties, with one of them called Obsidian Butte Variety C. With more careful sampling (see Figure 2.6) and using Sr and Ba to evaluate the intrasource variability, it is clear that there are five varieties—four associated with Obsidian Butte and one associated with North Obsidian Butte (see Figure 2.7).

Obsidian Butte appears to be a volcanic neck, the erosional remnant of a volcano that must have been much larger than the present landform (Figure 2.12). Obsidian Butte Variety 1, poor quality obsidian collected from near the top of the butte, is a low Sr-low Ba variety consistent with its being part of the older inner core of the volcano. Lava flows containing Obsidian Butte Varieties 2, 3, and 4 flowed out from the volcano forming its flanks. The concentric topography around Obsidian Butte is suggestive of the conical form of the volcano (Figure 2.13). Variety 2 (Airfield Canyon) is from the oldest of these flows. Obsidian Butte Varieties 3 and 4 occur in lava flows from subsequent, but separate, eruptions. Obsidian Butte Variety 4 was dated by Noble et al. (1991) at 8.8 +/- 0.3 Ma. This indicates that rhyolite flows were erupting from Obsidian Butte at about the same time as ash flow tuffs were erupting from the Black Mountain Caldera to the southeast. Obsidian Butte Variety 5 occurs in the youngest flow known to be erupted from the Obsidian Butte magma chamber. Figures 2.14 and 2.15 show the collection locations.

Obsidian Butte Variety 5 has the highest observed Sr and Ba concentrations and has been

Figure 2.10. Spherulites in the rhyolite of Obsidian Butte. Spherulites are rounded masses of feldspar and quartz that form while lava is cooling. Needle-like crystals of quartz and feldspar radiate out from a nucleus.

collected only from the area north Obsidian Butte, which appears to be a small vent (see Figure 2.14). This Obsidian Butte variety has the trace element profile of a previously unknown obsidian type that Richard Hughes termed Unknown C obsidian. Its age is unknown, but it must be younger than Variety 4 (8.8 Ma) but older than the oldest part of the Stonewall Tuff (7.6 Ma). It is likely that North Obsidian Butte represents the last eruption from the Obsidian Butte magma chamber.

CONCLUSIONS

The NTTR is within the Southwestern Nevada Volcanic Field that was active for nearly 9 million years. Most of the volcanic centers in and around the SWNVF developed in cycles of explosive eruption, collapse, and resurgence. Ash-flow tuffs produced by the explosive eruptions may cover hundreds to thousands of square kilometers and may contain the same obsidian. In contrast, relatively local lava flows erupted during resurgence—such as Obsidian Butte—may contain several chemically distinct varieties. To be successful, collection strategies must take these complexities into account. Although collecting and geochemically analyzing obsidian from secondary sources is useful for archaeologists in determining procurement localities, secondary obsidian alone should not be used to characterize a geologic source.

Obsidian Butte is an important source of toolstone-grade obsidian. Here, rhyolite lava flows erupted from Obsidian Butte and a small vent to the north, herein called North Obsidian Butte, contain five distinct chemical varieties. Variety 2 is called Airfield Canyon, and Variety 5 was previously called Unknown C. This intrasource chemical variability is due to chemical zonation in the magma chamber. Intrasource variability was also found in the rhyolite lava

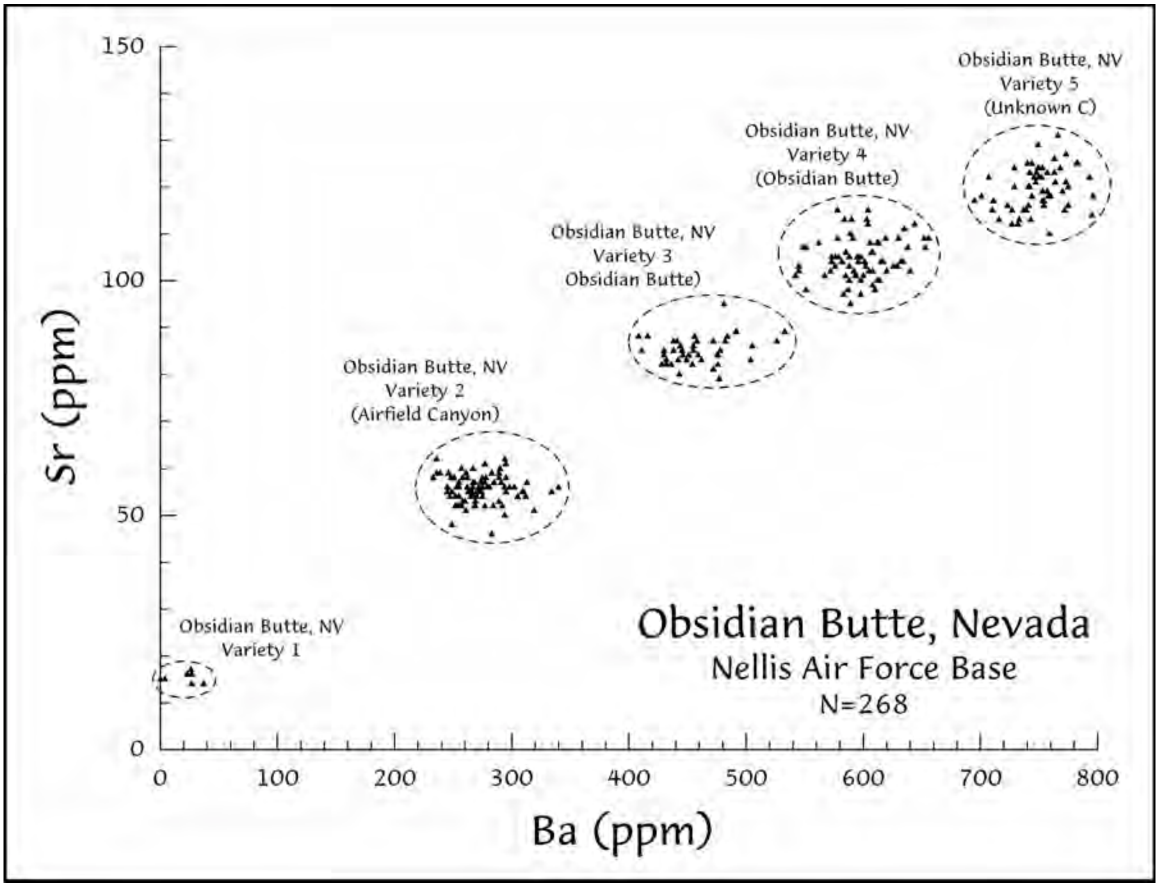


Figure 2.11. Scatter plot of barium (Ba) versus strontium (Sr) of 268 specimens from the Obsidian Butte Area. Analytical data are in Appendix B. The previous calls for the varieties are shown are in parentheses.

erupted during the resurgent phase of the Kane Springs Wash Caldera east of the Nevada Test and Training Range, which is discussed in Chapter 3. Intrasource variability is probably more widespread in the Great Basin than archaeologists realize. A well-thought-out sampling strategy uses geologic maps, geologic expertise, and careful collecting techniques is a cost-effective way to minimize ambiguities and misinterpretations.

Figure 2.12. Collecting obsidian on Obsidian Butte. When collecting geological obsidian. samples should be extracted from the outcrop rather than picking up float material that can contain mixed varieties or, worse, samples erupted from different volcanic centers.

Figure 2.13. Obsidian Butte, Nevada. Obsidian Butte, the larger peak on the right, is an eroded volcano that was active about 8.8 million years ago. The dark areas on the slopes of the butte are concentrations of obsidian nodules.

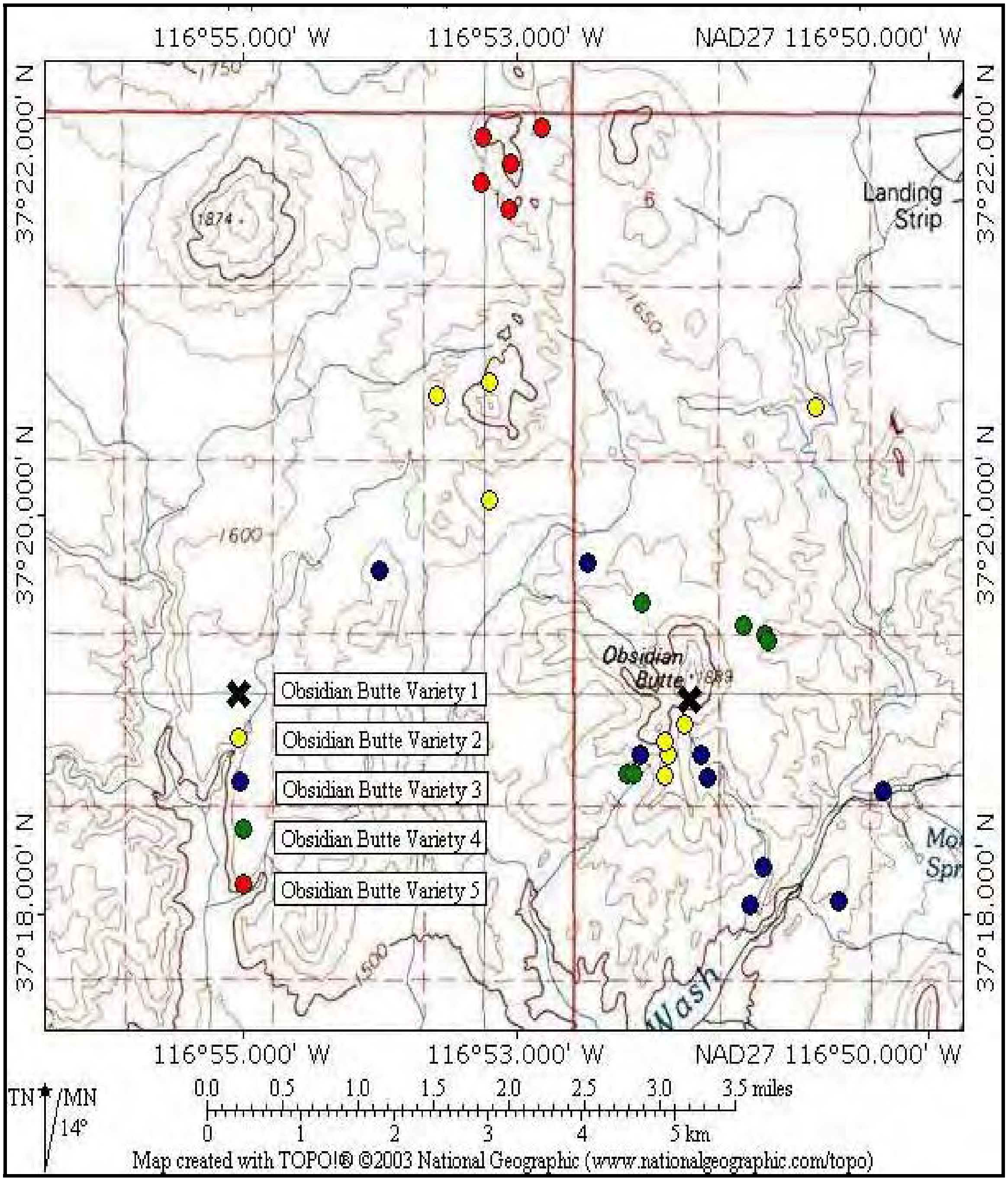


Figure 2.14. Map showing distribution of Obsidian Butte Varieties 1–5. Varieties 1–4 are on or from flows issued from Obsidian Butte. Variety 5 specimens are all from an unnamed hill referred to as North Obsidian Butte in the text.

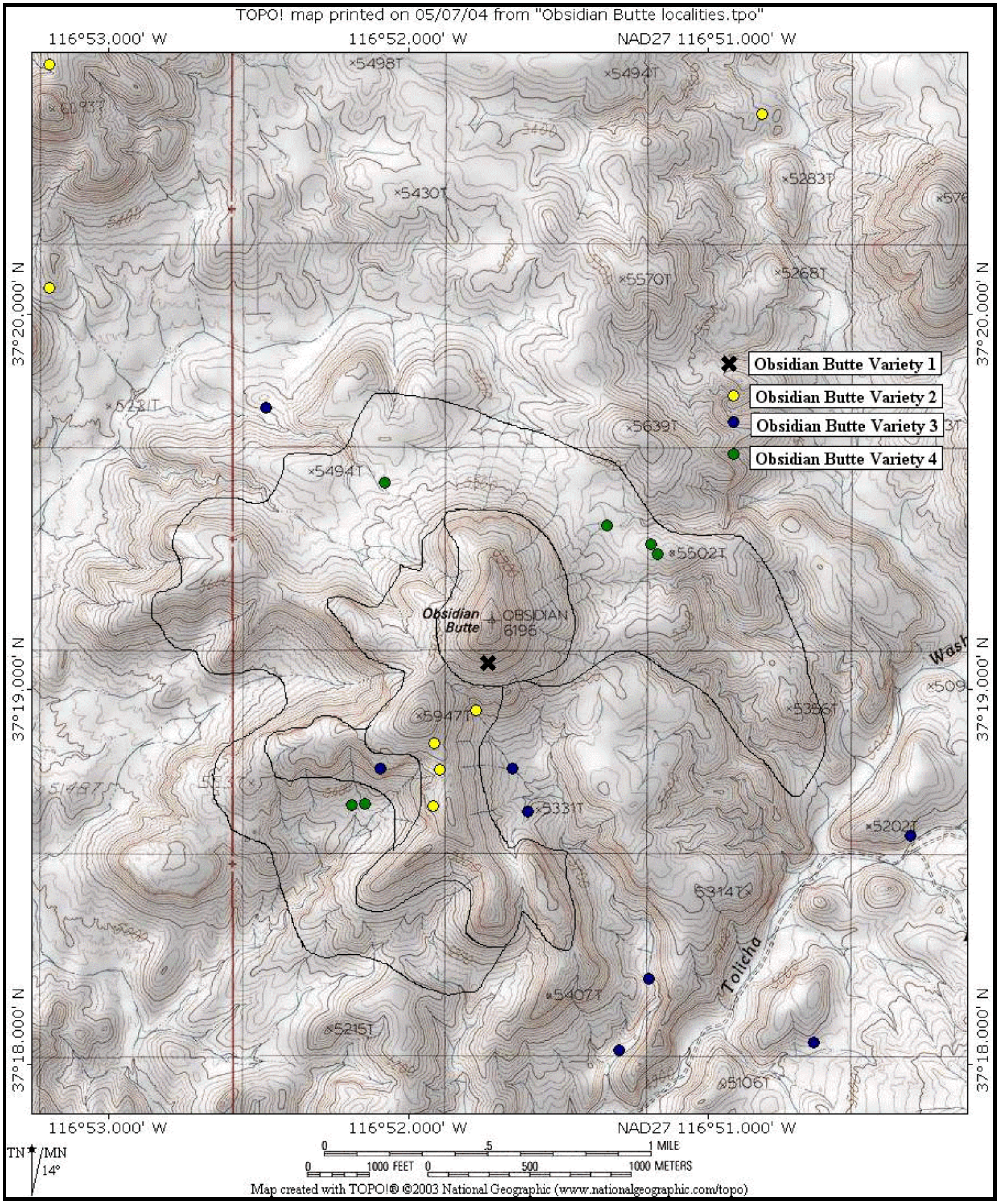


Figure 2.15. Map of Obsidian Butte showing a hypothetical reconstruction of the Obsidian Butte volcano. Reconstruction is based on the distribution of the four obsidian varieties identified from the collection localities. Variety 1 is the oldest, and 4 is the youngest.

REFERENCES CITED

Bacon, C. R., Ray Macdonald, R. L. Smith, and P. A. Baedecker

1981 Pleistocene high-silica rhyolites of the Coso Volcanic Field, Inyo County, California. *Journal of Geophysical Research* 86 (B11):10223–1014.

Bailey, R. A., G. B. Dalrymple, and M. A. Lanphere

1976 Volcanism, structure, and geochcronology of the Long Valley Caldera, Mono County, California. *Journal of Geophysical Research* 81 (B5):725–744.

Byers, F. M. Jr., W. J. Car, and P. P. Orkild

1989 Volcanic centers of southwestern Nevada: Evolution of understanding, 1960–1988. *Journal of Geophysical Research* 94 (B5):5908–5924.

Christiansen, R. L. and P. W. Lipman

1972 Cenozoic volcanism and plate-tectonic evolution of the western United States, II, Late Cenozoic. *Philosophical Transactions of the Royal Society of London, Series A,* 271: 249–284.

Christiansen, R. L., P. W. Lipman., W. J. Carr., F. M. Byers, , P. P Orkild, and K. A. Sargent

1977 Timber Mountain-Oasis Valley caldera complex of southern Nevada. *Geological Society of America Bulletin* 88:943–959.

Christiansen, R. L. and R. S. Yeats

1992 Post-Laramide geology of the U.S. Cordilleran region. In the Cordilleran Orogen: Conterminous United States. In the Geology of North America, edited by B. C. Burchfiel, P. W. Lipman, and M. L. Zoback. *Geological Society of America, Decade of North American Geology* G-3:261–406.

Elliott, G. S., C. T. Wrucke, and S. S. Nedell

1984 K-Ar ages of Late Cenozoic volcanic rocks from the northern Death Valley region, California. *Isochron / West* (40):3–7.

Haarklau, L.

2001 Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada. Report No. NAFB 00-04. 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

Hildreth, W.

1979 The Bishop Tuff: Evidence for the origin of compositional zonation in silicic magma chambers. In Ash-flow tuffs, edited by C. E. Chapin and W. E. Elston. Geological Society of America Special Paper 180: 43–75.

1981 Gradients in silicic magma chambers: Implications for lithospheric magmatism. Journal of Geophysical Research. 86 (B11):10153–10192.

Hughes, R. E.

2001a Geochemical Research Laboratory Letter Report 2000-121 submitted to L. Johnson, Sacramento, Calif., March 7, 2001.

2001b Geochemical Characterization of Obsidian from Outcrops on the Eastern and Southern Flanks of Obsidian Butte, Nellis Air Force Range, Nevada. In Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada, by L. Haarklau, pp. 27–54. Report No. NAFB 00-04. 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

Hughes, R. E., and L. Haarklau

2002 Geochemical Analysis of Volcanic Glasses from the Obsidian Butte Area, Southern Nevada. Paper presented at the 28th Great Basin Anthropological Conference, October 10–12, 2002, Elko, Nevada.

Minor, S. A, D. A. Sawyer, R. R. Wahl, R. R. Frizzell Jr., S. P. Schilling, R. G. Warren, P. P. Orkild, J. A. Coe, M. R. Hudson, R. J. Fleck, M. A. Lanphere, W. C. Swadley, and J. C. Cole

1993 Preliminary geologic map of the Pahute Mesa 30'x60 ' quadrangle, Nevada. *U.S. Geological Survey Open-File Report* 93–299.

Moore, J.

1995 Great Basin Toolstone Sources, A Progress Report on the NDOT Obsidian XRF Sourcing Project:1994. Report prepared by the Nevada Department of Transportation, Carson City, Nevada.

Noble, D. C., K. A. Sargent, H. H Mehnert, E. B. Ekren, and F. M. Byers Jr.
1968 Silent Canyon Volcanic Center, Nye County, Nevada. *Geological Society of America Memoir* 110:65–74.

Noble, D. C., S. I. Weiss, and E. H. McKee
1991 Magmatic and hydrothermal activity caldera, geology and regional extension in the western part of the Southwestern Nevada Volcanic Field. In *Geology and Ore Deposits of the Great Basin*, edited by G. L. Raines, R. E. Lisle, R. W. Shafer, and W. H. Wilkinson, pp. 913–934.

Novak, S. W.
1984 Eruptive history of the rhyolitic Kane Springs, Wash Volcanic Center, Nevada. *Journal of Geophysical Research* 89(B10):8603–8615.

1985 Geology and geochemical evolution of the Kane Springs Wash Volcanic Center, Lincoln County, Nevada. Stanford University Ph. D. dissertation.

Novak, S. W., and G. A. Mahood
1986 Rise and fall of a basalt-trachyte-rhyolite magma system at the Kane Springs Wash Caldera, Nevada. *Contributions to Mineralogy and Petrology* (94):352–373.

Orkild, P. P., F. M. Byers Jr., D. L. Hoover, and K. A. Sargent
1968 Subsurface geology of the Silent Canyon Caldera, Nevada Test Site, Nevada. In Nevada Test Site, edited by E. B. Eckel. *Geological Society of America Memoir* 110:77–86.

Orkild, P. P.; K. A. Sargent, Snyder, and R. P. Nye
1969 Geologic Map of Pahute Mesa, Nevada Test Site and Vicinity, Nye County, Nevada. *U.S. Geological Survey Miscellaneous Investigations* Map I-567.

Ross, D. C.
1970 Pegmatitic trachyandesite plugs and associated volcanic rocks in the Saline-Inyo Mountains region, California. *U.S. Geological Survey Professional Paper* 614-D.

Sappington, R. L.
1981 Additional Obsidian and Vitrophyre Source Descriptions from Idaho and Adjacent Areas. *Idaho Archaeologist* (5) 1:4–8.

Sawyer, D. A, R. J.Fleck, M. A. Lanphere, R. J. Warren, D. E. Broxton, and M. R. Hudson
1994 Episodic caldera volcanism in the Miocene Southwestern Nevada Volcanic Field: Revised stratigraphic framework, ^{40}Ar/^{39}Ar geochronology, and implications for magmatism and extension. *Geological Society of America Bulletin* 106:1304–1318.

Skinner, C. E. and J. J. Thatcher
2000 X-Ray Fluorescence Analysis and Obsidian Hydration Analysis of Artifact Obsidian from the Eureka Dunes Site, Death Valley National Park, Inyo County, California. Northwest Research Obsidian Studies Laboratory Report 2000-27 submitted to J. Burton, Western Archaeological and Conservation Center, Tucson, Arizona.

Smith, R. L.
1979 Ash-flow magmatism, In Ash-flow tuffs, edited by C. E. Chapin and W. E. Elston. *Geological Society of America Special Paper* 180:5–27.

Sternlof, K. R.
1988 Structural Style and Kinematic History of the Active Panamint-Saline Extensional System, Inyo County, California. Cambridge, Massachusetts Institute of Technology M.S. thesis.

Wagner, D. L. and L. Johnson
2002 Geology of the Saline Range obsidian source: Implications for sampling strategies, abstract: Geological Society of America.

OBSIDIAN SOURCE CHARACTERIZATION STUDY

3

Lynn Johnson and David L. Wagner

Obsidian was used throughout prehistory in the Great Basin to make a wide variety of flaked stone tools. Because flaked stone tools are often the only artifacts found at prehistoric sites in the region, it is imperative that archaeologists recover as much data as possible by analyzing this artifact class. Archaeometrists use X-ray fluorescence (XRF) spectrometry and other analytical techniques to identify the geologic provenance (i.e., source) of an obsidian artifact (Cann 1983; Jack 1976; Jack and Carmichel 1969; Glascock et al. 1998; Harbottle 1982). Archaeologists use these provenance data to examine patterns in obsidian source use over time and across space and artifact class to address questions about resource procurement, mobility, organization of technology, territoriality, trade, and exchange. Diachronic variability in obsidian procurement, conveyance, and use patterns is thought to reflect culture change. Because obsidian sourcing studies have helped us learn things about the past that we might not have otherwise known, locating and adequately characterizing geologic sources of obsidian has become an important component of archaeological research in regions where sources of obsidian toolstone are found (c.f. Shackley 1998; Glascock et al. 1998).

Many of the obsidian sources exploited throughout prehistory in the Great Basin have been known to archaeologists and archaeometrists for some time (Ericson et al. 1976; Farmer 1937; Hughes 1983, 1985; Lipman et al. 1978; Nelson 1984; Nelson and Holmes 1979; Sappington 1981a, 1981b; Singer and Ericson 1977). But most of these sources were characterized based on analytical data from only a few specimens, and often these specimens were collected from secondary contexts in areas lacking evidence of prehistoric exploitation. Furthermore, because XRF analytical procedures have evolved over the past few decades and are not always consistent even today, data generated over the years by various analysts are often not directly comparable. Thus, for many Great Basin obsidian sources, the geochemistry and geologic context of toolstone quality obsidian, as well as the geologic abundance and geographic distribution of workable-sized pieces of obsidian toolstone in both primary and secondary contexts are not well understood, and evidence of prehistoric procurement activities in most source areas is not well documented.

In addition, the geologic provenance of a number of geochemical types represented in the regional archaeological record remains unknown, so in some cases, archaeometrists have been unable to make source assignments for artifacts recovered from prehistoric sites. Incomplete knowledge of the distribution and trace element chemistry of regional geologic sources of obsidian toolstone can also lead to spurious source assignments. Because archaeologists rely so heavily on obsidian sourcing studies to interpret the past, lack of information about obsidian geochemistry and source distribution has made reconstructing prehistoric human behavioral patterns in some parts of the Great Basin more difficult.

Obsidians in stratigraphically distinct rocks erupted from a single volcanic center often show geochemical variability, making interpretation difficult for the archaeologist (Hughes and Smith 1993). Many researchers now recognize the necessity of using more rigorous sampling methods like those outlined in Chapter 2 to document both intra- and inter-source variability, especially in complex volcanic terranes such as found in the study area and vicinity. But because this sampling methodology has not been routinely followed in most parts of the Great Basin, both intra- and inter-source variability have often been missed. This oversight has hindered efforts to locate geologic sources for unknown geochemical types, chemically distinct obsidians identified in artifact assemblages for which the geologic provenance, or source rock, is not known.

To remedy this situation, an ambitious obsidian source location and characterization program was undertaken. Between 1999 and 2004, a significant sample of geologic obsidian specimens was collected from a number of previously investigated source areas, as well as from areas that had not been investigated before this study. Field investigations focused on locating and sampling those obsidian sources on or near NTTR that—based on the research of Haarklau (2001) and Kolvet et al. (2000)—would likely be identified in artifact assemblages found at prehistoric sites in the region. An effort was also made to pinpoint potential sources of obsidian toolstone reported in the geologic literature.

The main goals of this component of the study include documenting both intra- and inter-source variability in the study area and analyzing enough samples to establish or refine source standards for geochemical obsidian varieties. It was also hoped that geologic sources for unknown geochemical types identified in the regional archaeological record (e.g. Unknowns A, B, and C) would be identified. Further aims include documenting the size of obsidian nodules available in the source areas investigated, noting whether prehistoric procurement activities are evident, and making field observations that could be used to place each obsidian source within the proper geologic context.

The purpose of this chapter is to provide researchers with data to assist interpretations of prehistoric toolstone procurement behavior. Variables such as distance to source; size, quality, geologic abundance, and geographic extent of workable-sized pieces of obsidian toolstone in both primary and secondary contexts; proximity to other sources of toolstone; and proximity to other resources such as food and water potentially influence the degree to which obsidian sources were exploited. Although archaeologists routinely calculate distance to source to understand mobility patterns and trade and exchange, many Great Basin obsidian sources are not toolstone sources, and a single geochemical type or a mixture of several types can be widely disbursed in both primary and secondary deposits. An understanding of the geographic distribution of obsidian found in each source area is necessary before accurate distance-to-source calculations can be made. Because most variables influencing procurement activities have not been well documented, they are rarely considered when interpretations of prehistoric toolstone procurement behavior are made.

OBSIDIAN SOURCES INVESTIGATED

Ten obsidian source areas on and in the vicinity of NTTR were investigated for this study (Figure 3.1). Fieldwork that Haarklau and Hughes conducted between 2001 and 2003 focused on Obsidian Butte, Oak Spring Butte, the southern Kawich Range, the Goldfield Hills, Stonewall Mountain, and the intervening Stonewall Flat Basin, Shoshone Mountain, Sand Springs Valley, the southern Delamar Mountains, Coyote Spring Valley, and Devil Peak. In 2004, Haarklau, Wagner, and Johnson revisited the Obsidian Butte, Goldfield Hills-Stonewall Flat, Sand Springs Valley, and Delamar Mountains areas to make supplementary field observations. Other areas visited during the final phase of the project include Kane Springs Wash, the Meadow Valley Mountains, the South Pahroc Range, and the Monte Cristo Range. The methodology used to detect and sample sources of obsidian toolstone during the 2004 field investigations is described in Chapter 2.

Obsidian samples collected during these field investigations were used to establish or refine source standards for 15 geochemical varieties of toolstone quality obsidian. The sample locations include five geochemical types from the Obsidian Butte Volcanic Center source, two types from the Kane Springs Wash Caldera, and one type each from Oak Spring Butte, South Kawich Range, Goldfield Hills, Shoshone Mountain, South Pahroc Range, Monte Cristo Range (Crow Spring), Sand Springs Valley (Tempiute Mountain), and Devil Peak (Devil Peak East). A number of these geochemical types were unknowns before the current study. Data from XRF analysis of 496 specimens (476 toolstone-quality

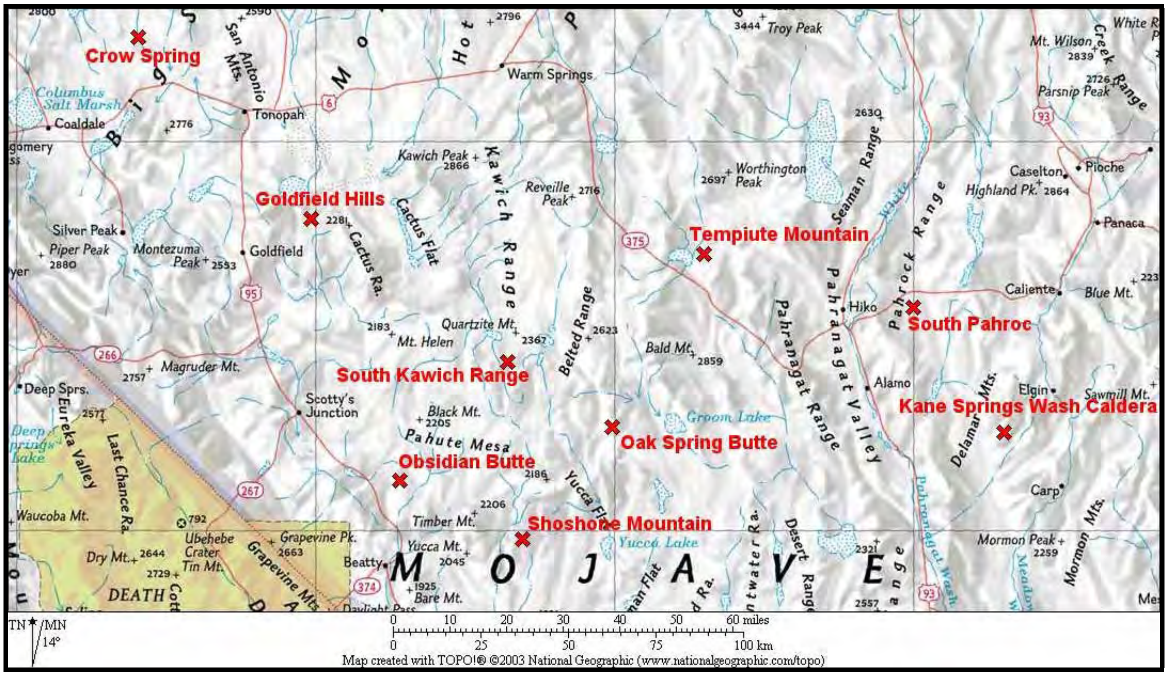


Figure 3.1. Map showing locations of 9 of the 10 obsidian source areas investigated for this study. The Devil Peak East source is on the California-Nevada border, south of the area shown in the map.

obsidian and 20 non-toolstone-quality vitrophyre) collected between 2001 and 2004 are reported by Skinner in Appendix A, and results from investigations conducted in 1999 are reported by Hughes (2001b). Appendix B comprises field descriptions of Obsidian Butte Volcanic Center, Oak Spring Butte, South Kawich Range, Shoshone Mountain, Tempiute Mountain, and Devil Peak East sample locations.

The geology of the Obsidian Butte Volcanic Center is described in Chapter 2, and the archaeological significance of obsidian toolstone varieties from the Obsidian Butte Volcanic Center source area is discussed in Chapter 6. The following descriptions of the Shoshone Mountain, Oak Spring Butte, South Kawich Range, and Devil Peak East sources are based on literature review and information provided in Appendix B. Descriptions of the Goldfield Hills, Kane Springs Wash Caldera, South Pahroc, Tempiute Mountain, and Crow Spring sources are based on literature review and observations made during the 2004 field season. These descriptions provide information about geologic age and context, known geographic distribution of primary and secondary deposits, and other names applied to the source. These data will enable researchers to better interpret prehistoric obsidian toolstone procurement behavior on and in the vicinity of the NTTR and guide future efforts to locate and characterize Great Basin obsidian sources.

Oak Spring Butte and South Kawich Range

The Comendite of Split Ridge, the Grouse Canyon Member of the Belted Range Tuff, and the Dead Horse Flat Formation, three geologic units in the Belted Range Group, reportedly contain obsidian (Macdonald and Bailey 1973; Marvin et al. 1970; Noble 1970; Noble and Parker 1974; Noble et al. 1979; Sawyer and Sargent 1989). Volcanic rocks making up the Belted Range Group were erupted between 13.5 and 13.85 million years ago from the Grouse Canyon Caldera, one of two calderas in the Silent Canyon Caldera Complex. Active during the Main Magmatic Stage of volcanism in the Southwest Nevada Volcanic Field (SWNVF), the Silent Canyon Caldera Complex straddles the NTTR-NTS boundary in Nye County, Nevada. The Grouse Canyon Caldera lies in the eastern part of Pahute Mesa (see Figure 2.1) but is obscured by younger rocks erupted from other nearby but unrelated volcanic centers (Noble et al. 1968; Orkild et al. 1968). X-ray fluorescence analyses of obsidian samples that USGS geologists collected from all three geologic units in the Belted Range Group show that values for certain trace elements overlap. But these specimens can be clearly distinguished from one another based on zirconium (Zr) concentrations (see Appendix A, Table A-1). These data suggest three chemically distinct obsidian varieties are associated with volcanic rocks erupted from the Grouse Canyon Caldera of the Silent Canyon Caldera Complex.

The Grouse Canyon Member of the Belted Range Tuff is a densely welded ash-flow tuff that has a basal vitrophyre of dense glass several inches to several feet thick. Apache tears (marekanites or obsidian nodules) are found within this vitrophyre at a number of widely separated localities (Macdonald and Bailey 1973; Marvin et al. 1970; Noble 1970:2679; Noble and Parker 1974; Noble et al. 1979; Sawyer and Sargent 1989). With an estimated volume of 50 cubic miles, the Grouse Canyon Member of the Belted Range Tuff originally covered approximately 3,000 square miles (Noble et al. 1968:67, 69).

During the 2003 field season, obsidian specimens were collected from Localities H03-31 and H03-32 on the west side of Oak Spring Butte below an outcrop of the Grouse Canyon Member of the Belted Range Tuff (Tbg) capping the butte (Figure 3.2; see Appendix B, Figure B18). Here, nodules of toolstone quality obsidian measure up to 10x6 cm, and prehistoric exploitation of this toolstone is evident (see Appendix B). Trace element values from XRF analysis of specimens collected on the west side of Oak Spring Butte (see Appendix A, Table A-1, Specimen Nos. 151-170) appear to correlate with those for obsidian collected by USGS geologists from the basal vitrophyre of the Grouse Canyon Member (see Appendix A, Table A-1).

Geologic specimens collected near Tub Spring on the southeast side of Oak Spring Butte, in the Split Ridge-Falcon Canyon area on the north east side of Yucca Flat (Figure 3.3), and from several localities on Pahute Mesa during previous archaeological investigations (Buck et al. 1998:221; Hughes 1995a, 1998b; Pippin 1984:50, 56, 1986:51) also have trace element signatures resembling those for the specimens collected at Localities H03-31 and H03-32 (see Appendix E, Table E-1). Although this similarity has resulted in a profusion of confusing names for the Oak Spring Butte geochemical type (e.g., Yucca Flat-Yucca Wash, Split Ridge-Pahute Mesa, and Tubb Spring), these data suggest Oak Spring Butte obsidian occurs in both primary and secondary contexts over a relatively wide area. In addition to the previously mentioned localities, Oak Spring Butte glass potentially occurs in exposures of the Grouse Canyon Member (Tbg) mapped to the west, north, and northeast of Black Mountain, in the southern halves of the Belted and Kawich Ranges, and in the area east of Split Ridge (Barnes et al. 1963; Christiansen and Noble 1968; Hinrichs et al. 1967; Noble and Christiansen 1968; Orkild et al. 1969; Rogers and Noble 1969).

The Dead Horse Flat Formation comprises lava flows that filled and overflowed the Silent Canyon Caldera after the eruption of the Grouse Canyon Member of the Belted Range Tuff (Sargent et al. 1994). Originally mapped by Orkild et al. (1969) as the upper (Trsu) and lower (Trsl) flows of the lava of Saucer Mesa, the Dead Horse Flat Formation covers a large portion of the southern Kawich Range from just north of Dead Horse Flat north to Saucer Mesa (Figure 3.4). Trace element data from the analysis of obsidian collected by USGS geologists from the upper flow (Trsu) on the eastern side of the Kawich Range near Kaw Station show similarities to trace element values reported for the small (4-cm or less) toolstone-quality obsidian nodules collected from secondary contexts at Locality H03-34 on the western edge of the Kawich Range near the mouth of Apache Tear Canyon (Appendix A, Table A-1, Specimen Nos. 180-189), as well as those for the non-toolstone-grade obsidian from H03-33 (Appendix B, Figure B19).

Although a definite correlation cannot be made with available data, the upper flow (Trsu) of the Dead Horse Flat Formation, which crops out widely in the area surrounding Apache Tear and South Apache Tear canyons (see Figure 3.4), is the likely source rock for South Kawich Range obsidian. No evidence of prehistoric exploitation of the small, sparsely distributed nodules found in alluvium at the mouth of Apache Tear Canyon was noted (see Appendix B), but data from the projectile point and ethnohistoric debitage studies (see chapters 4 and 6) indicate nodules of South Kawich Range obsidian were indeed used to manufacture chipped stone tools.

The Oak Spring Butte and South Kawich Range geochemical types may be two related obsidian varieties associated with volcanic rocks

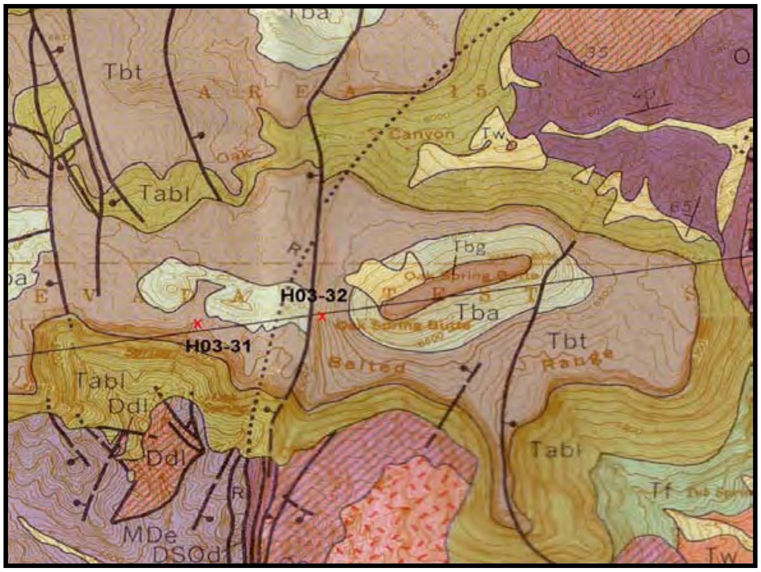


Figure 3.2. Geologic map of the northern half of Oak Spring Butte (Rogers and Noble 1969). Obsidian nodules collected at Localities H03-31 and H03-32 are probably from the Grouse Canyon Member of the Belted Range Tuff capping Oak Spring Butte, here mapped as Tbg.

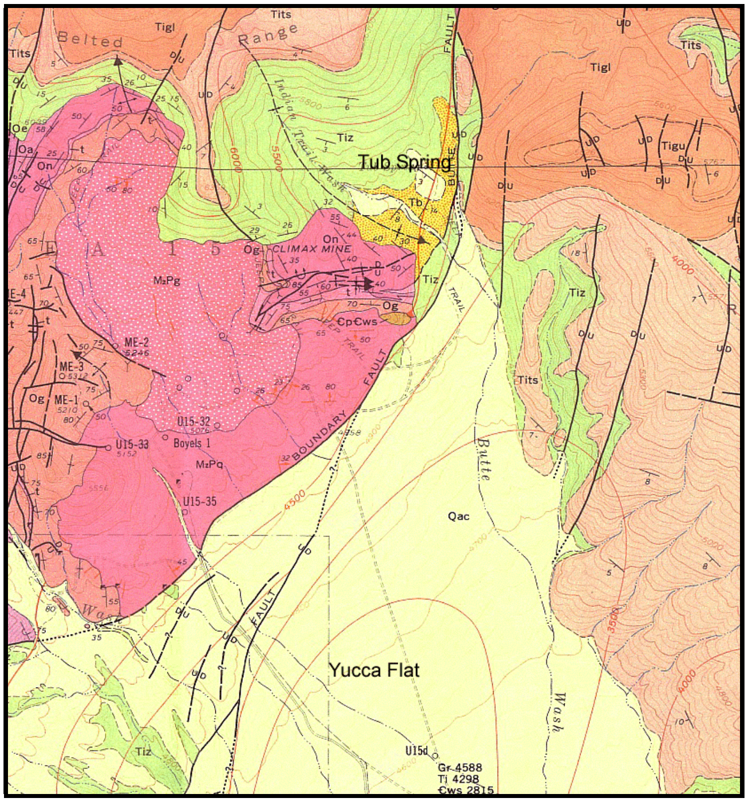


Figure 3.3. Geologic map of the southern half of Oak Spring Butte (Barnes et al. 1963). Obsidian reportedly occurs in a vitrophyre in the lower part of the Grouse Canyon Member of the Belted Range Tuff, here mapped as Tigl. This unit may be the source of obsidian nodules collected in the vicinity of Tub Spring and at the north end of Yucca Flat during earlier investigations.

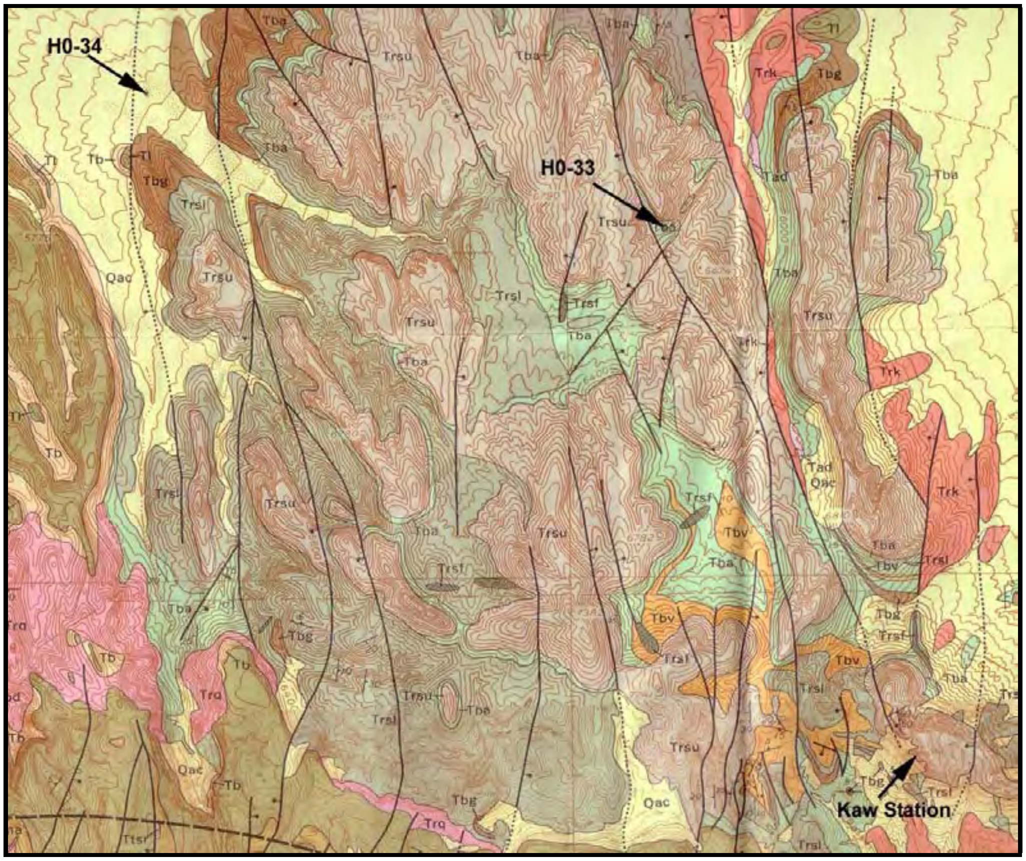


Figure 3.4. Geologic map of the Southern Kawich Range (Orkild et al. 1969). The unit mapped as the upper flow of the Lava of Saucer Mesa (Trsu), renamed the Dead Horse Flat Formation, may be the source of nodules collected from secondary contexts at Locality H03-34. Obsidian collected by USGS geologists from the upper flow near Kaw Station has a similar trace element profile to that of specimens collected at H03-33 and -34. Kaw Station is in the lower right corner of the map.

in the Belted Range Group, erupted between 13.5 and 13.85 million years ago from the Grouse Canyon Caldera of the Silent Canyon Caldera Complex. It should be noted that geological specimens collected in the Split Ridge-Falcon Canyon area (Pippin 1984, 1986) have a trace element signature that is similar to that of obsidian samples collected by USGS geologists from the Comendite of Split Ridge (Figure 3.5; see Appendix A, Table A-1). Although originally considered to be two distinct geochemical types (Haarklau 2001, Hughes 1998a, Kolvet et al. 2000), obsidians found on Split Ridge and Oak Spring Butte are now considered a single type (see Appendix D) that exhibits a wide range of zirconium (Zr) values (i.e., 900–1200 ppm). Clearly, further analyses of geologic specimens are needed to assure that accurate source assignments are made for artifacts fashioned from obsidian toolstone found in the ash flows and lavas that make up the Belted Range Group. With any luck, future research will permit archaeometrists to distinguish between obsidians found in the Comendite of Split Ridge and the Grouse Canyon Member of the Belted Range Tuff, allowing them to refine interpretations of prehistoric toolstone procurement behavior.

Goldfield Hills

The Goldfield Hills are in Esmeralda and Nye counties, Nevada. The northeastern end, which lies in the northwest corner of NTTR, has not been particularly well studied. Cornwall (1972: Plate 1) mapped volcanic rocks in this part of the Goldfield Hills as undifferentiated

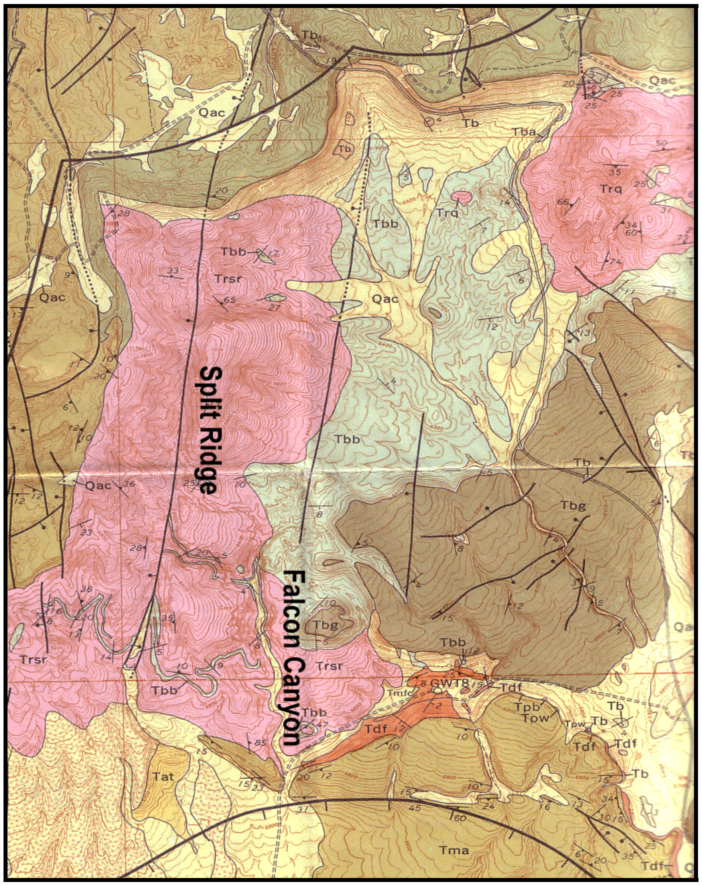


Figure 3.5. Geologic map of the Split Ridge area (Orkild et al. 1969). Obsidian collected by USGS geologists from the unit mapped as the Comendite of Split Ridge (Trsr) is chemically similar to obsidian collected by archaeologists in the Split Ridge-Falcon Canyon and Oak Spring Butte areas (see Appendix X, Table E.1). Split Ridge is on the Nevada Test Site.

Tertiary rhyolite flows and intrusive masses (Tr in Figure 3.6). The rhyolite bodies are "commonly flow layered, partly vitrophyric (glassy), and partly felsitic" and the vitrophyre is usually perlitic (Cornwall 1972:21). Obsidian found in alluvium in Ralston Valley and the Stonewall Flat basin along the north and northeast edges of the Goldfield Hills may come from this unit.

Tertiary rhyolite (Tr) is also mapped on Pahute Mesa immediately east of Stonewall Mountain, which lies south of Stonewall Flat (Figure 3.7). Ball (1907:86–87) reports "for a distance of 2 miles west of the rhyolite, pebbles of black glassy obsidian are common upon the surface of Stonewall Mountain." The rhyolite forms "low, massive brown and gray domes of the eastern part of Stonewall Mountain." This is probably the rhyolite that Weiss and Noble (1989) mapped and described as a rhyolite dome complex composed of lava, breccia, flow-banded intrusive rhyolite, and airfall tuff. According to Weiss and Noble (1989:6062), the Spearhead Member of the Stonewall Flat Tuff, which overlies the rhyolite, contains fragments of comenditic obsidian.

Obsidian nodules were collected from secondary contexts in the vicinity of the Goldfield Hills during several archaeological surveys conducted in the 1990s. Geologic specimens that Kolvet et al. (2000) collected at 26Ny10927, a lithic procurement site in southern Ralston Valley (see Figure 3.6), and near 26Ny10936, an opportunistic quarry-chipping station 3 km north of the Stonewall Flat depression (Figure 3.8), are the same geochemical type as nodules that Pippin (1995) collected from alluvium on the east side of the Goldfield Hills (Hughes 1995b, 1998a). Hughes (1995b, 1998a) refers to obsidian found in alluvial deposits emanating from the Goldfield Hills as the Stonewall Flat geochemical type. According to Kolvet et al. (2000), alluvial deposits north of Stonewall Flat contain small scattered nodules eroded from an unknown primary outcrop, and the nodules found in Ralston Valley are weathering out of volcanic tuff exposed at the northern edge of the Goldfield Hills.

In 2004, obsidian was collected in the northern part of Stonewall Flat basin along a drainage originating near the northeast end of the Goldfield Hills. Small nodules ranging in size from 2 cm to 5 cm are sparsely distributed in alluvial deposits in this area (see Locality DW-04-SF-1 in Figure 3.6), indicating future source location work should focus on the Tertiary rhyolites in the northern Goldfield Hills, especially near the area where Kolvet et al. (2000) report nodules eroding out of a tuff exposure. Because no obsidian specimens from the Stonewall Mountain source that Ball (1907) reported have been subjected to XRF analysis, it would be advisable to inspect this area as well. Trace element data for three specimens collected from Locality

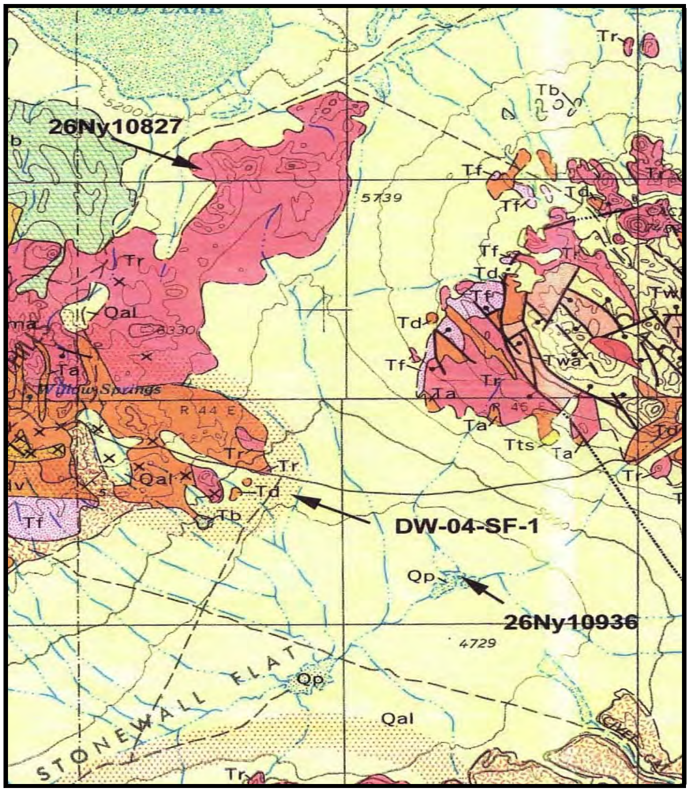


Figure 3.6. Geologic map of the north end of the Goldfield Hills (Cornwall 1972), showing obsidian sampling localities in the Stonewall Flat basin (DW-04-SF-1 and 26Ny10936) and Ralston Valley (26Ny10927). The unit mapped as Tertiary rhyolite (Tr) may be the source of obsidian nodules collected at these localities.

DW-04-SF-1 north of Stonewall Flat, as well as eight nodules collected in Ralston Valley by Kolvet et al. (2000) are reported in Appendix A (Table A-1, Specimen Nos. 273-275 and 418-425). All of the samples have the trace element fingerprint of Stonewall Flat obsidian. The name for this geochemical type has been changed to Goldfield Hills because the primary source rock for obsidian nodules found in alluvium in the northern part of the Stonewall Flat basin and at the south end of Ralston Valley undoubtedly lies in the Goldfield Hills.

Shoshone Mountain

Shoshone Mountain, situated on the NTS in Nye County, Nevada approximately 35 km east of Beatty, primarily comprises rhyolitic rocks mapped as the rhyolite of Shoshone Mountain. As described by Byers et al. (1976) and mapped by Orkild and O'Connor (1970), five stratigraphically distinct units are found in the Rhyolite of Shoshone Mountain (see Figure 3.8). Units A (Tsra), B (Trsb), C (Tsrc), and D (Trsd) consist of devitrified light-brownish gray to grayish-orange-pink, finely flow-banded rhyolite. These rhyolite flows have basal vitrophyres and are underlain by related pyroclastic rocks (ash-fall and ash-flow tuffs and breccia). A plug and dikes of flow-banded rhyolite (Tsp) intrude into the rhyolite lavas, and the plug is probably the vent for the lavas comprising units A–D (Orkild and O'Connor 1970). Christiansen et al. (1977) describe Shoshone Mountain as a major volcano that formed on the southeast flank of the Timber Mountain Caldera. Though it was originally mapped as Pliocene, Byers et al. (1989:5910, Table 1) report a late Miocene age of 9 Ma. Macdonald et al. (1992:142, 172) report major, minor, and trace element chemistry for residual obsidian collected by USGS geologists from perlite in the basal glass of a lava flow in the rhyolite of Shoshone Mountain (Figure 3.9). The Shoshone Mountain obsidian source has also been studied by Dickerson (2003) and Varley and Dickerson (2002). Dickerson (2003:20–21) reports that chunks of obsidian ranging in size from 1 to 15 cm are entrained in and are locally weathered out of a pyroclastic flow that shattered a volcanic plug of high-quality obsidian associated with an earlier-erupted tuff.

Several other names have been applied to obsidian found in primary contexts in the rhyolite of Shoshone Mountain. This geochemical obsidian type was initially called the Fortymile-Topopah-Yucca Wash source because archaeologist first noted obsidian nodules in alluvial terrace gravels along the aforementioned washes (Buck et al. 1998; Hartwell et al. 1996). When Amick (1990, 1993) first studied the secondary source of obsidian along Fortymile Wash, the primary source for nodules in the alluvial deposits was not known. In 1998, archaeologists found obsidian in situ in an outcrop on the north-facing slope of Shoshone Mountain, and the name for the Fortymile-Topopah-Yucca Wash glass type was changed to Shoshone Peak (Hartwell 1998, Hughes 2001a), then later changed to

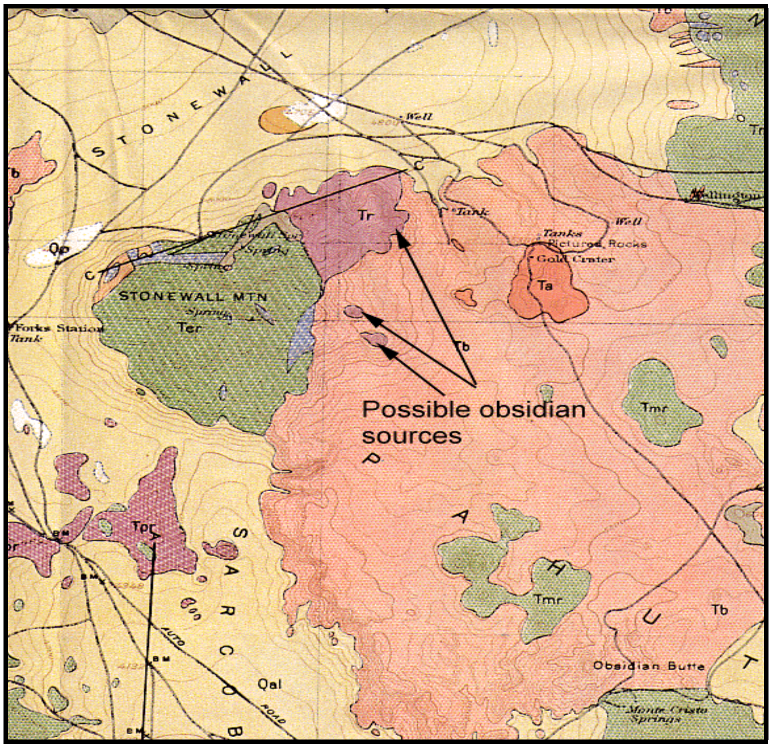


Figure 3.7. Geologic map of Stonewall Mountain and vicinity (Ball 1907). Ball reports "for a distance of 2 miles west of the rhyolite, pebbles of black glassy obsidian are common upon the surface of Stonewall Mountain." These rhyolites, mapped as Tr, form the "low, massive brown and gray domes of the eastern part of Stonewall Mountain." Arrows have been added to indicate rhyolite bodies that are possible sources of obsidian.

Shoshone Mountain by Hughes (2002). Obsidian-bearing outcrops on Shoshone Mountain are also the likely source for obsidian nodules that Moore (1995) collected from secondary contexts at Lathrop Wells, Nevada, as well as the small (2.5–3.5 cm) nodules noted in the Amargosa Desert during archaeological reconnaissance of the Ash Meadows 15' quadrangle (Hunt 1960; Hunt and Hunt 1964). Secondary deposits of Shoshone Mountain obsidian, distributed over wide areas and apparently occurring 60 km or more from primary outcrops (see Figure 3.9), obviously represented an important source of toolstone that was exploited beginning at least by the early Holocene (Buck et al. 1998).

In 2003, an exposure of obsidian was discovered northwest of Shoshone Peak during helicopter reconnaissance of the Shoshone Mountain area (see Appendix B, Figure B20). Hughes (Appendix B) reports Locality H03-35 (Figures 3.9 and 3.10) comprises a "dense concentration of extremely high-quality obsidian" located at about 6660 ft above sea level. Abundant evidence of prehistoric exploitation of obsidian, including biface fragments, cores, and debitage is evident at this locality. Nodules up to 20 cm in diameter were noted, though most were smaller. The H03-35 locality sampled in 2003 is in the pyroclastic rocks associated with Unit D of the Rhyolite of Shoshone Mountain (see Figure 3.8). H03-35 is about 7.5 km south of the locality that the USGS sampled, indicating obsidian is found in primary contexts in at least two places on Shoshone Mountain. Trace element data for obsidian samples collected at H03-35—reported in Appendix A (Table A-1, Specimen Nos. 190-191)—are similar to those for Shoshone Mountain obsidian that the USGS collected (Macdonald et. 1992-143, Appendix I, Specimen 82).

Tempiute Mountain

Geologic specimens that Robert Hafey (2002) collected from an alluvial fan on the east side of Sand Spring Valley in Lincoln County, Nevada, were analyzed at Northwest Research Obsidian Studies Lab and found to have the same trace element profile as a previously unknown obsidian termed Unknown B. The geochemical type is well represented in artifact assemblages from early Holocene archaeological sites in Butte Valley, Nevada, approximately 220 km north of the source (Hafey 2002; Jones et al. 2003:15, 16 Table 3). Jones et al. (2003:38) report that a bedrock source for obsidian nodules eroding from the alluvial fan at the Tempiute Mountain source was not known.

Because Sand Spring Valley adjoins the northeastern NTTR boundary, it was suspected this geochemical type would be identified in artifact assemblages from prehistoric sites on the military installation. In 2003, Hughes and Haarklau visited the Tempiute Mountain source to collect geologic specimens and make field observations. Hughes reports that obsidian nod-

Figure 3.8. Obsidian nodules collected from the south end of Ralston Valley. These nodules, as well as those from Locality DW-04-SF-1 in the northern part of Stonewall Flat Basin (see Figure 3.6) were used to characterize the Goldfield Hills geochemical type.

ules at Locality H03-28 measure up to 8x10 cm and occur as pavement on an alluvial fan (see Appendix B, Figure B17). Abundant evidence of prehistoric use of obsidian in the form of bifaces and manufacturing debris was noted at this locality (see Appendix B, Figure B17 inset). Trace element data for geologic specimens collected from Locality H03-28 are reported in Appendix A (Table A-1, Specimen Nos. 116–125).

The Tempiute Mountain source (Figure 3.11) was revisited in 2004 to confirm field observations made in 2003 by Haarklau, who felt the abundant obsidian nodules at H03-28 were weathering out of an underlying unit rather than eroding from an unknown primary outcrop somewhere to the east, then being transported down slope by fluvial processes. Although H03-28 is on an alluvial fan consisting of older Plio-Pleistocene gravels (QTg in Figure 3.10), as Haarklau suspected, a perlite body in rhyolite that Tschanz and Pampeyan (Tr in Figure 3.12) mapped west of and down slope from the Tempiute Mountain obsidian source does indeed underlie the alluvium.

Although the perlite body is not exposed on the surface at Locality H03-28, soft, gray, obsidian-bearing perlite was observed in shallow open pits that Hafey (2002) excavated as part of an ongoing investigation. Tschanz and Pampayen (1970) mapped the perlite as part of a poorly constrained unit containing all volcanic rocks, but the perlite is clearly in a Miocene rhyolite. The obsidian-bearing unit occurs in a band paralleling the local strike that trends north and dips east at a low angle, strongly suggesting that the obsidian nodules have eroded from the perlite underlying the alluvial fan and are close to the source rather than washed down from the mountains to the east.

South Pahroc Range

The South Pahroc Range, an arcuate range forming the western boundary of Delamar and Pahroc valleys, lies approximately 35 km northeast of NTTR, in Lincoln County Nevada. The range is a fault block tilted to the west with a steep, faulted escarpment on the east side and a gentle western slope. Obsidian occurs in perlitic vitrophyre in an unnamed aphyric rhyolite that Scott and Swadley (1992) mapped as Tar (Figure 3.13). These flows are part of what Scott et al. (1995) describe as “A complex sequence of lava flows, lava domes, and subordinate encapsulating ash-fall and ash-flow tuffs that are distributed throughout northern Delamar Valley. . . .”

Aphyric rhyolite lava flows underlie the Harmony Hills Tuff along the eastern escarpment of the range for a distance of about 5 km.

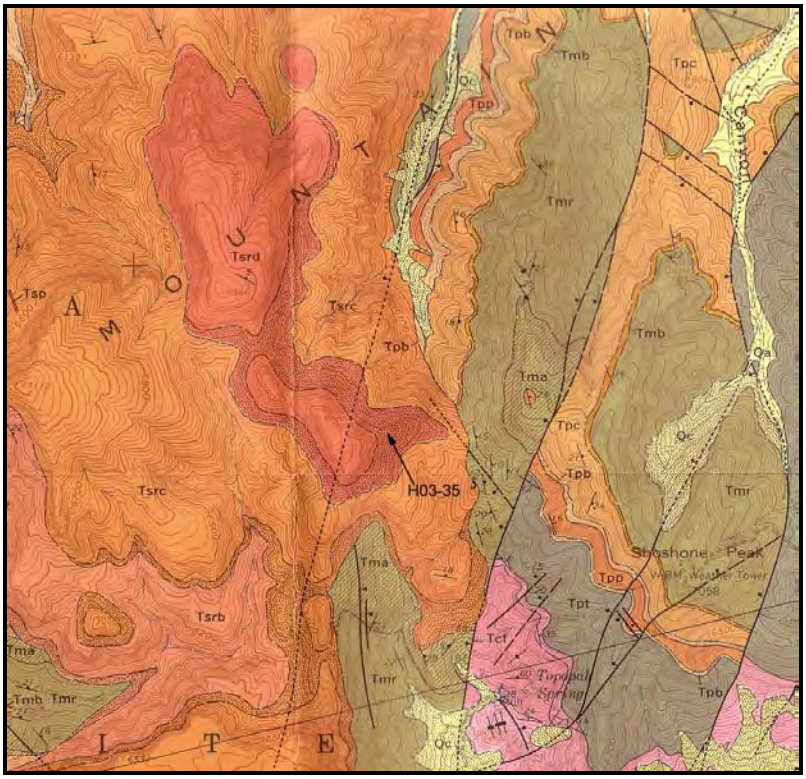


Figure 3.9. Geologic map of the north face of Shoshone Mountain (Orkild and O'Connor 1970), showing Locality H03-35 in the pyroclastic rocks (stippled area) associated with Unit D of the rhyolite of Shoshone Mountain (Tsrd). Nodules at this locality measure up to 20 cm in diameter.

The soft perlite, which is 6 m thick on average, is usually not exposed along this escarpment, but obsidian nodules lying on the lower slopes indicate there is an outcrop beneath a mantle of colluvium. The nodules are generally too small to be used in manufacturing flaked stone tools, though there are specimens measuring slightly more than 5 cm present (Scott and Swadley 1992:7–8; Tschanz and Pampeyan 1970:101). Scott et al. (1995) report that samples of non-hydrated obsidian from the Delamar (Kopenite) Perlite Mine, about 7.5 km south of Hwy 93, yielded K/Ar dates of 18.6 and 18.2 Ma. Tschanz and Pampeyan (1970: 101) describe a measured section of the exposed volcanic sequence.

During the 2004 field season, obsidian samples were collected at Locality DW-04-SP-1 from an outcrop exposed in the cut wall of a perlite quarry. The gray, crumbly perlite, which is shattered by faulting, contains concentrations of small (3-cm or less) nodules of non-hydrated obsidian (Figure 3.14). No evidence of prehistoric procurement of obsidian was noted at this highly disturbed locality. Modern quarrying of the perlite body (Cochran 1951:14; Moring et al. 1988) has undoubtedly created new exposures of obsidian-bearing perlite, affecting the integrity of prehistoric obsidian procurement sites on the east side of the South Pahroc Range. Trace element data obtained for 10 samples from Locality DW-04-SP-1 were used to establish source standards for the South Pahroc geochemical type (Appendix A, Table A-1, Specimen Nos. 408–417).

Crow Spring

The Crow Spring obsidian source is in the Monte Cristo Range, just west of Big Smoky Valley in northern Esmeralda County, Nevada, approximately 60 km northwest of NTTR. Stewart et al. (1994:4) report a date of 7.2 Ma on obsidian from a perlitic vitrophyre that is locally present along the margins of rhyolite flow domes (Tr) forming a northnortheast trending belt on the east side of the Monte Cristo Range (Figure 3.15). Near Crow Spring, obsidian nodules make up anywhere from 5 to 75 percent of a perlite zone found between the Tertiary rhyolite flows and domes (Tr) and a welded ashflow (Taw) (Albers and Stewart 1972:63). The perlite was mined commercially between 1964 and 1965, and obsidian nodules recovered during mining operations were apparently stockpiled for eventual use in producing terrazzo tile (Figure 3.16). Although toolstone-quality obsidian is found in several places in the Monte Cristo Range (Macdonald et al. 1992:172; Moore 1995:48, 1997:68; Silberman et al. 1975:14, 18; Stewart et al. 1994:7; Thomas 1983:395–396), some of this material was likely exposed during modern quarrying operations. Thus, it is difficult to estimate the geographic extent and amount of obsidian available for exploitation during prehistoric times.

Trace element concentrations and Fe/Mn

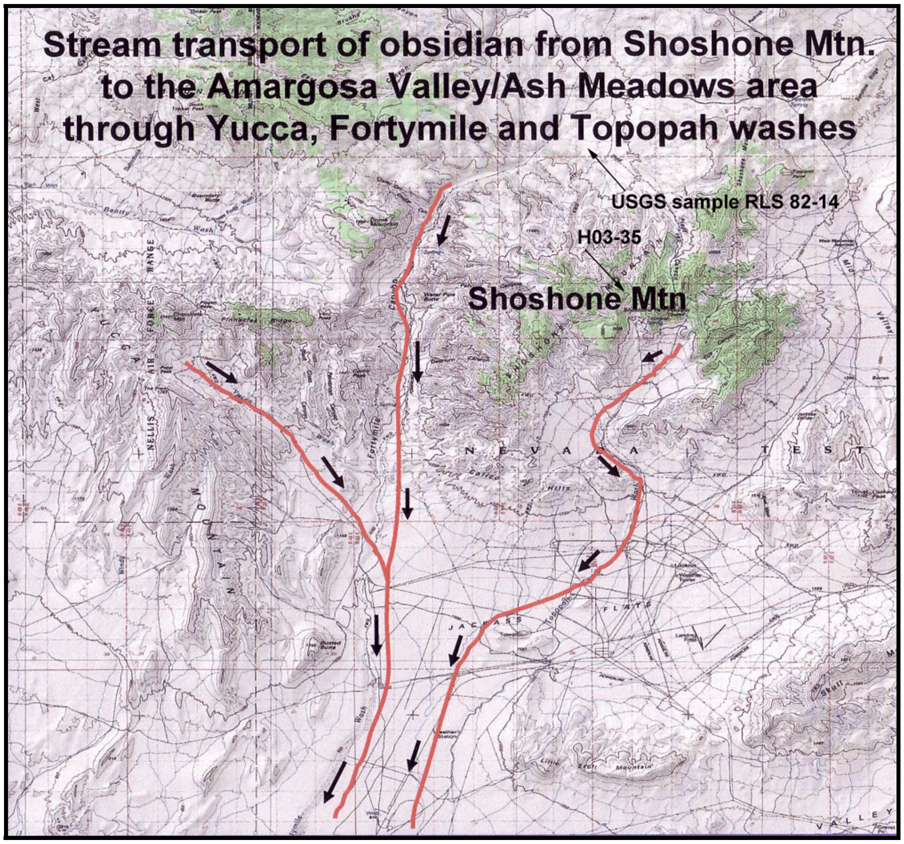


Figure 3.10. Map showing stream transport of Shoshone Mountain obsidian. Nodules occur in alluvial deposits along Yucca, Fortymile, and Topopah washes and have been noted in alluvium in the Amargosa Desert 60 km or more from the primary source. Obsidian nodules collected from primary contexts on the north side of Shoshone Mountain by the USGS (RLS 82-14) and Haarklau and Hughes (HO3-35) have a similar element profile.

ratios determined for three specimens collected in the vicinity of Crow Spring during the Monitor Valley Project first were used to establish geologic source standards for the Crow Spring geochemical type (Hughes 1983:403, Table 77; Thomas 1983; Sappington 1981a). Thomas (1983:395–396) reports obsidian at Crow Spring occurs as fist-sized nodules embedded in a matrix of perlite, and that nodules eroded from the perlite are scattered over several acres. Because the area had been seriously disturbed by extensive mining operations, little evidence of aboriginal procurement activities was noted. Two of the 54 obsidian artifacts from Gatecliff Shelter subjected to XRF analysis during the Monitor Valley Project were attributed to the Crow Spring source (Hughes 1983:406).

During the 2004 field season, nodules were collected from a cut wall at a perlite quarry about 2.5 km southwest of Crow Spring. Obsidian at this locality (DW-04-MCR-1) occurs in a zone of crumbly perlite in a welded ash-flow tuff at the base of the Tertiary volcanic section. Here, nodules ranging in size from one to nearly 8 cm in diameter carpet the ground. No evidence of prehistoric exploitation of obsidian was noted at this extensively disturbed locality, and it could not be determined if obsidian was exposed here and thus available to prehistoric peoples before modern quarrying activities. Although recovered from a different locality in the Monte Cristo Range than the obsidian nodules that Hughes (1983) analyzed during the Monitor Valley Project, the 10 specimens from locality DW-04-MCR-1 have the trace element profile of the Crow Spring geochemical type (see Appendix A, Table A-1, Specimen Nos. 426–435).

Kane Springs Wash Caldera

The Kane Springs Wash Caldera, as origi-

Figure 3.11. Overview of the Tempiute Mountain obsidian source in Sand Springs Valley. The Timpahute Range is in the background.

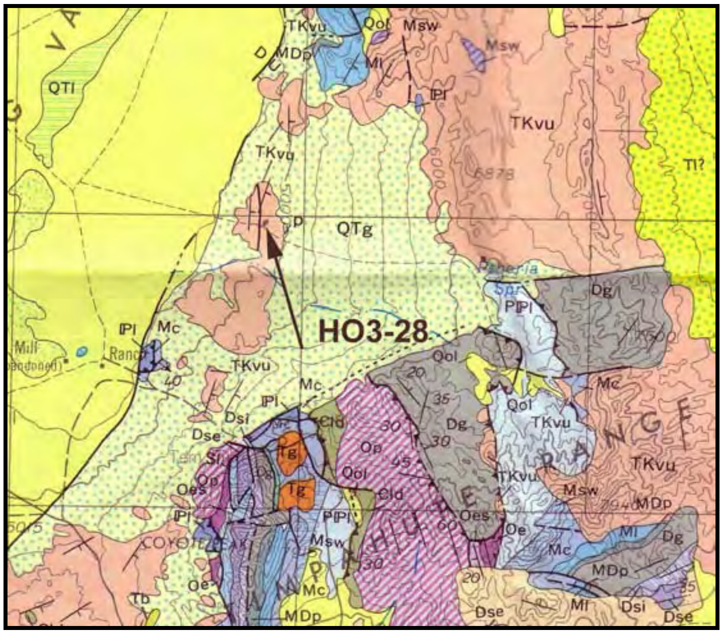


Figure 3.12. Geologic map of Sand Springs Valley (Tschanz and Pampeyan 1970). A perlite quarry (P) lies just west of the Tempiute Mountain source. An obsidian-bearing perlite body underlies a mantle of Plio-Pleistocene gravels (QTg) at Locality H03-28, sampled by Hughes and Haarklau in 2003.

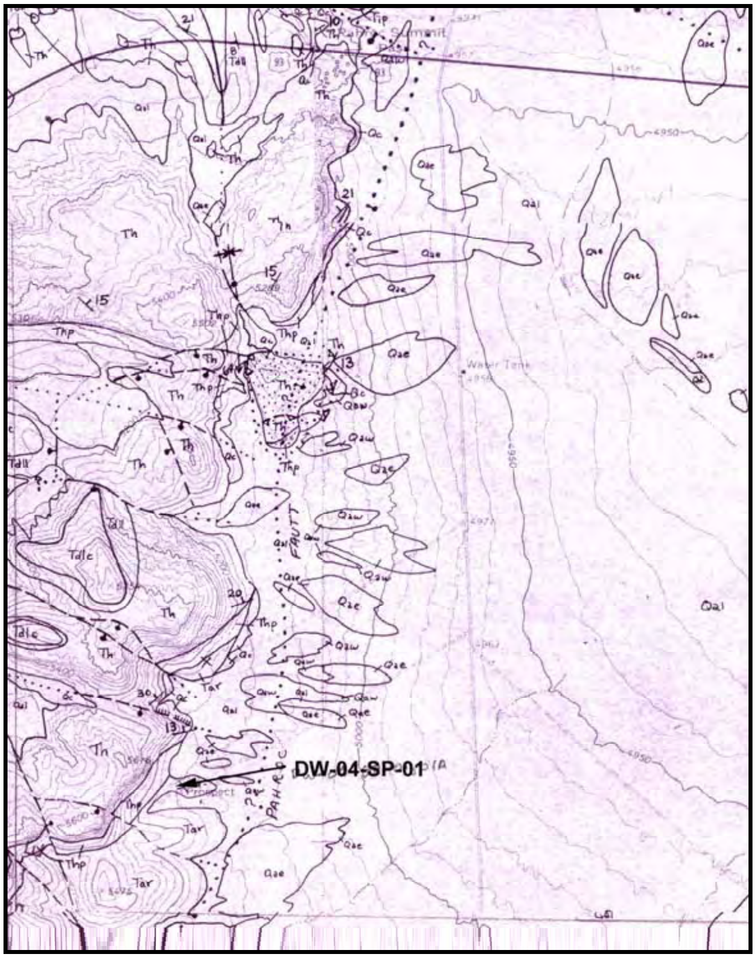


Figure 3.13. Geologic map of the northeast South Pahroc Range (Scott and Swadley 1992), showing Locality DW-04-SP-1. Obsidian is in perlite in the unit mapped as Tar.

Figure 3.14. Obsidian nodules exposed in the cut wall of the perlite quarry at DW-04-SP-1 measure 3 cm or less in diameter.

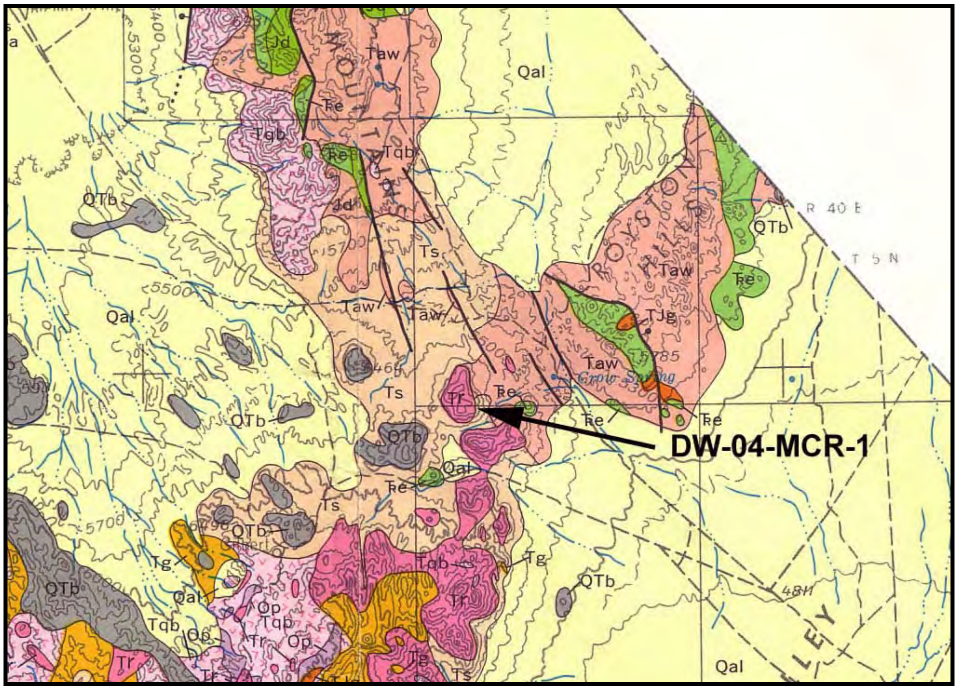


Figure 3.15. Geologic map of the Crow Spring vicinity, Monte Cristo Range (Albers and Stewart (1978: Plate 1). Obsidian is in a zone of perlite locally present along the contact between rhyolite domes (Tr) and welded ash flow (Taw) at the northeast end of the Monte Cristo Range. Obsidian was collected from Locality DW-04-MCR-1 during the 2004 field season.

Figure 3.16. Overview of modern perlite quarry and stockpiled obsidian nodules near Locality DW-04-MCR-1. The Big Smoky Valley is in the background.

nally defined by Noble (1968), is in the Delamar Mountains (see Chapter 2, Figure 2.1). Novak (1984, 1985) and Novak and Mahood (1986) investigated the Kane Springs Wash Caldera in detail, established an eruptive history, and produced valuable chemical data. Harding (1991) and Harding et al. (1995) extended the caldera to include rocks in the Meadow Valley Mountains. The western part of the caldera was mapped in detail by Scott, Novak and Swadley (1990) and Scott, Swadley, Page and Novak (1990), and the segment of the caldera in the Meadow Valley Mountains was mapped by Scott et al. (1991) and Harding (1991). Novak (1984, 1985) showed that caldera collapse occurred at about 14 Ma with eruption of the regionally extensive Kane Springs Tuff.

After the collapse, all subsequent eruptions took place within the caldera. The segment of the caldera in the Meadow Valley Mountains was then displaced about 7 km to the northeast along the left-lateral oblique Kane Springs Wash Fault (Harding et al. 1995). Figure 3.17 shows the basic elements of the caldera, the rim, a crystalline core composed of syenite, and material erupted within the caldera that comprises a diverse assemblage of rocks including basalt, dacite, andesite, and rhyolite.

Artifact-grade obsidian occurs in two intracaldera units that Novak and Mahood (1986) refer to as early and late moat rhyolites. These units are described as high-silica rhyolites that were the last eruptives from the caldera, quite distinct from the earlier magmas because they were primarily formed by melting of wall rocks. The late moat rhyolites are more evolved than the early moat rhyolite, so one would expect the Ba and Sr concentrations should be higher. The two Kane Springs Wash Caldera (KSWC) obsidian varieties analyzed for this project do fit this pattern, but the values that Novak (1985) reported are ambiguous.

Figure 3.18 shows the distribution of the samples collected during this project, sites where Novak (1985) collected marekanites, and some sample localities that Hughes (Appendix B) collected in earlier phases of this project. Samples from DW-04-DM-4, -5, -6, -8, -9, and -10 are all Kane Springs Wash Caldera (KSWC) Variety 1 and show good chemical correlation with marekanites from the early moat rhyolite that Novak (1985) analyzed. Samples from Localities DW-04-DM-12 (Figures 3.19 and 3.20) and DW-04-DM -15 are both primary sources for ob-

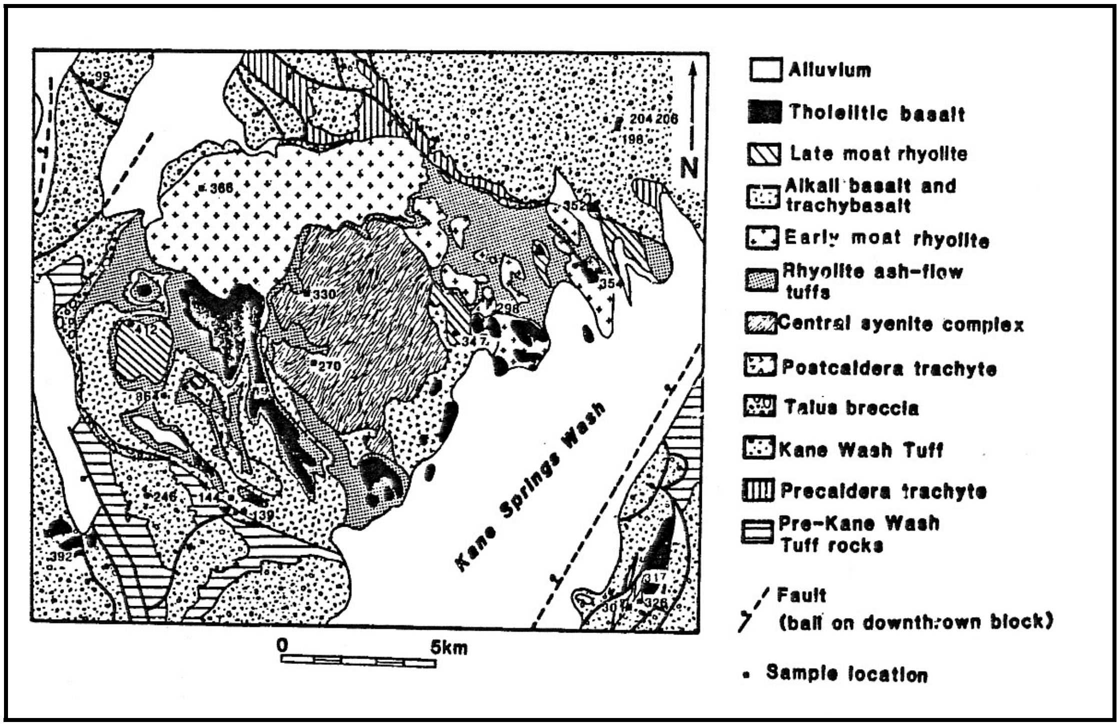


Figure 3.17. Geologic map of the Kane Springs Caldera (Novak 1984). The early moat rhyolite contains KSWC Variety 1 obsidian, and the Late Moat Rhyolite contains KSWC Variety 2.

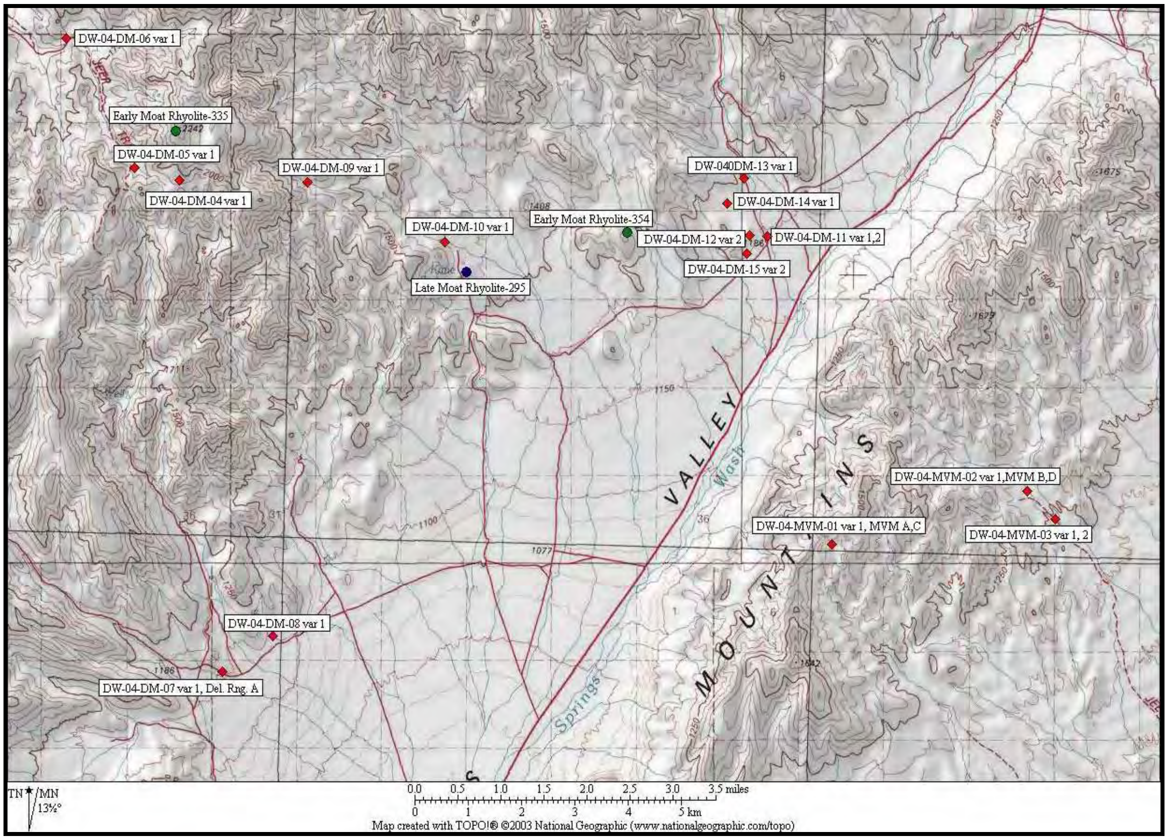


Figure 3.18. Map showing the KSWC localities analyzed by Novak (1984) and for this investigation. Late moat rhyolite indicated by blue dot, and early moat rhyolite indicated by green dot. Samples collected for this investigation and analyzed by Skinner (see Appendix A) indicated by red diamonds in the Delamar and Meadow Valley Wash Mountains

sidian of the Kane Springs Wash Caldera (KSWC) Variety 2 (Kane Springs) geochemical type. KSWC Variety 1 has the same trace element chemistry as an unknown geochemical type formerly called Unknown A and that Hughes later referred to as the Delamar Mountains source. KSWC Variety 2 is the Kane Springs geochemical type first documented in alluvial gravels along Kane Springs Wash by Nelson and Holmes (1979). Sample Localities DW-04-DM-11, -13, and -14 are in secondary contexts and contain a mixture of two KSWC varieties. Trace element data from the analysis of these specimens are reported by Skinner in Appendix A (see Table A-1).

Hughes collected samples from two localities (H03-29 and H03-30) near the western boundary of the Kane Springs Wash Caldera in the Delamar Mountains (Appendix B). Locality H03-29 is in a lithic-rich ash-flow tuff mapped by Scott et al. (1990) as late caldera fill. Samples of porphyritic, hydrated, non-toolstone grade vitrophyre that occur as accidental clasts in the tuff at this locality were sourced as Delamar Varieties A and B. Accidental clasts are exotic in terms of the surrounding tuff matrix, so the significance of these results cannot be evaluated. Toolstone quality obsidian collected form secondary contexts along the road at H0-30 have the trace element signature of KSWC Variety 1. It was at this locality and at Locality H03-31 in Coyote Spring Valley that Haarklau and Hughes first documented secondary sources for the unknown obsidian type formerly called Unknown A. The most likely source for this obsidian is the early moat rhyolites. Scott et al. (1990) report that abundant obsidian pebbles measuring up to 5 cm in diameter are in the Plio-Pleistocene gravel and that the obsidian comes from the Ter unit which is the same unit as Novak's (1984) early moat rhyolite.

In 2004, samples were collected from two localities (DW-04-DM-1 and -2) in the vicinity of H03-30 from an area that Scott et al. (1990)

Figure 3.19. View south across Kane Springs Wash toward Meadow Valley Wash Mountains. The knoll in the middle ground is the collection locality DW-04-DM-12. The obsidian here is Kane Springs Wash Caldera Variety 2. KSWC varieties 1 and 2 were found as float in the wash in the foreground.

mapped as Plio-Pleistocene gravel deposits (Ta). Samples collected at both localities also have the trace element profile of KSWC Variety 1. As in the Meadow Valley Mountains to the southeast across Kane Springs Wash, Harding (1991) and Scott et al. (1991) mapped volcanic rocks that were correlated with those found in the main part of the Kane Springs Wash Caldera in the Delamar Mountains. These rocks include rhyolite lava flows and tuffs that were interpreted as late caldera-fill volcanics that should correlate with the early and late moat rhyolites in the Delamar Mountains. Harding et al. (1995:140–141, Figure 3) and Scott et al. (1991) report that flow-banded rhyolite (Tfb) in the Meadow Valley Mountains contains Apache tears. Analysis of a sample from the Tfb unit (Harding et al. 1995:170, Appendix 2, Table 2a, sample no. 6AH18.4.88) shows trace elements concentrations are similar to Kane Springs Wash Caldera Variety 1 glass. A second unit in the Meadow Valley Mountains may also contain obsidian, though Apache tears are not specifically mentioned. A sample from a biotite rhyolite flow (Tbr) that Harding et al. (1995:140–141, Figure 3 and 171, Appendix 2, Table 2a, sample no. 1AH23.10.88) analyzed shows trace element concentrations similar to those of Kane Springs Wash Caldera Variety 2 (Kane Springs) glass. Pampeyan et al. (1988:C1, C7, C8, Table 1) report that perlite flows and irregular bodies in flows cover several square miles in the Meadow Valley Mountains and that Apache tears are abundant near weathered perlite outcrops.

No primary outcrops containing artifact-grade obsidian were located during a brief reconnaissance in the Meadow Valley Mountains in 2004, though as noted above, geologists (Harding 1991; Harding et al. 1995; Pampeyan et al. 1988; Scott et al. 1991) have reported primary outcrops. A sample of a black hydrated vitrophyre was collected on the crest of the Meadow Valley Mountains at Locality DW-04-MVM-1 that may be in the Tbr unit, though that is not clear from the maps of Harding et al. (1995) or Scott et al. (1991). Although the sample was in situ, the results were mixed because these specimens were sourced as Kane Springs Wash Caldera Variety 1 and Meadow Valley Mountains A and C (Appendix A, Table A-1). How samples collected from a single outcrop can contain three chemical varieties cannot be explained with the data on hand. All of the other samples collected in the Meadow Valley Mountains are from secondary contexts. These samples were identified as Kane Springs Wash Caldera Varieties 1 and 2 and Meadow Valley Mountains B and D. Although the data are inconclusive, it is very likely

Figure 3.20. KSWC Variety 2 obsidian nodules near outcrop of Late Moat Rhyolite of Novak and Mahood (1986). Nodules up to 15 cm in diameter are found at this Locality (DW-04-DM-12). Abundant nodules and manufacturing debris litters the slope below the outcrop.

that primary outcrops of both Kane Springs Wash Caldera varieties occur in the Meadow Valley Mountains. Hull (1992:160) reports obsidian that may be chemically related to KSWC Variety 1 from Meadow Valley Wash east of the Meadow Valley Mountains.

The Kane Springs Wash Caldera, situated to the east of NTTR in Lincoln County, Nevada, is a source area for two chemically distinct but related varieties of obsidian. Nodules of toolstone-quality obsidian ranging in diameter from 1 to 10 cm are available in both primary and secondary deposits that are widely distributed in the Delamar Mountains, along Kane Springs Wash, and in Coyote Spring Valley. Obsidian is also found in the Meadow Valley Mountains, but these occurrences are poorly documented. Although KSWC obsidian is found in primary outcrops on the east side of the Delamar Mountains approximately 55 km east of the eastern NTTR boundary, nodules of both KSWC obsidian varieties eroded from primary outcrops have been transported downstream to the southwest as much as 25 km. Obsidian is thus found in alluvial deposits less than 30 km east of NTTR. Primary sources of KSWC Variety 2 obsidian, previously known only from secondary contexts along Kane Springs Wash, were located during the 2004 field season. Many secondary occurrences of KSWC Variety 1 obsidian, a previously “unknown” geochemical type (Unknown A), were documented in 2003 and 2004. Primary sources of KSWC Variety 1 obsidian are undoubtedly in both the Delamar and Meadow Valley mountains, but these outcrops remain to be found. Future efforts should focus on locating and sampling these outcrops, as well as the secondary deposits of obsidian reported in Meadow Valley Wash by Hull (1992).

Study of the Kane Springs Wash-Meadow Valley Mountains region has yielded valuable information on the methodology of evaluating a multivariate source and the dispersion of variable obsidian into secondary alluvial deposits. Previous investigators (Dames and Moore 1994) sampled outcrops in Kane Springs Wash considered primary, which indeed they are, but did not analyze the samples they collected from secondary contexts, leading them to conclude that a single geochemical obsidian type, Kane Springs, is found in the Kane Springs Wash area. However, analyses of obsidian from the stream courses adjoining the outcrops revealed there are two obsidian varieties present. Samples analyzed for the Dames and Moore (1994) investigation were collected from outcrops from the same stratigraphic horizon. Had alluvial samples been analyzed, it would have been apparent that there must be another geologic source to the northwest in the Delamar Mountains. Based on the geologic structure and stratigraphy, as well as other reports showing two obsidian types in the alluvial deposits, it was recognized during the current investigation that a second geochemical obsidian type occurs in the area. Results reported by Skinner in Appendix A support this interpretation, but a primary source has yet to be located.

Devil Peak

The Devil Peak obsidian source area is in the southern Spring Mountains, approximately 80–85 km south of the southern boundary of NTTR in Clark County, Nevada. This source has been studied by Shackley (1994:119-122), who reports obsidian nodules are found *in situ* on both sides of the Spring Mountains within perlite and vitrophyre found in a series of coalesced Tertiary rhyolite domes. The primary deposits on the east and west sides of the Spring Mountains, separated by a distance of 5 km, are chemically distinct. Shackley (1994) refers to these chemically distinct obsidian types as Devil Peak West and Devil Peak East. As is the case for obsidians found in stratigraphically distinct volcanic rocks in a number of other source areas in the Great Basin, geochemical varieties of obsidian found in the Devil Peak area can be distinguished from one another on the basis of strontium and barium values.

Nodules eroded from primary deposits on either side of the Spring Mountains are found in Mesquite Lake basin to the west and in Roach Lake basin to the east (Shackley 1994). Manufacturing debris found on both sides of the mountains in areas where toolstone quality obsidian occurs in secondary contexts indicates both varieties of Devil Peak obsidian were exploited. According to Shackley (1994:121), obsidian is of higher quality and nodule size is larger (up to 10 cm, though, most are 4 cm or less) at the Devil Peak West source. Nodules found on the east side of the mountains are 2-3 cm or less in diameter, though occasional nodules slightly larger than 5 cm were noted.

During the 2003 field investigations, small obsidian nodules (3–4 cm in diameter) were collected from a layer of perlite at Locality H03-44 on the east face of Devil Peak (see Appendix B, Figure B44). No evidence of prehistoric exploitation of obsidian toolstone was found at this locality. Although the material is reportedly of high quality, use of obsidian found at this locality may have been inhibited by the small size of available nodules. But Shackley (1994:121–122) reports small nodules found in the Devil Peak source area were commonly worked by means of bipolar reduction. Trace element data for 12 obsidian samples collected from Locality H03-44 are reported in Appendix A (Table A-1, Specimen Nos. 261-272).

CONCLUSIONS

This investigation is the most ambitious obsidian sourcing project ever undertaken in the Great Basin. Objectives of this investigation were to refine the regional obsidian source database, locate primary sources for geochemical obsidian types known only from secondary contexts, and find primary geologic sources for the unknown glass types identified in the regional archaeological record. As a result, geologic source standards for 15 geochemical varieties of toolstone quality obsidian were established or refined These include five from the Obsidian Butte Volcanic Center, two from the Kane Springs Wash Caldera, and one each from Oak Spring Butte, South Kawich Range, Goldfield Hills, Shoshone Mountain, South Pahroc Range, Monte Cristo Range (Crow Spring), Sand Springs Valley (Tempiute Mountain), and Devil Peak (Devil Peak East). Primary sources for some of these geochemical varieties were documented for the first time. A number of these were unknowns before the current study.

A methodology for systematically identifying promising obsidian source localities using the most detailed geologic maps, matching published chemical analyses to those from the regional artifact record, and using systematic field sampling strategies was employed. This approach is effective in eliminating inconsistencies in data and in locating primary sources of obsidian. Because Great Basin prehistoric peoples often procured obsidian toolstone from secondary deposits, raw material samples from these procurement localities were included in the source characterization study. Use of this methodology resulted in a comprehensive reconstruction of the obsidian resource base of the prehistoric peoples occupying and using the resources of the NTTR.

REFERENCES CITED

Albers, J. P., and J. H. Stewart
1972 Geology and Mineral Deposits of Esmeralda County, Nevada. *Nevada Bureau of Mines and Geology Bulletin* 78. Mackay School of Mines, University of Nevada, Reno.

Amick, D. S.
1990 Lithic Reduction and Recycling Strategies at an Obsidian Nodule Source in Southern Nevada. Paper presented at the 22nd Great Basin Anthropological Conference, Reno, Nevada.

1993 Toolstone Use and Distribution Patterns among Western Pluvial Lakes Tradition Points from Southern Nevada. *Current Research in the Pleistocene* 10:49–51.

Ball, S. H.
1907 A Geologic Reconnaissance in Southwestern Nevada and Eastern California. *U.S. Geological Survey Bulletin* 308.

Barnes, H., F. N. Houser, and F. G. Poole
1963 Geologic Map of the Oak Spring Quadrangle, Nye County, Nevada. *Map GQ-214*. U.S. Geological Survey.

Buck, P. E., W. T. Hartwell, G. Haynes, and D. Rhode
1998 Archaeological Investigations at Two Early Holocene Sites Near Yucca Mountain, Nye County, Nevada. *Topics in Yucca Mountain Archaeology* Number 2.

Byers, F. M. Jr., W. J. Carr, R. L. Christiansen, P. W. Lipman, P. P. Orkild, and W. D. Quinlivan
1976 Geologic Map of the Timber Mountain Caldera Area, Nye County, Nevada. *Miscellaneous Geologic Investigations Map I-891*. U.S. Geological Survey.

Byers, F. M. Jr., W. J Carr, and P. P. Orkild
1989 Volcanic Centers of Southwestern Nevada: Evolution of Understanding, 1960–1988. *Journal of Geophysical Research* 94(B5):5908–5924.

Cann, J. R.
1983 Petrology of Obsidian Artefacts. In *The Petrology of Archaeological Artefacts*, edited by D. R. C. Kemp and A. P. Harvey, pp. 227–255. Clarendon Press, Oxford.

Christiansen, R. L., and D. C. Noble
1968 Geologic Map of the Trail Ridge Quadrangle, Nye County, Nevada. *Map GQ-774*. U.S. Geological Survey.

Christiansen, R. L., P. W. Lipman, W. J. Carr, F. M. Byers Jr., P. P. Orkild, and K. A. Sargent
1977 Timber Mountain-Oasis Valley Caldera Complex of Southern Nevada. *Geological Society of America Bulletin* 88:943–959.

Cochran K. L.
1951 Perlite resources, Meadow Valley Wash area, Clark and Lincoln Counties, Nevada, Beaver and Millard Counties, Utah: Union Pacific Railroad Co., Los Angeles. Manuscript on file at California Geological Survey, Sacramento.

Cornwall, H. R.
1972 Geology and Mineral Deposits of Southern Nye County, Nevada. *Nevada Bureau of Mines and Geology Bulletin* 77. Mackay School of Mines, University of Nevada, Reno.

Dames and Moore, Inc.
1994 Obsidian Studies. In Kern River Pipeline Cultural Resources Data Recovery Report: Utah, Volume 1, Research Context and Data Analysis, pp 7.1–7.64. Report prepared for Kern River Gas Transmission Company, Salt Lake City.

Dickerson, R.
2003 The Geology of Source Material for Lithic Artifacts in Southern Nevada. 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Ericson, J. E., Hagan, T. A., and C. W. Chesterman
1976 Prehistoric Obsidian in California, II: Geologic and Geographic Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R. E. Taylor, pp. 218–239. Noyes Press, Park Ridge, New Jersey.

Farmer, M.
1937 An Obsidian Quarry Near Coso Hot Springs. *The Masterkey* 11:7–10.

Glascock, M. D., G. E. Braswell, and R.H. Cobean
1998 A Systematic Approach to Obsidian Source Characterization. In *Archaeological Obsidian Studies: Method and Theory*, edited by M.S. Shackley, pp. 15–65. Plenum Press, New York.

Haarklau, L.
2001 Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada. Report No. NAFB 00-04. 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

Hafey, R. L.
2002 Obsidian Quarry Workshop: Source of Butte Valley Group B Located. Paper presented at the 28th Great Basin Anthropological Conference, October 10–12, 2002, in Elko, Nevada.

Harbottle, G.
1982 Chemical Characterization in Archaeology. In *Contexts for Prehistoric Exchange*, edited by J. E. Ericson and T. K. Earle, pp. 13–51. Academic Press, New York.

Harding, A. E.
1991 Evidence for the Kane Springs Wash Caldera in the Meadow Valley Mountains, Southeastern Nevada. University of Colorado, Boulder, M.S. thesis.

Harding, A. E., R. B. Scott, H. H. Mehnert, and L. W. Snee
1995 Evidence of the Kane Springs Wash Caldera in the Meadow Valley Mountains, Southeastern Nevada. In Geologic Studies in the Basin and Range-Colorado Plateau Transition in Southeastern Nevada, Southwestern Utah, and Northwestern Arizona, 1992, edited by R.B. Scott and W.C. Swadley, pp. 131–179. *U.S. Geological Survey Bulletin* 2056 E.

Hartwell, W. T.
1998 Shoshone Peak Obsidian: A Newly Discovered Source for Nodules Found along Fortymile, Yucca, and Tonopah Washes on the Nevada Test Site. Paper presented at the 26th Great Basin Anthropological Conference, October 8–10, 2002, in Bend, Oregon.

Hartwell, William T., Gregory M. Naynes, and David Rhode
1997 Early Obsidian use and Depletion at Yucca Mountain, Southern Nevada: Evidence from Obsidian Hydration Studies. *Current Research in the Pleistocene* 13:57–58.

Hinrichs, E. N., R. D. Krushesky, and S. J. Luft
1967 Geologic Map of the Ammonia Tanks Quadrangle, Nye County, Nevada. *Map GQ-638.* U.S. Geological Survey.

Hughes, R. E.
1983 X-ray Fluorescence Characterization of Obsidian. In The Archaeology of Monitor Valley: 2. Gatecliff Shelter, by D.H. Thomas, pp. 332–353. *Anthropological Papers of the American Museum of Natural History* 59(1), New York.

1985 Obsidian Source Use at Hidden Cave. In The Archaeology of Hidden Cave, Nevada, by D.H. Thomas, pp. 332–353. *Anthropological Papers of the American Museum of Natural History* Volume 61, Part 1. New York.

1995a X-ray Fluorescence Analysis of Geologic Obsidian Samples from the Vicinity of Tubb Spring, Nevada Test Site, Nevada. Geochemical Research Laboratory Letter Report 95–15 submitted to Anne DuBarton, Desert Research Institute, Las Vegas, Nevada, March 23, 1995. Cited in Kolvet et al. 2000.

1995b X-ray Fluorescence Analysis of Geologic Obsidian Samples from Stonewall Flat on the Tonopah Test Range, Nellis Air Force Base, Nevada. Geochemical Research Laboratory Letter Report 95-45 submitted to Anne DuBarton, Desert Research Institute, Las Vegas, dated June 27, 1995.

1998a Appendix D: X-ray Fluorescence Analysis, Geochemical Research Laboratory Letter Report 98-94. In A Stratified Archaeological Sample of Low Elevation Areas on Nellis Air Force Range, Nevada, by R.C. Kolvet et al. 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

1998b Obsidian Sourcing Results. In Springs and Lakes in a Desert Landscape: Archaeological and Paleoenvironmental Investigations in the Silurian Valley and Adjacent Areas of Southeastern California, edited by B.F. Byrd, pp. 683–684. ASM Affiliates, Inc. Report on file at U.S. Army Corps of Engineers, Los Angeles.

2001a Geochemical Research Laboratory Letter Report 2000-121 submitted to L. Johnson, Sacramento, Calif., March 7, 2001.

2001b Geochemical Characterization of Obsidian from Outcrops on the Eastern and Southern Flanks of Obsidian Butte, Nellis Air Force Range, Nevada. In Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada, by L. Haarklau, pp. 27–54. Report No. NAFB 00-04. 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

2002 Geochemical Research Laboratory Letter Report 2002-42. Submitted to L. Johnson and L. Greene, Death Valley National Park, June 10, 2002.

Hughes, R. E., and R. L. Smith
1993 Archaeology, Geology, and Geochemistry in Obsidian Provenance Studies. In Effects of Scale on Archaeological and Geoscientific Perspectives, edited by J. K. Stein and A. R. Linse, pp. 79–91. *Geological Society of America Special Paper* 283.

Hull, K. L.
1992 Obsidian Studies. In Kern River Pipeline Cultural Resources Data Recovery Report: Nevada. Dames and Moore. Report submitted to Federal Energy Regulatory Commission, Washington, D.C.

Hunt, A.
1960 Archaeology of the Death Valley Salt Pan. *University of Utah Anthropological Papers* 47.

Hunt, A. P., and C. B. Hunt
1964 Archaeology of the Ash Meadows Quadrangle, California and Nevada. MS on file at the Western Archaeological Center, Tucson.

Jack, R. N.
1976 Prehistoric Obsidian in California 1: Geochemical Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R.E. Taylor, pp. 183–217. Noyes Press. Park Ridge, New Jersey.

Jack, R. N., and I. S. E. Carmichael
1969 The Chemical Fingerprinting of Acid Volcanic Rocks. *California Division of Mines and Geology Special Report* 100: 17–32.

Jones, G. T., C. Beck, E. E. Jones, and R. E. Hughes
2003 Lithic Source Use and Paleoarchaic Foraging Territories in the Great Basin. *American Antiquity* 68(1):5–38.

Kolvet, R. C., R. Deis, S. Stornetta, and M. K. Rusco
2000 A Stratified Archaeological Sample of Low Elevation Areas on Nellis Air Force Range, Nevada. 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Lipman, P. W., P. D. Rowley, H. H. Mehnert, S. H. Evans Jr., W. P. Nash, and F. H. Brown
1978 Pleistocene Rhyolite of the Mineral Mountains, Utah-Geothermal and Archaeological Significance. *Journal of Research U.S. Geological Survey* 6(1):133–147.

Macdonald, R., and D. K. Bailey
1973 The Chemistry of the Peralkaline Oversaturated Obsidians. *U.S. Geological Survey Professional Paper* 440-N-1. United States Government Printing Office, Washington, D.C.

Macdonald, R., R. L. Smith, and J. E. Thomas
1992 Chemistry of the Subalkalic Silicic Obsidians. *U.S. Geological Survey Professional Paper* 1523. United States Government Printing Office, Washington, D. C.

Marvin, R. F., F. M. Byers Jr., H. H. Mehnert, P. P. Orkild, and T. W. Stern
1970 Radiometric Ages and Stratigraphic Sequence of Volcanic and Plutonic Rocks, Southern Nye and Western Lincoln Counties, Nevada. *Geological Society of America Bulletin* 81:2657–2676.

Moore, J.
1995 Great Basin Toolstone Sources, A Progress Report on the NDOT Obsidian XRF Sourcing Project:1994. Report prepared for the Nevada Department of Transportation, Carson City, Nevada.

1997 Great Basin Tool-Stone Sources, Revised Draft. The NDOT Obsidian and Tool-Stone Sourcing Project: 1999 Progress Report prepared for the Nevada Department of Transportation, Carson City, Nevada.

Moring, B. C., H. R. Blank, H. N. Barton, and T. R. Neumann
1988 Mineral Resources of the South Pahroc Range Wilderness Study Area, Lincoln County, Nevada. *U.S. Geological Survey Bulletin* 1729-A.

Nelson, F. W. Jr.
1984 X-ray Fluorescence Analysis of Some Western North American Obsidians. In Obsidian Studies in the Great Basin, edited by R.E. Hughes, pp.27–62. *Contributions of the University of California Archaeological Research Facility* No. 45, University of California, Berkeley.

Nelson, Fred W., and Richard D. Holmes
1979 Trace Element Analysis of Obsidian Sources and Artifacts from Western Utah. *Antiquities Section Selected Papers* 6 (15). Division of State History, Utah State Historical Society.

Noble, D. C.
1968 Kane Springs Wash Volcanic Center, Lincoln County, Nevada. In Nevada Test Site, edited by E. B. Eckel, pp. 109–116. *Geological Society of America Memoir* 110.

1970 Loss of Sodium from Crystallized Comendite Welded Tuffs of the Miocene Grouse Canyon Member of the Belted Range Tuff, Nevada. *Geological Society of America Bulletin* 81:2677–2688.

Noble, D. C., and R. L. Christiansen
1968 Geologic Map of the Southwest Quarter of the Black Mountain Quadrangle, Nye County, Nevada. *Miscellaneous Geologic Investigations Map I-562*. U.S. Geological Survey.

Noble, D. C., and D. F. Parker
1974 Peralkaline Silicic Volcanic Rocks of the Western United States. *Bulletin Volcanologique* 38(3):803–827.

Noble, D. C., W. L. Rigot, and H. R. Bowman
1979 Rare-Earth-Element Content of Some Highly Differentiated Ash-Flow Tuffs and Lavas. In Ash Flow Tuffs, Edited by C. E. Chapin and W. E. Elston, pp. 77–85. *Geological Society of America Special Paper* 180.

Noble, D. C., K. A. Sargent, H. H. Mehnert, E. B. Ekren, and F. M. Byers Jr.
1968 Silent Canyon Volcanic Center, Nye County, Nevada. In Nevada Test Site, edited by E.B. Eckel, pp. 65–75. *Geological Society of America Memoir* 110.

Novak, S. W.
1984 Eruptive History of the Rhyolitic Kane Springs, Wash Volcanic Center, Nevada. *Journal of Geophysical Research* 89(B10):8603–8615.

1985 Geology and Geochemical Evolution of the Kane Springs Wash Volcanic Center, Lincoln County, Nevada. Ph. D. dissertation, Stanford University.

Novak, S. W., and G. A. Mahood
1986 Rise and Fall of a Basalt-trachyte-rhyolite Magma System at the Kane Springs Wash Caldera, Nevada. *Contributions to Mineralogy and Petrology* (94):352–373.

Orkild, P. P., F. M. Byers Jr., D. L. Hoover, and K. A. Sargent
1968 Subsurface Geology of Silent Canyon Caldera, NTS, NV. In Nevada Test Site, edited by E.B. Eckel, pp. 65–75. *Geological Society of America Memoir* 110.

Orkild, P. P. and J. T. O'Connor
1970 Geologic Map of the Topopah Spring Quadrangle, Nye County, Nevada. *Map GQ*-849. U.S. Geological Survey.

Orkild, P. P., K. A. Sargent, and R. P. Snyder
1969 Geologic Map of Pahute Mesa, Nevada Test Site and Vicinity, Nye County, Nevada. *Miscellaneous Geologic Investigations Map I*-567. U.S. Geological Survey.

Pampeyan, E. H., H. R. Blank Jr., and H. W. Campbell
1988 Mineral Resources of the Meadow Valley Range Wilderness Study Area, Lincoln and Clark Counties, Nevada. *U.S. Geological Survey Bulletin* 1729-C.

Pippin, L. C.
1984 Limited Test Excavations at Selected Archaeological Sites in the NNWSI Yucca Mountain Project Area, Southern Nye County, Nevada. *Desert Research Institute Technical Report* No. 40.

1986 An Overview of Cultural Resources on Pahute and Rainier Mesas on the Nevada Test Site, Nye County, Nevada. *Desert Research Institute Social Sciences Center Technical Report* No. 40.

Rogers, C. L., and D. C. Noble
1969 Geologic Map of the Oak Spring Butte Quadrangle, Nye County, Nevada. Map GQ-822, U.S. Geological Survey.

Sappington, R. L.
1981a A Progress Report on the Obsidian and Vitrophyre Sourcing Project. *Idaho Archaeologist* (4) 4:4–17.

1981b Additional Obsidian and Vitrophyre Source Descriptions from Idaho and Adjacent Areas. *Idaho Archaeologist* (5) 1:4–8.

Sargent, D. A., R. J. Fleck, M. A. Lanphere, R. G. Warren, D. E. Broxton, and M. R. Hudson
1994 Episodic Caldera Volcanism in the Miocene Southwestern Nevada Volcanic Field: Revised Stratigraphic Framework, $^{40}Ar/^{39}Ar$ Geochronology, and Implications for Magmatism and Extension. *Geological Society of America Bulletin* 106:1304–1318.

Sawyer, D. A., and K. A. Sargent
1989 Petrologic Evolution of Divergent Peralkaline Magmas form the Silent Canyon Caldera Complex, Southwestern Nevada Volcanic Field. *Journal of Geophysical Research* 94(B5):6021–6040.

Scott, R. B., C. S Gromme, M. G. Best, J. G. Rosembaum, and M. R. Hudson
1995 Stratigraphic Relationships of Tertiary Volcanic Rocks in Central Lincoln County, Southeastern Nevada. In Geologic Studies in the Basin and Range-Colorado Plateau Transition in Southeastern Nevada, Southwestern Utah, and Northwestern Arizona, 1992, edited by R. B. Scott and W. C. Swadley, pp. 5–41. *U.S. Geological Survey Bulletin* 2056.

Scott, R. B., A. E. Harding, W. C. Swadley, S. W. Novak, and E. H. Pampeyan
1991 Preliminary Geologic map of the Vigo NW quadrangle, Lincoln County, Nevada. *U.S. Geological Survey Open-File Report* 91-389.

Scott, R. B., S. M. Novak, and W. C. Swadley
1990 Preliminary Geologic Map of the Delamar 3 NE Quadrangle, Lincoln County, Nevada. *U.S. Geological Survey Open-File Report* 90-33.

Scott, R. B., and W. C. Swadley
1992 Preliminary geologic map of the Pahroc Summit Pass and Hiko SE quadrangles, Lincoln County, Nevada. *U.S. Geological Survey Open-File Report* 92-423.

Scott, R. B., W. C. Swadley, W. C. Page, and S. W. Novak
1990 Preliminary Geologic Map of the Gregerson Basin Quadrangle, Lincoln County, Nevada. *U.S. Geological Survey Open-File Report* 90-646.

Shackley, M. S.
1994 Intersource and Intrasource Geochemical Variability in Two New Archaeological Obsidian Sources in the Southern Great Basin: Bristol Mountains, California and Devil Peak, Nevada. *Journal of California and Great Basin Anthropology* 16(1):118–129.

1998 Intrasource Chemical Variability and Secondary Depositional Processes. In *Archaeological Obsidian Studies: Method and Theory*, edited by M.S. Shackley, pp. 83–102. Plenum Press, New York.

Silberman, M. L., H. F. Bonham Jr., and D. H. Osborne
1975 New K-Ar Ages of Volcanic and Plutonic Rocks and Ore Deposits in Western Nevada. *Isochron / West* 13:13–21.

Singer, C. A., and J. E. Ericson
1977 Quarry Analysis at Bodie Hills, Mono County, California: A Case Study. In Exchange Systems in Prehistory, edited by T.K. Earle and J.E. Ericson, pp.171–188. Academic Press, New York.

Stewart, J. H., P. C. Kelleher, and E. A. Zorich
1994 Geologic Map of the Monte Cristo Range Area, Esmeralda and Mineral Counties, Nevada. *USGS Map MF-2260*.

Thomas, D. H.
1983 The Archaeology of Monitor Valley 2: Gatecliff Shelter. *Anthropological Papers of the American Museum of Natural History New York* Volume 59: Part 1.

Tschanz, C. M., and E. H. Pampeyan
1970 Geology and Mineral Deposits of Lincoln County, Nevada. *Nevada Bureau of Mines and Geology Bulletin* 73. Mackay School of Mines, University of Nevada, Reno.

Varley, K., and R. P. Dickerson
2002 Source Rock for Obsidian Projectile Points, Nevada Test Site. Paper presented at the Annual Meeting of the Geological Society of America. Denver, Colorado.

Weiss, S. I., and D. C. Noble
1989 Stonewall Mountain Volcanic Center, Southern Nevada: Stratigraphic, Structural, and Facies Relations of Outflow Sheets, Near-vent Tuffs and Intracaldera Units. *Journal of Geophysical Research* 94(B5):6059–6074.

PREDICTING WESTERN SHOSHONE OBSIDIAN PROCUREMENT THROUGH SOCIOECONOMIC PATTERNS: STEWARD'S RESEARCH VALIDATED

4

Lynn Haarklau

As discussed in Chapters 2 and 3, millions of years of rhyolitic volcanism produced many obsidian outcrops throughout the Great Basin. For thousands of years, Great Basin native peoples procured obsidian to manufacture sharp, chipped stone tools. Because each obsidian flow produced during an eruptive event possesses a unique and quantifiable minor and trace element chemistry, researchers can determine the place of origin of the raw material from which Great Basin people manufactured their obsidian tools.

Preliminary research on the northern Nevada Test and Training Range (NTTR) ranges, situated in the central Great Basin of Nevada, indicated that toolstone-quality obsidian sources are abundant in the study area (Hughes 2001). Obsidian sources identified in small artifact samples retrieved from hunting camps and obsidian scatters near plant foods were local, indicating that indigenous people procured obsidian raw material from nearby sources while traveling to or occupying the sites (Haarklau 2001). But sources of obsidian artifacts collected during previous studies (Dames and Moore, Inc. 1998; Kolvet et al 1999) from other site types such as temporary camps are outside the study area, some more than 300 km distant (Haarklau 2001).

The preliminary study results indicated that obsidian artifact sourcing research has tremendous potential for mapping human behavior patterns in the study area but also raised further questions. If people who occupied specific residential camps procured obsidian while on hunting and plant-food-gathering expeditions, then most artifact sources from the site should indicate the general area traveled to acquire food. Distant artifact sources might indicate trade, but the word does little to elucidate the process. Why would people who could easily manufacture their own tools from local obsidian desire similar tools from more distant sources? Did people living 300 km distant travel back and forth to visit, leaving a few tools behind, or did groups residing between pass the items along? Fortunately, a great deal of documentation exists that addresses ethnohistoric-period Great Basin peoples' socioeconomic patterns. These data provide the material necessary to construct a predictive model and test of ethnohistoric-period obsidian procurement in the study area.

ETHNOHISTORIC PERIOD SOCIOECONOMICS OF THE STUDY AREA

The study area is on the northern NTTR ranges and north Nevada Test Site (NTS) in central Nevada (Figure 4.1), ethnohistoric period homeland to Western Shoshone people. During the 1920s and 1930s, anthropologist Julian Steward conducted ethnographic reconnaissance among the Great Basin Native Americans, whom he referred to collectively as the Basin-Plateau Peoples. He recorded a great deal of data derived from the collective memories of these Native Americans in efforts to reconstruct their lives before the socioeconomic and sociopolitical changes that occurred when Western settlers began populating the area (Steward 1997 [1938], 1941).

Steward (1997:230–232, 256–258 [1938]) described the Basin-Plateau Peoples as highly mobile families relying heavily on the plant resources of the stark and arid region, especially in the study area. Population density was quite

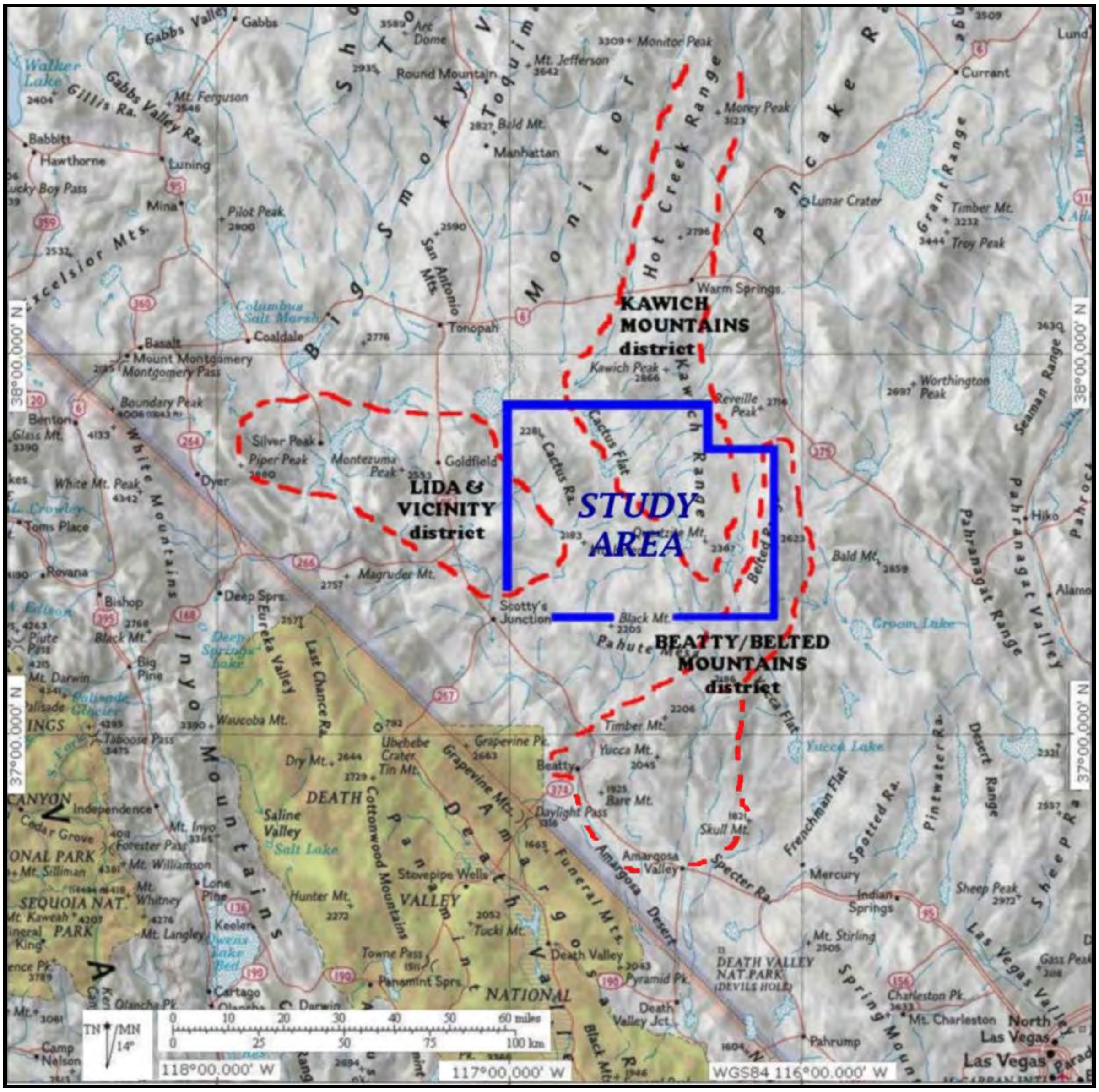


Figure 4.1. Rough boundaries of the study area and Steward's (1997 [1938]) Western Shoshone Districts.

low, and families often traveled hundreds of miles each year in subsistence pursuits. Individual families or small groups of families positioned their winter camps, the most long-lived Western Shoshone residences, near reliable water sources and abundant plant resources, most often near pinyon pine forests. Because pinyon pine nuts were a significant dietary staple, families frequently relocated winter camps in relation to local abundance of the resource.

The bilateral family with division of labor by gender was the most cohesive form of social organization that Steward (1997:236 [1938]) observed among most Basin-Plateau Peoples. He delineated what he called districts of families, however, where winter camps and villages were relatively nearby and cooperation between families was high because of intermarriage. District families shared food procurement areas and cooperated in the occasional communal hunts. In the study area are portions of the Lida and Vicinity Shoshone, Kawich Mountains Shoshone, and Beatty-Belted Mountains Shoshone districts (see Figure 4.1).

Rather than geographic proximity, abundance of foods in localized, resource-dense areas was a primary factor promoting socioeconomic interactions between families of different districts. Divorce and accusations of witchcraft and other offenses could disrupt relationships between neighboring families within and between districts. Large groups of Western Shoshone families from different districts seldom gathered. Annual fall festivals were the only "social determinant" that produced "temporary cohesion" for large groups making up several districts (Steward 1997:237–238 [1938]).

Western Shoshone families generally held annual inter-district festivals in autumn, concurrent with pinyon pine nut harvests. Festivals were held after rabbit drives in districts in which pinyon pine woodlands were sparse. Because the storable resource was so significant to the Western Shoshone diet, abundance of pinyon pine nuts in a particular area was the primary factor promoting inter-district aggregations for brief periods. The large quantities of meat procured during rabbit drives—mainly held to acquire quantities of pelts for winter blankets—allowed for inter-district gatherings lasting as long as a month in some areas (Steward 1997:44–46, 83, 90, 98, 237 [1938]).

Autumn festival activities included feasting, exhibition and group dancing, gambling, acquisition of wives, information exchange, and in some districts, mourning ceremonies. Although Steward (1997:237 [1938]) indicates that festivals were "noneconomic" and that trade was nearly nonexistent, his documentation of festival activities implies that trade was a component of these intra- and inter-district gatherings. Festival exhibition dancers were paid for their performances, gambling involved material exchange, and acquiring a wife required a bride-price, which could include food items, material goods, and strings of shell beads from coastal California. Specialized stone tools, ceramics, salt, twisted rabbit-skin rope, rabbit-skin blankets, buckskin, roots, pinyon pine nuts, sinew-backed bows, and moccasins were among some of the more desired Great Basin trade items (Steward 1997:44–45 [1938]).

Lida and Vicinity District

The Lida and Vicinity district includes the Goldfield Hills and Stonewall Mountain to the east, Montezuma Range to the north, southeastern Silver Peak Range to the west, and Sylvania Mountains to the south (see Figure 4.1). Steward (1997:69–70 [1938]) estimated that population density was very low because resources were scarce in the comparatively barren region (Figure 4.2). The largest winter village, comprising five families, was in the foothills of the Palmetto Mountains near the town of Lida. Permanent water sources and productive pinyon forest were most abundant in that area. Families of the Lida and Vicinity district routinely gathered seeds and berries in the arid valleys of the district and in autumn burned brush to increase the productivity of seed plants in gathering lands near winter villages and camps. Individual families hunted deer, bighorn sheep, antelope, and small game in the mountains and valleys.

The easternmost winter camps and villages, *Tumbasai'uwi* (rock/water/fall down) at Stonewall Mountain and *Matsum* in the Goldfield Hills, lie in the western portion of the study area. Seven people lived at Palmetto Fred's camps near the springs on Stonewall Mountain, and Matsum Sam and a few other people lived at a three-spring complex, *Kamuva* (jackrabbit/water), Wildhorse Spring (*Hugapa*: cane/water), and *Wi:pa* (knife/water), in the Goldfield Hills (Steward 1997:69[1938]). The Matsum area is unique in that it is the only winter village in the Bailey Greasewood (*Sarcobatus baileyi*)-Shadscale (*Atriplex confertifolia*) vegetation alliance rather than at the edge of Pinyon Pine (*Pinus monophylla*)-Utah Juniper (*Juniperus osteosperma*) alliance (Pritchett and Smith 2001:4–6, Appendix A).

Steward's (1997 [1938]) Figure 7 map indicates that Lida and Vicinity Shoshone families occupying winter camps in the study area traveled west to the Montezuma Range and Silver Peak Range near Lida to gather pinyon pine nuts. The Pinyon Pine-Utah Juniper alliance also dominates at elevations from 1,950 to 2,440 m on Stonewall Mountain, thus making it reasonable to assume that Palmetto Fred's people gathered pinyon pine nuts in this area as well. Seed plants that include muttongrass (*Poa fendleriana*) and squirreltail (*Elymus elymoides*) and berries such as desert gooseberry (*Ribes velutinum*), Utah serviceberry (*Amelanchier utahensis*), fragrant snowberry (*Symphoricarpos longiflorus*), all of which the Western Shoshone consumed (Steward 1997:22–30 [1938]), are common plant foods on Stonewall Mountain (Pritchett and Smith 2001:4–6, Appendix A).

Big sagebrush (*Artemisia tridentata*), the

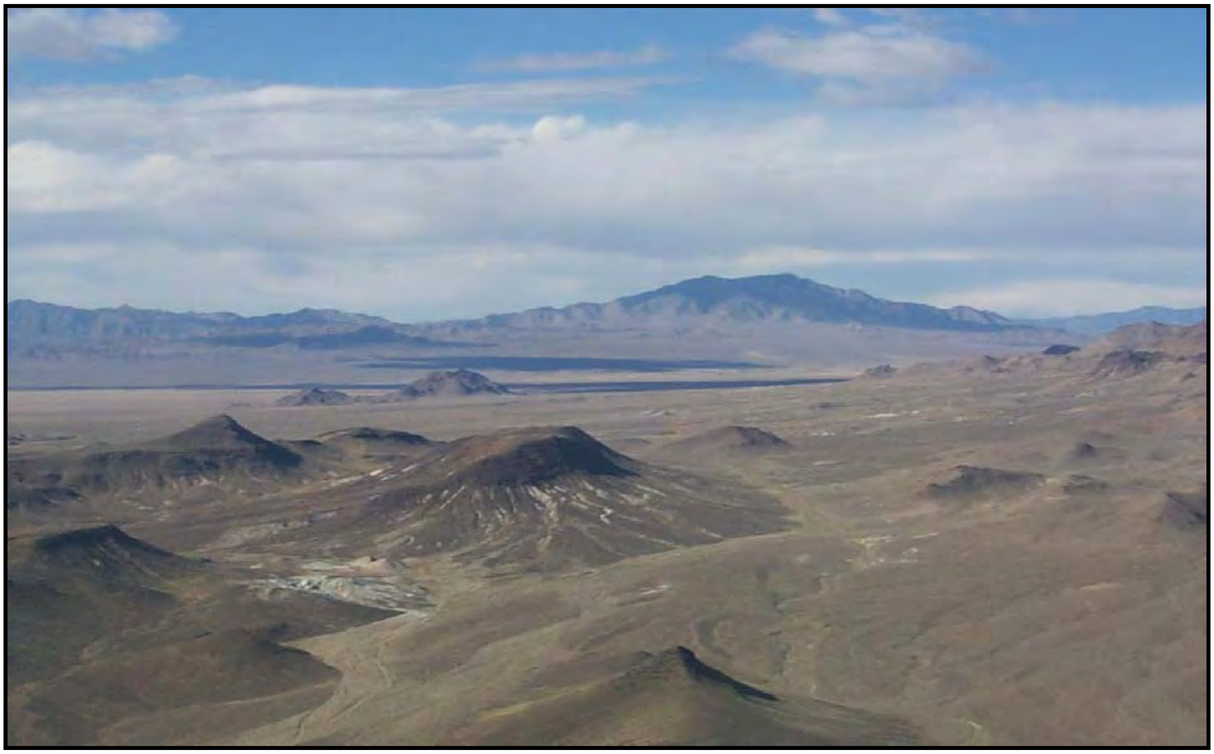


Figure 4.2. Aerial view of the northeastern Lida and Vicinity district landscape. The Goldfield Hills make up the foreground; the Montezuma Range and more distant Silver Peak Range form the horizon. Vegetation is comparatively sparse in this Western Shoshone district.

fuel of choice for most Western Shoshone people (Steward 1941:286), co-occurs in the Pinyon Pine-Utah Juniper community on Stonewall Mountain. The plant species occurs in even greater abundance at elevations from 1,765 to 2,225 m, where the Big Sagebrush alliance dominates (Pritchett and Smith 2001:4–6, Appendix A). Stonewall Mountain plant and water resources also support animal populations that Lida and Vicinity Western Shoshone hunted and trapped. These include desert bighorn sheep (*Ovis canadensis*), seasonal herds of mule deer (*Odocoileus hemionus*), and small game such as mountain cottontail (*Sylvilagus nuttalli*) (Dames and Moore, Inc. 1997; Nevada Division of Wildlife 2000; Steward 1997:70 [1938]).

The easternmost Lida and Vicinity Shoshone families gathered seeds on the bajadas of the Cactus Range where the Bailey Greasewood–Shadscale alliance dominates. Joshua tree (*Yucca brevifolia*) and Nevada ephedra (*Ephedra nevadensis*), plants Great Basin peoples used, are common in the area. The Shadscale–Winterfat (*Krascheninnikovia lanata*) alliance dominates on the arid, sandy, highly saline valley floor of east Cactus Flat, an additional seed-gathering place (Steward 1997:Figure 7 [1938]). Indian ricegrass (*Acnatherum hymenoides*) is abundant in this area (Pritchett and Smith 2001:4–6, Appendix A).

Desert bighorn sheep inhabit most of the easternmost Lida and Vicinity district at elevations between 1,430 and 2,225 m on the craggy slopes of Stonewall Mountain and the Cactus Range, and canyons and arroyos on Pahute Mesa. Pronghorn (*Antilocapra americanus*) are attracted to the springs in the foothills of the Cactus Range. Black-tailed jackrabbit (*Lepus californicus*) and a variety of rodents that Western Shoshone families routinely trapped and consumed are common in all foothills, valleys, and mesas of the study area (Nevada Division of Wildlife 2000; Steward 1997 [1938]).

Lida and Vicinity Shoshone are the only people of the study area who did not host fall festivals in their district. This might be because pinyon pine woodlands are sparse in the region. District families most often joined Fish Lake Valley Northern Paiute and Deep Springs Valley Northern Paiute families to the west for these annual events. People aggregated for about six days in the autumn after the pinyon pine nut harvest and before returning to winter residences. Activities included rabbit drives during the day and gambling, feasting, and dancing during the night (Steward 1997:60, 65–66, 70 [1938]).

The Fish Lake Valley district lies on the California-Nevada border and includes all of Fish Lake Valley, the eastern flanks of the White Mountains to the west, the western flanks of the Silver Peak Range to the north and east, and the Sylvania Mountains to the south. The Deep Springs Valley district in east-central California comprises all of Deep Springs Valley, the White Mountains to the northwest, and the Inyo Mountains to the southeast. Families generally used valleys and flats in each of the districts for seed gathering and rabbit drives and higher elevations for berry and pinyon pine nut gathering and encampments (Steward 1997:50–70 [1938]).

In the latest ethnohistoric times, Lida and Vicinity-Fish Lake Valley-Deep Springs Valley festivals were held in the Fish Lake Valley district at Pigeon Springs (*Tün ăva*) in the Sylvania Mountains. In years of poor pinyon pine nut production in the Sylvania Mountains, people went to Oasis, California, where rabbit drives provided excess food for festival aggregatison. Before the late 1800s, population density was higher in the Deep Springs Valley district and a reciprocal fall festival host relationship existed between the Deep Springs Valley and Fish Lake Valley people. Places designated for annual festivals alternated between Wyman Canyon and Deep Springs Lake in Deep Springs Valley, and Pigeon Springs and Oasis in the Fish Lake Valley district. Occasionally, some Owens Valley Paiute families attended the Deep Springs Valley district festivals (Steward 1997:60, 65–66, 70 [1938]).

Kawich Mountains District

The Kawich Mountains district includes the entire Kawich Range and the southern Hot Creek Range to the north, although delineation of the northern boundary is vague (see Figure 4.1). The Kawich Mountains district included 15 to 20 Western Shoshone families totaling about 90 to 120 individuals, a population density of about 1 person per 20 square miles. Winter villages, comprising an average of three families, were generally near springs at the edge of pinyon-juniper woodlands. When establishing high elevation camps in areas lacking perennial springs, families used snowmelt as a water source (Steward 1997:109–113).

Families gathered pinyon pine nuts, seeds, berries, and tubers and hunted and trapped throughout the district's mountains, foothills, and adjoining valleys. In years of scarcity, however, the district head person would allocate pinyon pine nut gathering plots to each family. The only other subsistence events that required organization beyond the family level were annual, late-autumn rabbit drives, directed by a rabbit-drive leader, and the occasional springtime antelope drives, directed by an antelope shaman (Steward 1997:111–112 [1938]).

The south half of the Kawich Mountains district lies in the northern study area. Steward (1997:111–112 [1938]) indicates that winter camps and villages in the study area were located near Breen Creek (Figure 4.3) where the district head person, Chief Kawatč , and his extended family resided. The area is shown in Figure 4.3. Also in the study area are winter camps near Rose Spring (*Tüava*: serviceberry/water) where two Kawich Mountains Shoshone families lived.

Unique to the Kawich Range at elevations of about 2,680 m on steep north-northwest facing slopes is the Limber Pine (*Pinus flexilis*) alliance, associated with big sagebrush and wax currant (*Ribes cereum*) (Pritchett and Smith 2001:4–6, Appendix A). These resources would have provided fuel and additional food when Kawich Mountains district families established high-elevation (≥2100 m) winter camps. High-elevation camps were situated near bountiful pinyon pine forests where melted snow served as a water source (Steward 1997:111 [1938]).

Found at elevations from 1950 to 2440 m, the Pinyon Pine-Utah Juniper alliance is significantly more expansive in the Kawich Range. The Black Sagebrush (*Artemesia nova*) alliance dominates on the lower slopes at elevations from 1700 to 2350 m where soils are thin or rocky. Ephedra, Indian ricegrass, squirreltail, and big sagebrush co-occur throughout this vegetation zone. Most Kawich Range permanent water sources are in the Big Sagebrush alliance, which dominates at elevations from 1765 to 2225 m where soils are relatively thick (Pritchett and Smith 2001:4–6, Appendix A).

Figure 4.3. The Breen Creek landscape. This was the site of Kawich Mountains district winter camps and autumn festivals. Willows (center) line the edges of the stream.

The plant and water resources of the Kawich Range maintain year-round mule deer populations that Kawich Mountains district people hunted for food and hides. The Big Sagebrush alliance provides habitat for a substantial population (now greater than 300 individuals) of pronghorn antelope (Figure 4.4). These animals roam the foothills of the Kawich Range, Cactus Flat, and Kawich Valley (Nevada Division of Wildlife 2000).

Kawich Mountains district people were unique among the study area's groups in that they occasionally conducted antelope drives. An antelope shaman directed the drives that took place on east Cactus Flat, situated in the study area and supporting a substantial pronghorn

Figure 4.4. Pronghorn herd wintering in Kawich Valley.

population. This area was also the site of communal rabbit drives, which lasted for up to a month. Nearby Breen Creek, the area in which people of several districts often aggregated for autumn festivals, provides a unique big sagebrush and wetlands environment that seasonally supports a population of sage grouse (*Centrocercus urophasianus*). Western Shoshone people snared the large game birds in nets (Steward 1997:22, 111–112 [1938], 1941:273; Stevenson 2000).

Kawich Mountains district festival participation with other districts appears to have been minimal compared to others that Steward discussed (1997:109–113, Figure 8 [1938]). The Big Smoky Valley-Monitor Valley district—comprising Monitor Valley, Monitor Range, Alta Toquima Range, Big Smoky Valley, and the southeastern flanks of the Toiyabe Range—is the only district documented as regularly participating in annual festivals with Kawich Mountains district families. Beatty-Belted Mountains district families sometimes attended festivals held in the Kawich Range. Interestingly, Kawich Mountains district families did not reciprocate by attending Beatty-Belted Mountains district festivals. They sometimes participated in Belted Mountains rabbit drives after the fall festival, however.

The subsistence and settlement patterns of Big Smoky Valley-Monitor Valley district families were quite like those of the Kawich Mountains Western Shoshone. They used valleys for seed gathering and game drives and established residential camps in pinyon pine woodlands. Big Smoky Valley-Monitor Valley Shoshone held 10-day rabbit drives near Fish Spring in northern Monitor Valley (Steward 1997:109–113, Figure 8 [1938]).

The inter-district autumn pinyon pine nut harvest festivals lasted for five days, and locations varied based on where pine nuts were most abundant (Steward 1997 [1938]:109–113). When Kawich Mountains Shoshone hosted, festivals were most frequently held at Breen Creek (see Figure 4.3) or Horse Canyon (*Hugwapagwa*: cane/mouth of canyon)in the Kawich Range, or Tybo Creek in the Hot Creek Range (*Kunugiba*: elderberry/water). Big Smoky Valley-Monitor Valley district festivals were held at Belmont or Manhattan, both in the foothills of the Toquima Range, Fish Spring in the foothills of the Monitor Range, or Millet's Ranch in Big Smoky Valley. After the autumn festival, families of each district returned to the valleys near their winter camps, where they assembled for communal rabbit drives.

Beatty-Belted Mountains District

The Beatty-Belted Mountains district comprises the Belted Range to the east, the southern flanks of Pahute Mesa to the north, and the northeastern edge of the Amargosa Desert to the south (see Figure 4.1). The Beatty-Belted Mountains district comprised two population centers. The *Ogwe´pi* (creek) Shoshone inhabited areas near permanent water sources surrounding Beatty, Nevada, and the *Ĕso* (little hill) Shoshone inhabited the Belted Range. Twenty-nine Ogwe´pi people lived at four winter villages to the north, east, and south of Beatty, and about 42 Ĕso Shoshone scattered their winter camps near several springs in the lower elevations of the southern Belted Range. Population density for the entire Beatty-Belted Mountains district was about one person per 35 square miles (Steward 1997:48, 93–94 [1938]).

The Ogwe´pi depended more heavily on plant foods compared to other Shoshone families because few large animals lived near their camps and villages. Steward (1997:95–97 [1938]) documented that one of his Ogwe´pi consultants described an annual subsistence-based travel route that covered more than 1,300 square miles. In late spring, families might travel a 50-mile round trip to either south Pahute Mesa or the Calico Hills in the Amargosa Desert to gather Indian ricegrass seeds. In May or June, Ogwe´pi families traveled to the Grapevine Mountains on the Nevada-California border to hunt mountain sheep. They carried the dried meat back to their residential camps in the Beatty area. In July, the Beatty area families made 80-mile round trips to the Belted Range to harvest wheat and rye grass seeds.

In early autumn, Ogwe´pi people made a second 80-mile round trip to the Belted Range for pinyon pine nut gathering and the annual rabbit drive. In years of poor pinyon pine nut production in the Belted Range, families might travel as far as the Kawich Range or to the Lida and Vicinity for the nuts, a round trip of about 100 miles. Within 5 to 10 miles of their winter villages, people gathered Joshua tree buds and greens in the spring and summer before and after seed gathering in the Belted Range.

Typically, women gathered seeds while men hunted, snared, and trapped rabbits, lizards, and small rodents (Steward 1997:95–97 [1938]).

In his discussion of the people of the Beatty-Belted Mountains district, Steward (1997:93–99 [1938]) focused on the subsistence activities of the Ogwe´pi, providing comparatively little data pertaining to the Ĕso people of the Belted Range whose territory lies in the study area. It seems likely that the Ĕso peoples' subsistence was more like that of the Kawich Mountains Shoshone because the Belted Range environment is very similar to that of the Kawich Range.

All plant species of the Pinyon Pine-Utah Juniper, Big Sagebrush, and Black Sagebrush alliances of the Belted Range occur at similar elevations and soil conditions as in the Kawich Range. Mule deer inhabit the Belted Range yearround (Nevada Division of Wildlife 2000). In the highest Belted Range elevations (2,250 to 2,560 m), the White Fir (*Abies concolor*) alliance occurs in association with mountain maple (*Acer glabrum*), wax currant, and muttongrass (Pritchett and Smith 2001:4–6, Appendix A). Exceptional to the Belted Range is Gambel oak (*Quercus gambelii*), which occurs in sheltered areas in the Pinyon Pine-Utah Juniper alliance (Figure 4.5). The acorns were a highly desired storable food for Great Basin people living in areas in which it occurs (Steward (1997:28,111[1938]).

Ĕso people situated their winter camps in the southern Belted Range, the portion of the study area mostly located on the northern NTS. The Ĕso headperson, Wanda^{g}wana, lived with the seven members of his extended family at Whiterock Springs (Tünăva). Wanda^{g}wana hosted festivals and directed Ĕso district autumn rabbit drives on the flats south of his camp. Wuŋiakuda was a camp in an area of rock shelters near Ammonia Tanks where a family of eight lived. One of the *Wuŋiakuda* area children, Panamint Joe, later moved to the Beatty area and was the district headperson during the 1905–1910 regional mining boom. One-eye Captain Jack and his wife lived at Captain Jack Spring (*Kuikuin:´*) and Kapitasugupütsi and his extended family of five lived at Tippipah Spring (*Tupipa*: rock/water) in the Shoshone Mountain foothills. Other camps of the Ĕso district included *Mütsi* (thistle), *Sivahwa*, and *Wi:va* (Steward 1997:95, 97[1938]).

The Beatty-Belted Mountains and Eastern California districts' relationships appear to be the most extensive and shifting of any of the study districts. Steward (1997:72–73, 95–96 [1938]) attributed this to the irregular distribution of productive plant food patches throughout the region. In addition, Ogwe´pi (Beatty area) families tended to associate more frequently with Eastern California district families to the west, and Ĕso (Belted Range) families associated more often with Kawich Mountains

Figure 4.5. Gambel's oak thicket in the Belted Range. Elevation is about 1,800 m.

district families to the north. Steward (1997:93 [1938]) felt it more appropriate, however, to group the two areas into a single, loosely affiliated district because intermarriage and cooperation were high compared to relationships with families in surrounding districts.

The Eastern California district posed similar classification problems. Steward (1997:70–93 [1938]) divided the district, which includes the north halves of Death Valley and Panamint Valley, Saline Valley, south Eureka Valley, Owens Lake south shore, and the Coso Range (Koso Mountains), into sub-divisions for discussion but classified the widely spaced clusters of families a single district. Although topographic areas in the district can be clearly defined—which appears to be the basis for Steward's Death Valley, Saline Valley, Panamint Valley, and Koso Mountains sub-divisions—Eastern California district inter-village alliances constantly shifted and were not necessarily based on proximity. Steward (1997:75 [1938]) attributed the shifting family alliances to annual changes in the abundance of pinyon pine nut crops. It is of interest, though, that peoples bordering the Eastern California district were the most ethnically diverse of the entire Shoshone region. Intermarriage between the Eastern California Shoshone and those ethnic groups was common.

The annual festival in the Beatty-Belted Mountains district alternated between the Ogwe´pi camps at Beatty Wash and an area near Ammonia Tanks in the Belted Range called Wuŋiakuda, where the district headperson Wanda^{g}wana hosted festivals. In Beatty, the festival was concurrent with the autumn rabbit drive. Ĕso families held festivals during pinyon pine nut harvest, before the October rabbit drive. The five-day festival included exhibition dancing, headperson talks, and communal round dancing. Eastern California district Shoshone hosted festivals wherever pinyon pine nuts and rabbits were sufficiently abundant to support large groups that assembled for several days from considerable distances. Eastern California district festivals took place at one of six places that include Surveyor's Well in Death Valley, Willow Spring in the Grapevine Mountains, two locations in the mountains surrounding Saline Valley, Coso (Koso) Hot Springs, and Olancha, California, near Owens Lake. In addition to dancing, talking, and gambling, people observed annual mourning ceremonies at Eastern California district festivals (Steward 1997:75, 98, Figure 7 [1938]).

Summary

Steward's ethnographic research provides detailed descriptions of the socioeconomic-based travels of the study area Western Shoshone. About 20 Western Shoshone families of three different districts—Lida and Vicinity, Kawich Mountains, and Beatty-Belted Mountains—lived at camps in the 2 million acres making up the study area. Most of their dwellings were at the lower margins of pinyon pine-Utah juniper woodlands, where perennial water sources, animals, pinyon pine nuts, and other plant foods were most plentiful. Families traveled hundreds of miles each year for sufficient food resources to meet their subsistence needs. Communal subsistence activities were few, limited to annual autumn rabbit drives, pinyon pine nut harvest festivals, and the occasional antelope drive.

Although the study area Western Shoshone districts adjoined each other, inter-district fall festival relationships were mostly between Basin-Plateau districts outside the study area. Lida and Vicinity Shoshone primarily interacted with Fish Springs Valley and Deep Springs Valley Northern Paiute. Kawich Mountains families reciprocated as fall festival hosts with Big Smokey Valley-Monitor Valley Shoshone families. Fall festival relationships of the Beatty-Belted Mountains Shoshone were somewhat more complex.

The Ogwe´pi of the Beatty area tended to participate in Eastern California district festivals when they or the Ĕso families were not hosting the annual fall festival. When not hosting the festival or attending a festival in the Beatty area, Ĕso families tended to participate in Kawich Mountains festivals. Kawich Mountains families sometimes participated in Ĕso rabbit drives, which were held after the pinyon pine nut harvest festival. Steward's detailed documentation of the places that families visited to acquire food and to socialize provides the data necessary to formulate obsidian source predictions for artifact samples collected from ethnohistoric period sites in the study area.

SOURCE PROJECTIONS FOR ETHNOHISTORIC PERIOD OBSIDIAN ARTIFACTS

Ethnohistoric period obsidian artifact source projections rely on the validity of five assumptions. Primary is the assumption that Steward's (1997 [1938], 1941) data are accurate. Second is the assumption that ethnohistoric period Great Basin peoples of the study area used obsidian to manufacture chipped stone tools. Third is the assumption that people procured the obsidian raw material used to manufacture tools during their subsistence-based activities. Fourth, it is assumed that some trade occurred during annual fall festivals. Hinging on the validity of the previous assumption is the idea that obsidian raw material and obsidian tools were among the items exchanged.

Assuming that Steward's (1997 [1938]) documentation of the Lida and Vicinity, Kawich Mountains, and Beatty-Belted Mountains Shoshone socioeconomic land-use patterns is accurate, obsidian artifacts recovered from ethnohistoric period sites in the study area could originate from at least 15 different sources found throughout an area of more than 200 km². Seven obsidian sources are within the boundaries of the Western Shoshone districts under study. Five of these are within the study area boundaries. Figures 4.6a and 4.6b illustrate the locations of obsidian sources in relationship to Steward's (1997: Figure 7, Figure 8 [1938]) documented central Nevada Western Shoshone socioeconomic patterns.

The Goldfield Hills source is in the Lida and Vicinity district and the South Kawich Range source is at the southern border of the Kawich Mountains district. The Shoshone Mountain and Oak Spring Butte sources are in the Beatty-Belted Mountains district. The five obsidian varieties outcropping in several locations throughout the extensive Obsidian Butte Volcanic Center are found in the shared resource procurement lands between the three districts. The Silver Peak and Montezuma Range sources are located west of the study area in the Lida and Vicinity district. The Tempiute Mountain source in Sand Springs Valley is just to the east of the study area, proximal to the eastern boundary of the Kawich Mountains district.

Seven more obsidian sources are in Basin-Plateau districts interacting in fall festivals that study area Western Shoshone families attended.

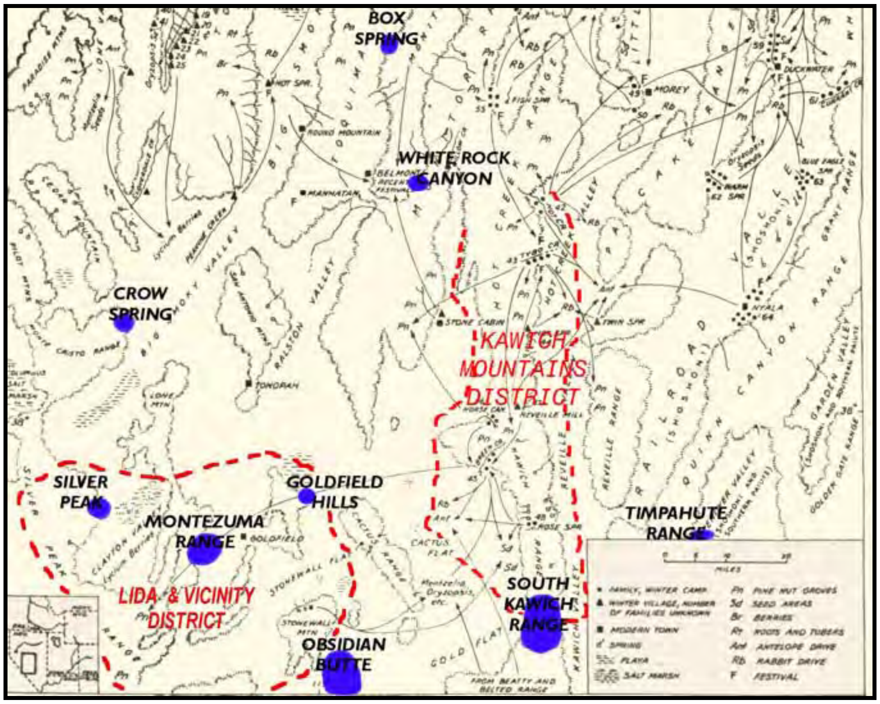


Figure 4.6a. Steward's (1997 [1938]) maps illustrating study area Western Shoshone socioeconomic patterns in relationship to regional obsidian sources.

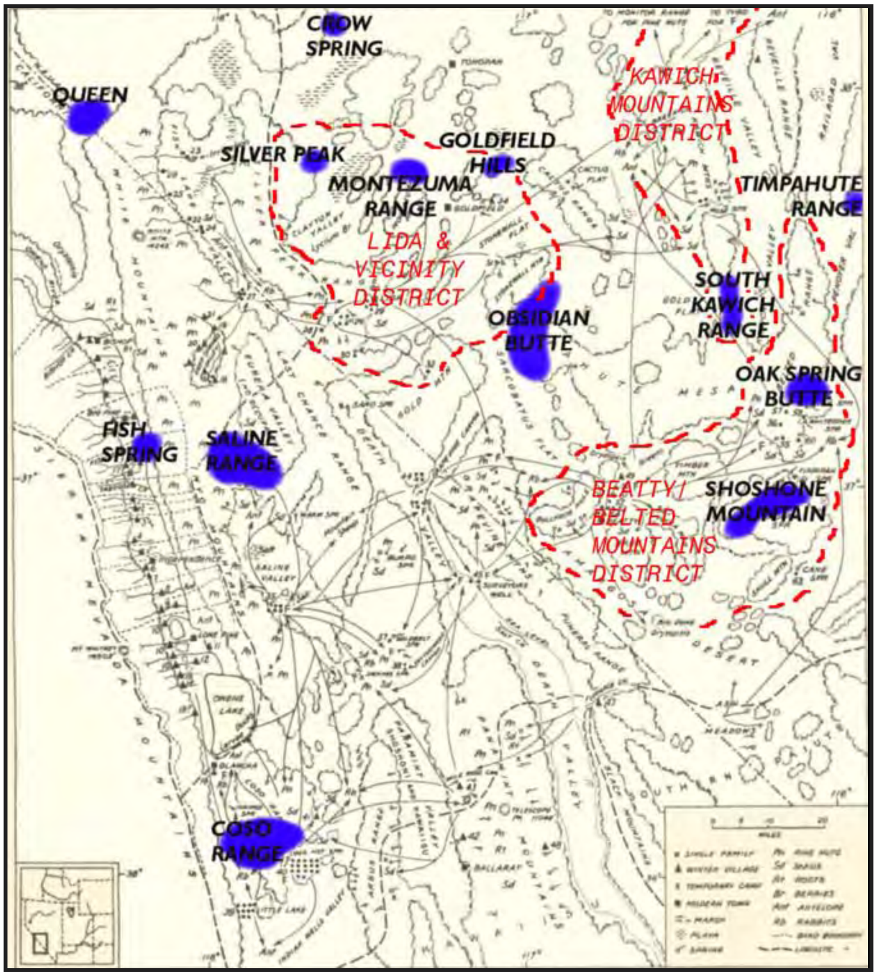


Figure 4.6b. Steward's (1997 [1938]) maps illustrating Western Shoshone socioeconomic travel patterns in relationship to regional obsidian sources.

In districts interacting with the Lida and Vicinity families are the Queen source northwest of Fish Lake Valley, the Fish Spring source in Owens Valley, and the three varieties of Saline Range obsidian south of Deep Springs Valley. In the Big Smoky-Monitor Valley district are the Box Spring and White Rock Canyon sources of Monitor Valley and the Crow Springs source in Big Smoky Valley. In the Eastern California district are the three varieties of Saline Range obsidian and the four varieties of the Coso volcanic field. If Steward's (1997 [1938]) documentation of the socioeconomic relationships of the Basin-Plateau Peoples of the region are accurate and people procured obsidian during subsistence activities and social gatherings, then these 15 sources should be present in obsidian artifact samples found at ethnohistoric period sites in the study area.

Lida and Vicinity District Predicted Obsidian Artifact Sources

If Lida and Vicinity families obtained obsidian during subsistence activities and autumn festivals, then they would have had access to seven sources. Subsistence travels of Lida and Vicinity families would have placed them near at least four sources. Families gathered seeds in May and June on Cactus Flat, Stonewall Flat and near the Montezuma Range. In autumn, they harvested pinyon pine nuts in the Montezuma Range, Silver Peak Range, and probably on Stonewall Mountain. These subsistence activities would have provided Lida and Vicinity families opportunities to procure obsidian from the Goldfield Hills, Obsidian Butte Volcanic Center, Montezuma Range, and Silver Peak sources.

Lida and Vicinity families interacted with Fish Lake Valley district and Deep Springs Valley district Northern Paiute families and, occasionally, Owens Valley Paiute families during inter-district pinyon pine nut harvest festivals and rabbit drives. Fish Lake Valley families likely obtained obsidian from the Queen obsidian source on the Nevada-California border while harvesting pinyon pine nuts in the White Mountains at the northern border of their district. Deep Springs Valley Northern Paiute may have obtained Saline Range obsidian while harvesting pinyon pine nuts to the south of their district. Owens Valley Paiute families obtained obsidian from the Fish Spring source in the Inyo Mountains during pinyon pine nut gathering expeditions. If people traded for obsidian raw material or tools at inter-district autumn festivals, then Queen, Saline Range, and Fish Spring obsidian would have been available to the Lida and Vicinity district families. If obsidian procurement occurred during subsistence activities and autumn festivals, then obsidian artifacts retrieved from Lida and Vicinity ethnohistoric sites in the study area should derive from the Goldfield Hills, Obsidian Butte Volcanic Center, Montezuma Range, Silver Peak, Queen, Saline Range, and Fish Spring sources.

Kawich Mountains District Predicted Obsidian Artifact Sources

Obsidian sources in the Kawich Mountains district are sparse compared to other districts in the study area. If people procured obsidian during subsistence activities, then the Kawich Mountains district families would potentially have had access to three sources. Seed gathering in the Kawich Valley may have placed Kawich Mountains district families near the South Kawich Range source, the only obsidian source in their district. Seed gathering on Gold Flat would have provided reasonable opportunities for procurement from the Obsidian Butte Volcanic Center source. The proximity of the Tempiute Mountain source to some of the Kawich Mountains district temporary and winter camps likely made this source relatively available to district families as well.

Kawich Mountains district families interacted with Big Smoky Valley-Monitor Valley and Beatty-Belted Mountains families at autumn festivals. Big Smoky Valley-Monitor Valley families likely procured obsidian from the White Rock Canyon, Box Spring, and Crow Spring sources while gathering seeds in the district's valleys and harvesting pinyon pine nuts in the mountains. The Ĕso people of the Belted Range would have procured Oak Spring Butte, Shoshone Mountain, and Obsidian Butte Volcanic Center during subsistence activities. Kawich Mountains families participating in Belted Range inter-district rabbit drives also would have had even greater opportunity to procure the Beatty-Belted Mountains district obsidians. If Kawich Mountains district families traded for obsidian at inter-district festivals, they would have had access to the Box Spring, White Rock Canyon, Crow Spring, Oak Spring Butte, Shoshone Mountain, and Obsidian Butte Volcanic Center sources. If obsidian procurement occurred during subsistence activities and autumn festivals, then obsidian artifacts retrieved from Kawich Mountains ethnohistoric sites in the study area should derive from the South Kawich Range, Obsidian Butte Volcanic Center, Tempiute Mountain, Box Spring, White Rock Canyon, Crow Spring, Oak Spring Butte, and Shoshone Mountain sources.

Beatty-Belted Mountains District Predicted Obsidian Artifact Sources

Beatty-Belted Mountains families could have easily obtained obsidian from the two sources within their district during routine plant gathering and hunting activities. Seed gathering on west Pahute Mesa also would have provided them opportunities to procure Obsidian Butte Volcanic Center obsidian. If Beatty-Belted Mountains Shoshone families procured obsidian during subsistence activities, then they would have had access to Oak Spring Butte, Shoshone Mountain, and Obsidian Butte Volcanic Center obsidian.

Beatty-Belted Mountains festival relationships were the most complex of the Western Shoshone districts under study. Beatty-Belted Mountains families alternately interacted with Kawich Mountains families or Eastern California district families during autumn festivals. Eastern California district families could have readily procured Saline Range and Coso Range volcanic field obsidian during subsistence activities. As discussed above, Kawich Mountains families potentially had access to the South

Saline Range, Coso Range volcanic field, South Kawich Range, Tempiute Mountain, Box Spring, White Rock Canyon, and Crow Spring sources.

Summary

Steward's detailed descriptions of the socioeconomic landscapes of Great Basin peoples provide the foundation for projecting ethnohistoric period obsidian artifact sources in the study area. Artifact source predictions rely on the assumptions that his data are accurate, that study area ethnohistoric peoples used obsidian, and that people procured obsidian during socioeconomic activities. By placing the locations of regional obsidian sources on Steward's subsistence and settlement maps, specific sources of obsidian artifacts retrieved from ethnohistoric period sites in the study area are predicted.

It is expected that 15 obsidian sources will appear in ethnohistoric period artifact samples from the study area. These are Obsidian Butte Volcanic Center, Goldfield Hills, South Kawich Range, Oak Spring Butte, Shoshone Mountain, Tempiute Mountain, Montezuma Range, Silver Peak, Saline Range, Queen, Fish Spring, Box Spring, White Rock Canyon, Crow Spring, and Coso Range volcanic field. Because socioeconomic patterns differed among the three Western Shoshone districts of the study area, artifact sample source patterns should also vary based on district. Specific artifact source predictions for each district are summarized in Table 4.1.

PROVENIENCE OF THE ETHNOHISTORIC PERIOD OBSIDIAN ARTIFACT SAMPLES

Samples of obsidian artifacts from ethnohistoric period Lida and Vicinity, Kawich Mountains, and Beatty-Belted Mountains Shoshone sites were needed to test the expected source distributions outlined in Table 4.1. Artifact samples from winter camps were preferred because people stayed for the longest periods at

Table 4.1. Projected ethnohistoric period obsidian artifact sources per study area district

District	Projected Sources	Procurement Means
LIDA AND VICINITY	Goldfield Hills	subsistence travel
	Obsidian Butte Volcanic Center	subsistence travel
	Montezuma Range	subsistence travel
	Silver Peak	subsistence travel
	Saline Range	festival trade
	Queen	festival trade
	Fish Spring	festival trade
KAWICH MOUNTAINS	South Kawich Range	subsistence travel
	Obsidian Butte Volcanic Center	subsistence travel
	Tempiute Mountain	subsistence travel
	Box Spring	festival trade
	White Rock Canyon	festival trade
	Crow Spring	festival trade
	Oak Spring Butte	festival trade
	Shoshone Mountain	festival trade
BEATTY-BELTED MOUNTAINS	Oak Spring Butte	subsistence travel
	Shoshone Mountain	subsistence travel
	Obsidian Butte Volcanic Center	subsistence travel
	Saline Range	festival trade
	Coso Range volcanic field	festival trade
	South Kawich Range	festival trade
	Tempiute Mountain	festival trade
	Box Spring	festival trade
	White Rock Canyon	festival trade
	Crow Spring	festival trade

residential sites. A wide variety of activities that required chipped stone tools took place at winter camps, such as textile manufacturing, tool making, and food preparation. In addition, people likely used and stored luxury and exotic items at their residential camps. Thus, obsidian artifact samples from ethnohistoric period winter camps should provide the optimal data set that best reflects the entire spectrum of obsidian procurement for the ethnohistoric period Western Shoshone of the study area.

Steward (1997 [1938]) documents that at least two Lida and Vicinity, four Kawich Mountains, and six Beatty-Belted Mountains Shoshone winter camps were situated in the study area. During 13 days of field research, efforts were made to locate two winter camp sites per district, the maximum common denomination expected in the study area for each district. Obsidian tool-manufacturing and maintenance debris was collected from each site. This artifact class was chosen because it is more likely that when ultimately abandoning their winter camps, people would have left behind more of these obsidian artifacts than serviceable tools. Thus, tool-manufacturing and maintenance debris should best reflect the broad-spectrum obsidian procurement patterns at winter camps.

In the Lida and Vicinity district, winter camp remains were discovered at Wildhorse Spring in the Goldfield Hills and at Jerome Spring on the south face of Stonewall Mountain. In the Beatty-Belted Mountains district, a winter camp was found near Indian Spring in the Belted Range on the NTTR. The NTS Cultural Resources Manager provided access to artifacts collected during mitigation of 26Ny3393, situated in the south Belted Range at the edge of South Silent Canyon. Based on the artifact assemblage, the Silent Canyon site was likely a temporary camp used for a few weeks during a communal rabbit drive. Only one winter camp—at Sumner Spring—was found in the Kawich Mountains district. Haarklau (2003) describes these sites in detail in *Ethnohistoric Period Winter Camps In The South-Central Great Basin: An Archaeological Guide*.

Because two ethnohistoric period sites per district were desired for making comparable samples and only one winter camp was discovered in the Kawich Mountains district, a temporary camp along Breen Creek was chosen as the second study site for that district. The temporary camp site is in the area that Steward (1997:Figure 8 [1938]) indicated was Chief Kawatc's pinyon pine nut festival grounds. Although the sparse site assemblage indicated people occupied the camp for a very brief period, two factors made the Breen Creek sample appropriate in meeting the study objectives. First, the obsidian debitage sample was similar in size to the winter camp samples. Second, because the nearest obsidian source is more than 40 km away, the obsidian artifacts likely originated from sources in the festival participants' district, which would be either the Kawich Mountains, Big Smoky Valley-Monitor Valley, or Beatty-Belted Mountains district. Projected sources should be relatively similar for all three of these interacting districts.

All obsidian artifacts were collected from tool-manufacturing and maintenance loci within the ethnohistoric period site components. Samples comprised raw material reduction flakes, tool finishing and resharpening waste flakes, and tool fragments. In the Lida and Vicinity district, 112 obsidian artifacts were collected—40 artifacts from the Wildhorse Spring winter camp and 74 from the Jerome Spring camp. The Kawich Mountains district sites yielded 48 obsidian artifacts—19 from the Sumner Spring camp and 29 from the Breen Creek festival camp. The Beatty-Belted Mountains district sample comprised 51 artifacts—4 flakes from the relatively late ethnohistoric period Indian Spring camp and 47 pieces of debitage and tool fragments retrieved from the floor of the Silent Canyon dwelling. The study sample totaled 208 artifacts.

ARTIFACT SOURCE ANALYSIS RESULTS

All study artifacts were submitted to Geochemical Research Lab for energy dispersive x-ray fluorescence (XRF) analysis to determine the obsidian source of each artifact. Northwest Obsidian Lab collated analysis results and assigned source names based on results of the obsidian resource base identification study discussed. Listed in Appendix A and Appendix D are analysis results for each artifact.

Lida and Vicinity District Analysis Results

Four of the seven projected obsidian sources appear in the Lida and Vicinity district sample. Most of the sample derives from three of the four sources that district families were projected to have procured during subsistence activities. The Obsidian Butte Volcanic Center source makes up most of, 68 percent, the sample. The Montezuma Range source appears with the second highest frequency, 24 percent, and the Goldfield Hills source constitutes 3.5 percent of the sample. The Silver Peak source, the most distant obsidian source from the study area Lida and Vicinity camps, is completely absent. Thus, 75 percent of the subsistence travel-based projected sources appear in the sample. Figure 4.7 illustrates percentages of obsidian sources comprising the Lida and Vicinity district sample.

Only one projected festival trade-based source, the Saline Range, appears, making up 2.5 percent of the sample. Two percent of the sample comprises unexpected sources, Shoshone Mountain and Unknown Type F. Shoshone Mountain is a projected source in both the Kawich Mountains and Beatty-Belted Mountains samples but not in the Lida and Vicinity sample. It is possible, however, that the Lida and Vicinity family living on Stonewall Mountain acquired the obsidian when families of the other study area districts were contemporaneously gathering seeds on west Pahute Mesa or west Cactus Flat, the no man's land used by families of all three districts.

Unknown Type F represents a geochemical type identified in a few artifacts collected from Eureka Valley, California (see Chapter 3). Considering that the obsidian is apparently exceptionally limited in distribution in the Great Basin, it is highly probable that the source is in or very near Eureka Valley, the same general area in which the various outcrops of Saline Range obsidian are found. Deep Springs Valley Paiute families likely had access to this source as well when pinyon pine nut gathering in the mountains surrounding their district. The Stonewall Mountain family could have acquired the Unknown Type F obsidian during an autumn festival the same way that they would have procured Saline Range obsidian. Thus, though not expected, Unknown Type F is classified in this study as a festival trade-based obsidian source for the Lida and Vicinity district.

Kawich Mountains District Analysis Results

Source distributions for the Kawich Mountains district sample resemble those of the

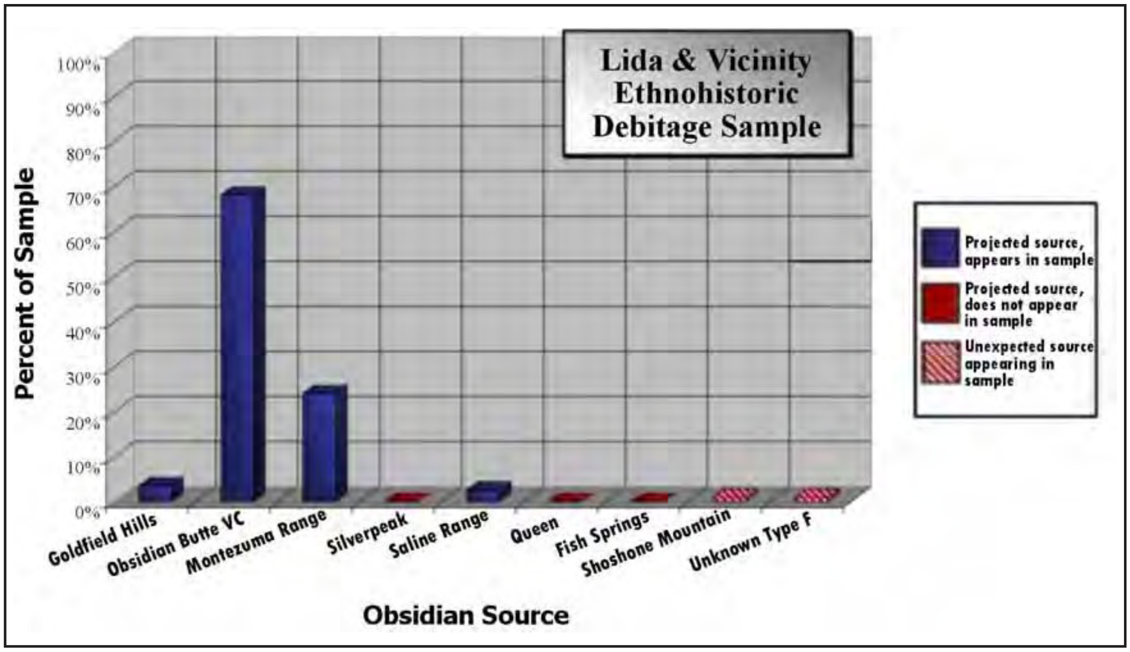


Figure 4.7. Lida and Vicinity District obsidian source percentages.

Lida and Vicinity district. Four of the eight projected sources appear in the sample. Of the sources projected based on Steward's (1997 [1938) documentation of district families' subsistence travels (Table 4.2), 100 percent were accurate. The Obsidian Butte Volcanic Center source again makes up most (64 percent) of the sample. The Tempiute Mountain source appears in 11 percent of the artifact sample and the South Kawich Range source comprises 2 percent. Figure 4.8 illustrates percentages of sources in the Kawich Mountains district sample.

Only one of the five obsidian source predictions based on fall festival trade, the Oak Spring Butte source, appears in the Kawich Mountains district sample. The Oak Spring Butte source, found in the Beatty-Belted Mountains district, appears in 9 percent of the district artifacts. The other projected festival trade-based source in the Beatty-Belted Mountains district, Shoshone Mountain, is absent. Also absent are artifacts originating from the obsidian sources of the Big Smoky Valley-Monitor Valley Western Shoshone district. Not predicted yet occurring are the Montezuma Range and Goldfield Hills sources of the Lida and Vicinity district. Montezuma Range obsidian makes up 11 percent of the sample and Goldfield Hills, 2 percent.

The appearance of the Montezuma Range and Goldfield Hills sources of the Lida and Vicinity district, though not projected, support the deduction stated above that inter-district family interactions occurred in seed-gathering no man's lands. Kawich Mountains families also gathered plant foods on Pahute Mesa and Cactus Flat, the study area no man's land that buffered the three districts. Kawich Mountains people likely got Montezuma Range and Goldfield Hills obsidian from Lida and Vicinity families who were contemporaneously using the area.

Beatty-Belted Mountains District Analysis Results

Geochemical analysis results for the Beatty-Belted Mountains district are mostly redundant because, again, subsistence travel-based obsid-

Table 4.2. Actual percentages of sources by procurement means appearing in the artifact sample

Source Name	Procurement Means	Percent of Sample
Goldfield Hills	subsistence travel-based (direct procurement)	2.5
Obsidian Butte Volcanic Center	subsistence travel-based (direct procurement)	62.0
Montezuma Range	subsistence travel-based (direct procurement)	15.5
South Kawich Range	subsistence travel-based (direct procurement)	0.5
Tempiute Mountain	subsistence travel-based (direct procurement)	2.5
Shoshone Mountain	subsistence travel-based (direct procurement)	2.0
Oak Spring Butte (Beatty-Belted Mountains district)	subsistence travel-based (direct procurement)	9.0
Oak Spring Butte (Kawich Mountains district)	festival trade-based (secondary procurement)	2.0
Saline Range	festival trade-based (secondary procurement)	2.0
Queen	festival trade-based (secondary procurement)	1.5
Unknown Type F	unpredicted, festival trade-based (secondary procurement)	0.5
Kane Springs Wash Caldera	unpredicted (unknown)	0.5

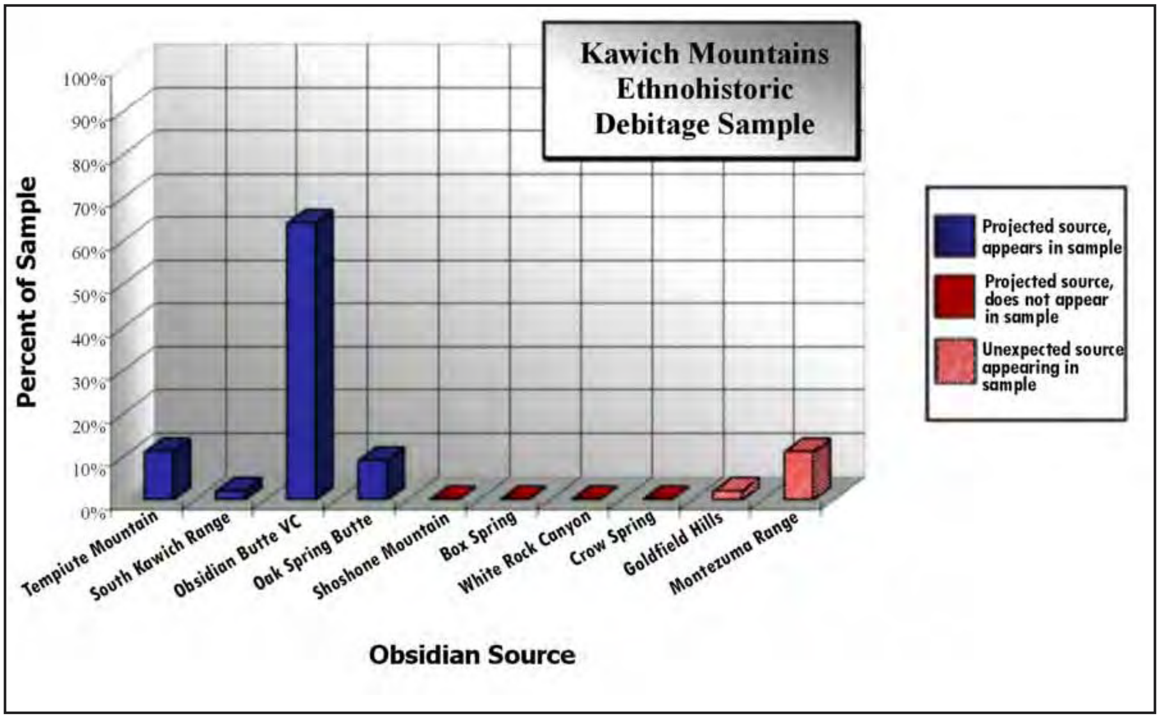


Figure 4.8. Kawich Mountains District obsidian source percentages.

ian procurement projections are most accurate and dominate the sample. Projected subsistence travel-based sources are again 100 percent accurate because all three appear in the sample. The Obsidian Butte Volcanic Center source again makes up most of the sample, 47 percent, but in a notably lesser percentage than in the Kawich Mountains and Lida and Vicinity samples. Oak Spring Butte obsidian artifacts are only slightly less common, comprising 37 percent of the sample. Six percent of the artifacts geochemically correspond with Shoshone Mountain obsidian. Figure 4.9 illustrates the variety and percentages of obsidian sources that constitute the Beatty-Belted Mountains district tool-manufacturing and maintenance debris sample.

Only one artifact originating from one of the six obsidian sources projected to be present in the sample through fall festival trade, the Saline Range source, actually occurs. The Coso Range volcanic field, Box Spring, White Rock Spring, and Crow Spring sources are absent. Two obsidian sources outside the Beatty-Belted Mountains district and not projected make up 8 percent of the artifact sample, however.

The Queen source, on the northern boundary of the Fish Lake Valley Northern Paiute district, makes up 6 percent of the Beatty-Belted Mountains. The Queen source was projected to appear in the Lida and Vicinity sample as a festival trade-based source (see Table 4.1) but was absent. It is possible that Beatty-Belted families acquired the obsidian from Lida and Vicinity families when gathering plant foods in the study area no man's land. The absence of the Queen source in the Lida and Vicinity sample, however, lends no support to this supposition.

One artifact in the Beatty-Belted Mountains sample geochemically corresponds with the Kane Springs Caldera source, in the Delamar and Mormon Mountains to the east of the district (see Chapter 3). Steward (1997:Figure 1, 98 [1938]) said that Pahranagat Southern Paiute occupied the area and suggested that relationships between the two districts were somewhat hostile. His Beatty-Belted Mountains Shoshone consultants could remember only two disputes in their lifetimes. One of those disputes occurred when the Pahranagat Southern Paiute objected to the Beatty-Belted Mountains Shoshone fishing in the White River, situated about 80 km east of the district. Based on Steward's data, it seems unlikely that Beatty-Belted Mountains Shoshone families would have

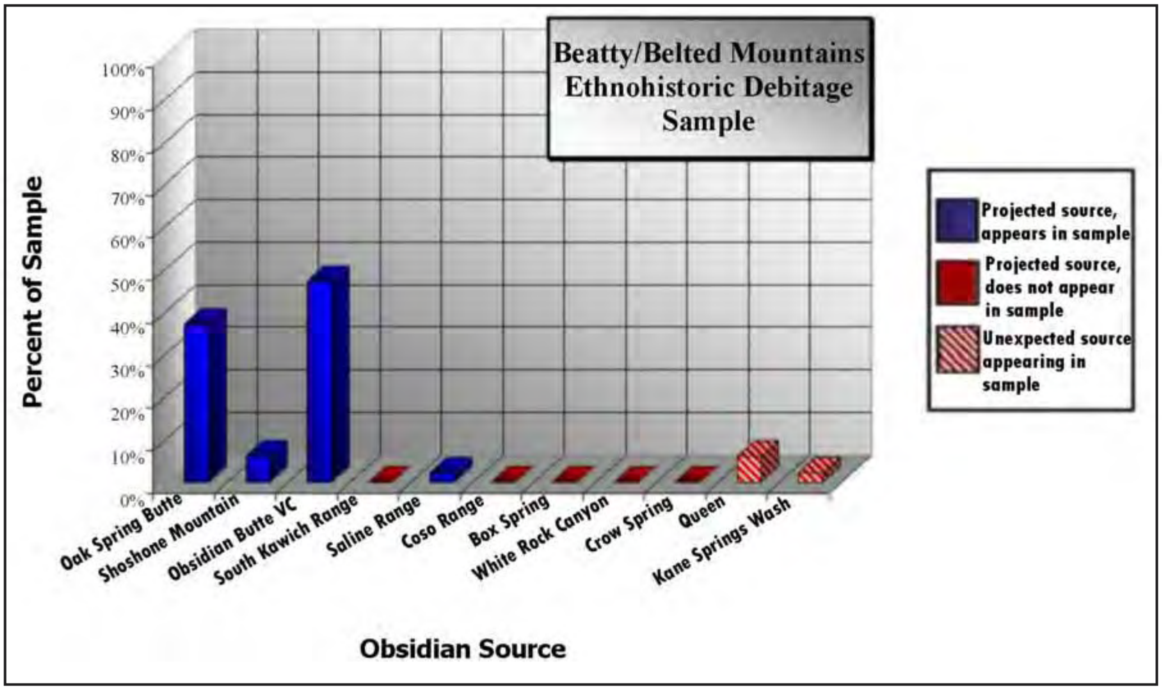


Figure 4.9. Beatty-Belted Mountains District sample obsidian source percentages.

had an inter-district relationship with Pahranagat Southern Paiute families that would have afforded them access to the Kane Springs Caldera source.

OBSIDIAN ARTIFACT SOURCES AND WESTERN SHOSHONE SOCIOECONOMIC PATTERNS

Based on Steward's (1997 [1938]) documentation of ethnohistoric period Western Shoshone socioeconomic systems in central Nevada, 15 regional obsidian artifact sources likely to appear in samples from specific areas were projected. Study expectations relied on the validity of five assumptions: that Steward's (1997 [1938], 1941) data are accurate; that ethnohistoric period Great Basin peoples of the study area used obsidian to manufacture chipped stone tools; that people procured obsidian raw material during their subsistence-based activities; that some trade occurred during annual autumn festivals, and that obsidian raw material or obsidian tools were among the items exchanged at fall festivals.

From six ethnohistoric period sites in three of Steward's (1997 [1938]) Western Shoshone districts in central Nevada, 208 obsidian artifacts were collected and geochemically analyzed. Nine of the 15 projected sources—Goldfield Hills, Obsidian Butte Volcanic Center, Montezuma Range, South Kawich Range, Tempiute Mountain, Shoshone Mountain, Oak Spring Butte, Saline Range, and Queen—appear in the artifact sample. Six of the projected sources—Silver Peak, Fish Spring, Box Spring, White Rock Canyon, Crow Spring, and Coso Range volcanic field—are absent. Two unexpected sources, Kane Springs Wash Caldera and Unknown Type F, make up 1 percent of the total sample. Figure 4.10 illustrates percentages of all sources comprising the study sample.

Although only 60 percent of the projected sources appear in the sample, only two sources were unexpected. One of the unpredicted sources, Unknown Type F, was not projected because of the geographic anonymity of the source (see Chapter 3) but was likely acquired during festival trade. Correcting for the incomplete knowledge of the regional obsidian resource base reduces the error. Thus, of the 11 sources appearing in the artifact sample, all but 1 (91 percent) of the sources should have been anticipated based on Steward's (1997 [1938]; 1941) data. Because nearly all of the artifacts were manufactured from expected sources but not all projected sources are present in the sample, it appears that some of the study

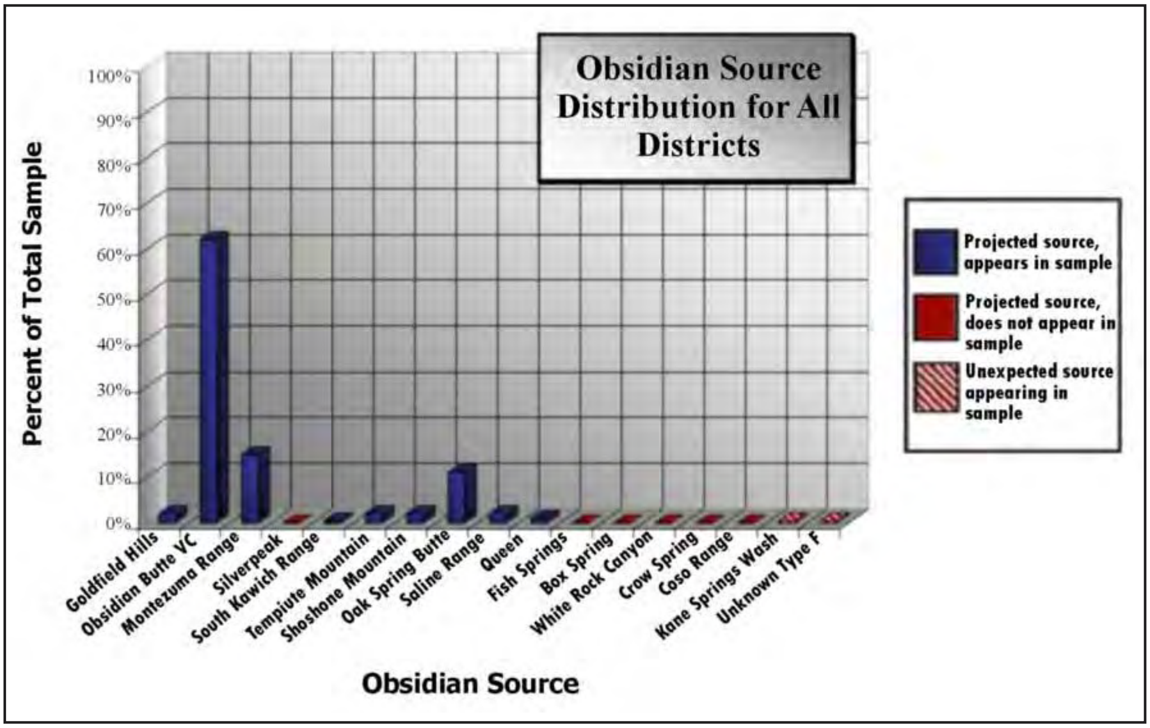


Figure 4.10. Total sample obsidian source percentages.

assumptions are move valid for central Nevada Western Shoshone obsidian procurement than others. A closer look at the percentage of artifacts deriving from anticipated sources and the means of procurement for each source clarifies and strengthens the study assumptions. Table 4.2 summarizes percentages of sources appearing in the sample and the means of obsidian procurement projected based on the documented (Steward 1997 [1938]) subsistence travels and festival relationships of Western Shoshone families who occupied the study area.

Validity of the Study Assumptions

Obsidian from 7 of the 11 sources appearing in the study sample was projected to have been directly procured by Western Shoshone families during regular subsistence activities in their districts, such as seed gathering. People likely procured obsidian from four of the sources during autumn festivals from families of other districts who had directly procured the obsidian during their regular subsistence activities. Only one source appearing in the sample cannot be explained with the ethnohistoric period obsidian procurement model constructed from Steward's (1997 [1938]; 1941) data. Although the appearance of the source is inexplicable, only one artifact (0.5 percent) in the entire 208-artifact sample geochemically corresponds with an unanticipated source.

Geochemical analysis results show that sources of obsidian tool manufacturing and maintenance debris collected from ethnohistoric period camps in the study area predominantly indicate the subsistence travels of Western Shoshone families. Ninety-four percent of the sample comprises obsidians that Western Shoshone people were projected to have procured directly from sources available during subsistence activities. Seven of the eight sources projected based on subsistence activities appeared in the sample. The relatively distant Silver Peak source, which has a very limited geographic distribution, is the only subsistence travel-based source absent in the sample.

Only three of the eight sources (38 percent) projected to be present based on festival trade appear in the sample. As discussed above, Unknown Type F is also considered a festival trade-based source that supports the obsidian procurement model. Although four of these secondary procurement sources appear in the sample, they make up only 5.5 percent of the entire sample. Thus, although trade-based sources occur, they form a minor percentage of the ethnohistoric period artifact sample. Figure 4.11 shows the source procurement categories that make up the total sample. Examination of the assumptions on which the ethnohistoric period obsidian procurement model is based in reference to the study results indicates that the assumptions are sound.

Assumption 1, Steward's Data Are Accurate. That 99.5 percent of the obsidian artifacts derive from sources that were expected or should have been expected based on Steward's (1997 [1938]; 1941) ethnographic documentation of Western Shoshone socioeconomic patterns indicates that his data are indeed reliable. Study results especially support his documentation of subsistence activities for the region. That the study results confirmed only some of his documented inter-district festival relationships also supports the assumption that his data are accurate. Steward (1997:45 [1938]) clearly maintained that Great Basin trade was rare, stating that "some trade by Death Valley people is indicated, but Shoshoni [sic] in Nevada practiced little or none."

Assumption 2, Great Basin Ethnohistoric Peoples Used Obsidian To Manufacture Tools. Obsidian-manufacturing and maintenance debris and tool fragments were found at all of the ethnohistoric period study sites. Although ethnohistoric period peoples used glass to manufacture some chipped stone tools (see Haarklau 2003 for a more detailed discussion), obsidian artifacts at the study area sites were relatively abundant and present in adequate amounts to test the study expectations. These data indicate that ethnohistoric period peoples used obsidian to manufacture tools.

Assumption 3, People Procured Obsidian during Subsistence Activities. Study results strongly support the accuracy of this assumption. Ninety-one percent of all obsidian sources projected to appear based on Steward's (1997 [1938]) documented subsistence activities were present in the sample. Obsidian procured during subsistence activities comprised 94 percent of the entire sample. These results overwhelmingly indicate that ethnohistoric peoples of the study area embedded obsidian procurement into their subsistence systems.

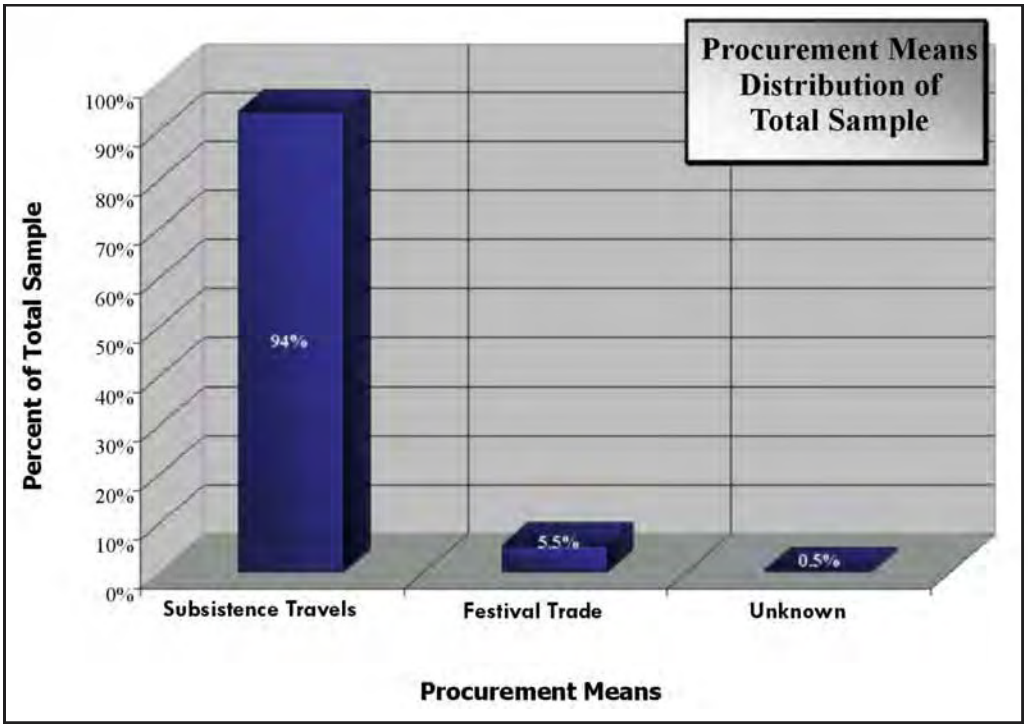


Figure 4.11. Distribution of obsidian procurement means in the sample.

Assumption 4, Some Trade Occurred during Autumn Festivals. As indicators of the occurrence of trade during ethnohistoric inter-district fall festivals, obsidian artifact sources are considerably less reliable. Only 38 percent of the anticipated festival trade-based sources appear and make up only 5.5 percent of the sample. Nevertheless, festival trade-based sources do appear in the sample, indicating that some trade occurred during the annual events. Thus, the assumption is valid, but sources of obsidian artifacts reveal only some of these inter-district social relationships.

Assumption 5, Obsidian Was among the Items Exchanged at Festivals. As discussed under the previous assumption, some obsidian artifact sources that were anticipated based on inter-district festival relationships appear in the sample. Unfortunately, the occurrences of festival trade-based sources are minimal. That trade sources do occur in the sample, however, indicates that the final assumption upon which the ethnohistoric period obsidian procurement model is based is a valid one.

Conclusions

Two significant conclusions emerge from the the ethnohistoric period obsidian procurement study. First, data overwhelmingly indicate that sources of obsidian artifacts identified in ethnohistoric period camp assemblages are most often discovered in food procurement areas. Obsidian procurement was deeply embedded in the subsistence systems of the ethnohistoric Great Basin peoples of the study area.

Second, and of even greater significance to Great Basin archaeologists, is that Steward's (1997 [1938], 1941) epic ethnographic research of Basin-Plateau sociopolitical groups contains a wealth of data that can be used to explain the material remains of past lives. Study results indicate that he accurately mapped the locations of ethnohistoric camps and various food procurement localities. His documentation of the interrelationships among the scattered Great Basin families of the region are reliable. His descriptions of the material culture of the ethnohistoric peoples of the region, such as house types and storage facilities, are consistent with the archaeological record.

Steward (1997 [1938], 1941) gives life to the ethnohistoric past through his detailed descriptions of subsistence and settlement patterns, sociopolitical groups, and material culture. In documenting these data, he provided archaeologists with a powerful tool to recognize and explain the most recent material remains of the indigenous peoples of the region. It is through an adequate understanding of the most recent past that archaeologists can begin to recognize and explain similarities and differences in the material record rooted deeply in the past.

REFERENCES CITED

Dames and Moore, Inc.

1997 *Wetland Survey Report*. Prepared for the U.S. Air Force, Air Combat Command, Contract No. RKXF956044. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

1998 *The Prospects Look Good: A View into 10 Ranching and Mining Sites on Nellis Air Force Range*. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA63-97-D-0022. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Haarklau, L.

2001 *Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada.* Prewitt and Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA63-95-D-0051. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

2003 *Ethnohistoric Period Winter Camps in the South-Central Great Basin: An Archaeological Guide.* Prewitt and Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA63-00-D-0006. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Hughes, R. E.

2001 Chapter 4: Geochemical Characterization of Obsidian from Outcrops on the Eastern and Southern Flanks of Obsidian Butte, Nellis Air Force Range, Nevada. In *Investigation of Geochemical Variability in Obsidian Raw Material And Artifact Sources on the North Nellis Air Force Range, Nevada,* by L. Haarklau, pp. 27–44. Prewitt and Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA 63-95-D-0051. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Kolvet, R. C., R. Deis, S. Stornetta, and M. K. Rusco

2000 *A Stratified Archaeological Sam-ple of Low Elevation Areas on the Nellis Air Force Range, Nevada*. Western Cultural Resource Management, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA 63-95-0022. Copies available from 99 CivilEngineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Nevada Division of Wildlife

2000 Field notes compiled by Nevada Division of Wildlife, NAFB Natural Resources files, 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Pritchett, D. and F. J. Smith

2001 *2000 Vegetation Sampling at Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada*. The Nature Conservancy. Prepared for the U.S. Air Force, Air Combat Command. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Stevenson, C.

2000 Nevada Division of Wildlife draft letter report dated 29 August 2000. Natural Resources Management files, 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Steward, J. H.
1997[1938] *Basin-Plateau Aboriginal Sociopolitical Groups*. University of Utah Press, Salt Lake City. [United States Government Printing Office, Washington, D.C.]

1941 Culture Element Distributions: XIII Nevada Shoshone. In *Anthropological Records* 4:2, edited by A. L. Kroeber, R. H. Lowie, R. L. Olson, and E. W. Gifford, pp. 209–359. University of California Press, Berkeley.

WHAT'S THE POINT? PROJECTILE POINT COLLECTIONS AND TYPOLOGY

5

Lynn Haarklau

Addressing the third objective of the research design required obtaining, classifying, and geochemically analyzing samples of obsidian projectile points from the central, western, eastern, and southern hydrographic Great Basin. Deciding what regions to include in this research was based on results of a preliminary study (Haarklau 2001:63–68) that examined obsidian sources of about 15 percent of Nellis AFB obsidian point collection. Although the largest percentage of obsidian points was manufactured from obsidian sources found within the boundaries of the study area—primarily from Obsidian Butte Volcanic Center varieties—results indicated that a small percentage was manufactured from sources up to 320 km (200 miles) away.

Distant sources in the western Great Basin included the Queen source on the California-Nevada border, Casa Diablo volcanic field in California's Long Valley, and the Saline Range in Death Valley National Park. Castle Mountains, California, was the most distant southern Great Basin source, and Wild Horse Canyon in Utah's Mineral Mountains was the most distant eastern Great Basin source. Thus, point collections from sites in areas between and near those sources and the study area were included to determine if the Obsidian Butte Volcanic Center varieties and other study area sources had similarly distant distributions.

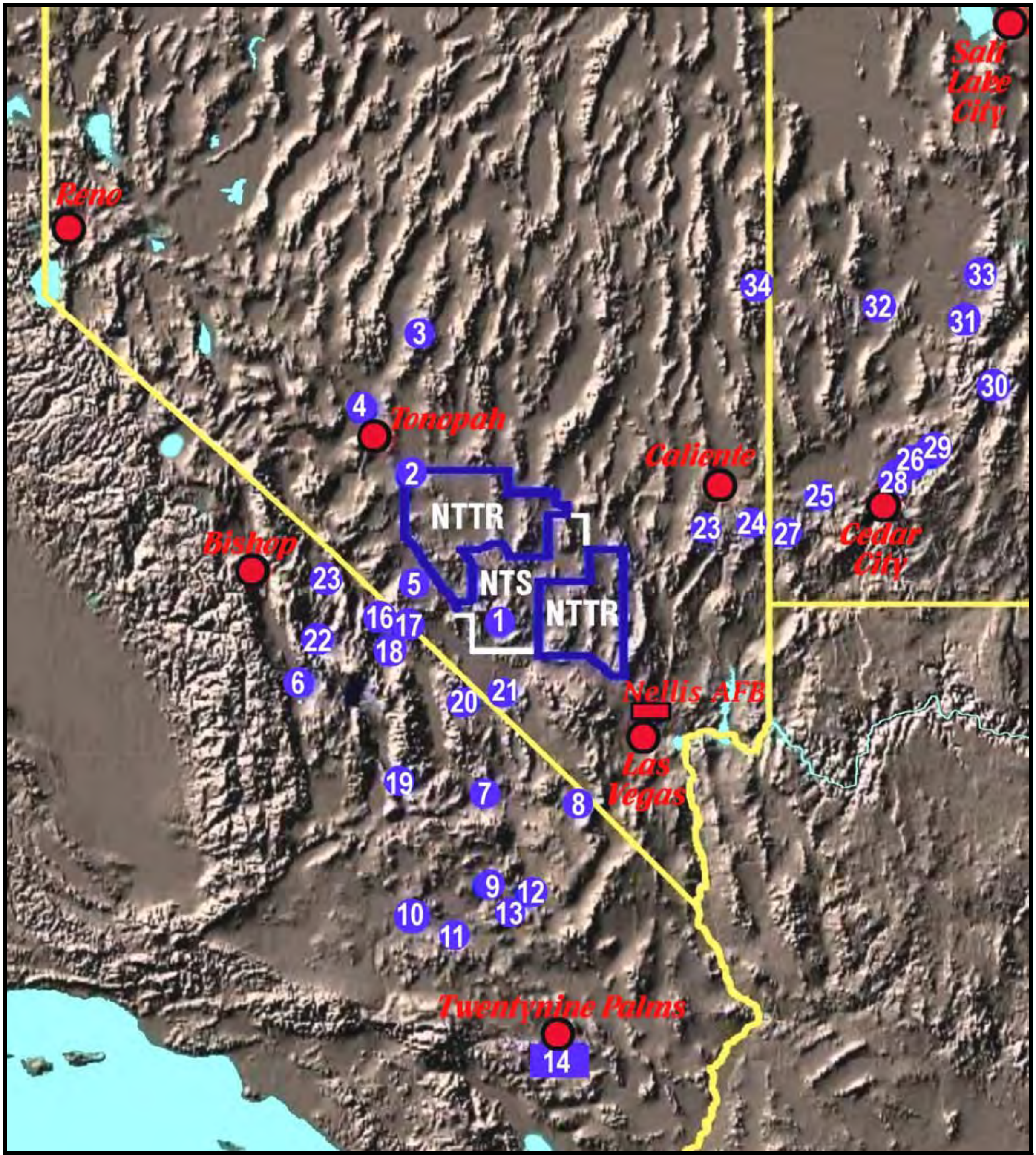
Nine public institutions and federal agencies contributed about 1,700 obsidian artifacts from 34 sites or areas for the study. These include Nevada State Museum, Carson City; American Museum of Natural History, New York; University of California, Davis; Joshua Tree National Park, California; Death Valley National Park, California; Desert Research Institute, Reno; State of Utah School and Institutional Trust Lands Administration, Salt Lake City; Southern Utah University, Cedar City; and University of Utah, Salt Lake City. Figure 5.1 indicates the general locations of the sites included in the projectile point source study.

Identifying changes in patterns of obsidian projectile point procurement over time is an objective of the third part of the research design. Thus, systematic classification of point types was necessary. The author measured and classified all points to maintain maximum consistency in measurements and point type designations. Thomas's (1981) Monitor Valley key was used as the basic guideline for obtaining significant metric attributes. Stem length was added to Thomas's (1981) list of typological attributes because Basgall and Hall (2000) indicate that this measurement is highly significant in separating some morphologically similar point types. Justice's (2000) volume on California and Great Basin points was used to identify types questionably classified with the Monitor Valley key. The following text describes the sites where the point collections originated, results of the metric analysis of the points, problems encountered in the classification process, and alternative interpretations of point types that consider function rather than chronology.

PROVENANCE OF THE OBSIDIAN POINT COLLECTIONS

The Study Area Sample, Central Nevada

The study area sample comprises 301 artifacts collected between 1940 and 1998 from more than 60 locations on the Nevada Test and



1.Tippipah Spring; 2. Mud Lake. Loan from American Museum of Natural History, New York; 3. Alta Toquima Village-Mount Jefferson. Loan from Joshua Tree National Park; 4. Big Smoky Valley; 5. Sarcobatus Flat; 6. Owens Valley; 7. Saratoga Spring; 8. Mesquite Valley; 9. Paradise River Valley; 10. Hinkley district; 11. Newberry Spring; 12. Crucero district; 13. Mesquite Spring; 14. Joshua Tree National Park. Loan from University of California, Davis; 15. Deep Springs Valley. Loan from Death Valley National Park; 16. Grapevine Canyon; 17. Grapevine Mountains; 18. Mesquite Flat; 19. Panamint Range; 20. Amargosa Valley; 21. Ash Meadows; 22. Saline Valley. Loan from Desert Research Institute, Reno; 23. Conaway shelter; 24. O'Malley shelter. Loan from State of Utah, School and Institutional Trust Lands Administration, Salt Lake City; 25. Escalante Valley. Loan from Southern Utah University, Cedar City; 26. Evans Mound. Loan from University of Utah, Salt Lake City; 27. Pine Park shelter; 28. Median Village; 29. Paragonah Mounds; 30. Marysvale; 31. Kanosh Mounds; 32. Sevier Lake; 33. Pharo Village; 34. Garrison site.

Figure 5.1. Obsidian artifact collection sites.

Training Range (NTTR) and the Nevada Test Site (NTS). All artifacts were collected from surface sites. Most of the collection localities are situated in valleys in the southernmost floristic Great Basin. Based on projectile point types, researchers have assigned the various locations from which the artifacts were collected to the earliest through the most recent periods of Great Basin prehistory.

Nevada Test and Training Range, Nellis AFB Collection. The Nellis AFB obsidian point collection consists of 209 artifacts collected over the past 70 years of archaeological research within the 3 million acres making up the NTTR in central Nevada. In most cases, decisions to collect points on the NTTR acreage were based on the impulses of the various researchers rather than systematic collection driven by research designs. Thus, the collection is not a scientific sample representing actual types of obsidian points for the macro-region but is more comparable to the cabinet of curiosities artifact collections popular in the late 1800s.

Most of the NTTR obsidian points (98 percent) were collected from the northern ranges. Nellis AFB archived site records indicate that of the 209 points making up the collection, 18 percent (n=37) are isolated occurrences. The remainder were collected from 64 small surface sites in Nye, Lincoln, and Clark counties. Sixty-nine percent (n=145) were collected from 43 sites in Nye County, 10 percent (n=21) from 15 sites in Lincoln County, and 2 percent (n=6) from six sites in Clark County. Site types from which points were retrieved include temporary camps, hunting localities, toolstone-procurement areas, and residential camps. Most of the sites are situated in developed areas of valleys at elevations of less than 1,675 m (5,500 ft).

Mud Lake, Nevada (26Ny1101), Nevada State Museum, Carson City Collection. Most of the acreage that Mud Lake playa comprises lies in the northwest corner of the NTTR. Mud Lake is reportedly the remnants of a Pleistocene lake that covered approximately 165 square miles (430 km^2) up to a depth of 40 ft. Before the 1970s, Tonopah area avocationalists collected the 35 points that make up the Mud Lake sample from several localities surrounding the playa. They donated some of their collections to the Nevada State Museum, Carson City (Tuohy 1969:136, 1978:4; A. Woody, Nevada State Museum, 2004, personal communication). Figure 5.2 is an aerial view of east Mud Lake shoreline.

Touhy (1968:27–31, 34) designated the area from which the 35-point Mud Lake collection were retrieved the Lowengruhn Beach Ridge. The series of collection localities were assigned site number 26Ny1101 (S. Murphy, Harry Reid Center for Environmental Studies, 2004, personal communication; A. Woody, Nevada State Museum, 2004, personal communication). He noted that most points from the collection localities are attributable to the “Lake Mohave complex.” The Tonopah avocationalists reported that they had collected 15 “western Clovis” points from the lower Mud Lake shorelines.

Tippipah Spring, Nevada (26Ny3), Nevada Test Site, Nevada State Museum, Carson City Collection. The 57 obsidian points making up this collection are a portion of the Tippipah Spring site assemblage that S. M. Wheeler collected in the early 1940s. The site lies on the Nevada Test Site at the base of Shoshone Mountain’s northeast face. Steward (1997 [1938]:95) noted that the Shoshone of the region called the spring, which lies at an elevation of about 1,645 meters (5,400 ft), *Tupipa* (*tupi*, rock + *pa*, water). A family of six inhabited the area during the ethnohistoric period.

The site covers an area of about 0.5 square miles surrounding the spring and contains prehistoric, ethnohistoric, and historic components. At least four archaeologists have recorded the site since Wheeler’s initial discovery, and the various descriptions are somewhat difficult to integrate. Recorded features include two stone structures, one wooden tack shed, a corral, one water tank, a water trough, a well, two adits, a trash dump, and a lithic scatter (Nevada Archaeological Survey Site Survey Record, Desert Research Institute, 1968; Site Inventory Form, Desert Research Institute, 1984; University of California Site Survey Record, Ritter, D. W., 1957; Worman 1969:10–11). Descriptions of one feature, a collapsed stone structure, remarkably resemble descriptions of ethnohistoric winter dwellings located to the north on the NTTR (Haarklau 2004).

North of the Study Area Sample

The sample from sites north of the study area comprises 138 artifacts collected from two areas. Most of the sample (76 percent) was

Figure 5.2. Aerial view of the east Mud Lake shorelines.

collected from sites discovered in the higher elevations of central Nevada's Toquima Range. Most Toquima Range artifacts were collected during excavation of the Alta Toquima Village site. The rest of the sample was retrieved from low-elevation surface sites on beach terraces surrounding Pleistocene Lake Tonopah in Big Smoky Valley.

Alta Toquima Village (26Ny920) and Mount Jefferson Research Natural Area, Nevada, American Museum of Natural History, New York Collection. Alta Toquima Village, situated at an elevation of 3,350 m (11,000 ft), was discovered in 1978 during 100 percent survey of the 3,440-acre Mount Jefferson Research Natural Area in the Toquima Range of central Nevada. The objective of the survey was to locate residential base camp satellite sites, such as high elevation hunting features, to better understand prehistoric human adaptive strategies in the central Great Basin. Field methods included mapping all sites and 100 percent collection of all surface artifacts (Thomas 1981).

Unexpectedly, Alta Toquima Village, a high elevation residential village, was discovered during the 1978 field survey and further field research was conducted in 1981. The 1981 fieldwork included excavating 27 of the 31 features making up the village; trenching a large midden in the village; testing 26Ny2731, a five structure village 1 km north of Alta Toquima Village; and completing the field survey of the Mount Jefferson Research Natural Area that began in 1978 (Thomas 1982).

The dwellings at Alta Toquima Village and those in the greater Mount Jefferson Research Natural Area are remarkably alike in both appearance and construction methods to those on the NTTR (Haarklau 2003). Foundations are round to oval in shape, partially excavated into the uphill slope on which they are situated, and lined with stacked stones. Some structures were built by incorporating naturally occurring outcrops into the foundations (Grayson 1993:262; Thomas 1981).

Many of the dwellings contained hearths in front of the entrances. Artifacts encountered during archaeological excavation included chipped stone points and knives, debitage, manos, grinding stones, abraders, ceramics vessels and pipes, bone beads, stone ornaments, limber pine nut hulls, and butchered and charred animal bones. Historic cans were found in two dwellings making up the group of structures at Alta Toquima Village labeled Cluster IV and historic cans and glass were found in association with structures constituting site 26Ny2729, a small village about 17 km (10.5 miles) north of Alta Toquima Village (Thomas 1981).

Radiocarbon assay of charcoal samples collected from hearths in 12 of the Alta Toquima Village dwellings returned dates ranging from A.D. 200 through ethnohistoric times, with most indicating a post-A.D. 900 occupation. Faunal analysis revealed that most of the animals that Alta Toquima residents consumed were yellow-bellied marmot, also called rock chuck (*Marmota flaviventris*), and bighorn sheep (*Ovis canadensis*). Flotation analysis indicated that both local plant foods, specifically limber pine (*Pinus flexilus*) nuts and Simpson's hedgehog cactus (*Pediocactus simpsonii*), and those carried in from lower elevations, such as alkali bulrush (*Scirpus maritimus*), were used (Grayson 1993:261–263). A total of 105 obsidian points collected during Thomas's (1981) research are included in this study, 82 collected from Alta Toquima Village and 23 from the greater Mount Jefferson Research Natural Area.

Big Smoky Valley, Nevada, Joshua Tree National Park Collection. The 33 obsidian points under analysis for this study derive from sites situated along extant shorelines of Pleistocene Lake Tonopah, in the southern Big Smoky Valley of central Nevada. The points are a small portion of a 3,000 artifact collection from Big Smoky Valley that Elizabeth and William Campbell and crew recovered between 1936 and 1942 when they conducted a great deal of archaeological research in the Nevada and California deserts. Thirty-three sites were discovered during the Campbells' field reconnaissance of the area (Campbell 1949:340; Pendleton 1977:24).

In her field notes, Elizabeth Campbell (1939) indicates that all of the sites from which artifacts of "old nature" were recovered were camps situated on the "crests of bars and spits" along the northern shores of Pleistocene Lake Tonopah. Most of the camps on the Pleistocene beach lines contained "Silver Lake" assemblages, but "Yuma Folsom" camps were also frequently discovered. Campbell (1939) also notes the presence of a number of "Pinto" sites. "Lake Mohave" camps were uncommon and when found, primarily comprised "Lake Mohave oval knives and dart points." "Old and new Paiute camps" were numerous, consistently discovered on sand dunes and on the flats beneath the Pleistocene lake shorelines. Campbell (1939) concludes that Pleistocene Lake Tonopah differed from other Pleistocene lakes in the region in that single component "Folsom Yuma" camps were found, providing evidence that "Folsom occurs in southern Nevada," and that "there is a suggestion of cultures coming between Silver Lake, Pinto, and Paiute."

West of the Study Area Sample

The sample from sites west of the study area includes 433 obsidian artifacts. Forty-four percent of the sample was collected during excavation of a late prehistoric camp in east-central California's Saline Valley. Most of the remaining artifacts making up the sample were collected between 1936 and 1990 from small surface sites in Owens Valley, Deep Springs Valley, and Death Valley National Park.

Owens Valley, California, Joshua Tree National Park Collection. From 1936 through 1942, the Campbell crew collected the 107 obsidian points examined for this study during their archaeological research in Owens Valley, California. As in Big Smoky Valley, Owens Valley maintains remnant Pleistocene lake shorelines and river delta (Campbell 1949). Unlike Big Smoky Valley, Owens Lake still contains shallow water, fed by the Owens River that originates in Long Valley and is replenished by melting snows of the Sierra Nevada Range. The lake, having no outlet, is highly saline, a condition that has worsened since the 1920s completion of the Owens River aqueduct that diverts Owens River waters to Los Angeles County (Wood 1973:7, 9, 14).

The "dart points" under analysis were collected from "ancient" camps on beach terraces along the northeast Pleistocene lake shoreline near Dolomite station (Campbell 1937). Figure 5.3 is a photo of the general area. Campbell (1949:340) attributed artifacts from the highest beach line to the Lake Mohave culture and noted that Pinto artifacts were encountered "farther back from the lake." The two terraces beneath the highest terrace lacked artifacts and "Folsom" culture artifacts were

Figure 5.3. Northeast shorelines of Owens Lake near Dolomite Station.

retrieved from the third terrace. She noted that "the three types of artifacts were fully segregated, nowhere mixed." "Fairly modern Paiute looking camp[s]" were most numerous at creek drainages, springs, and seeps along the south and west shores of the recently decimated Owens Lake. Most of the obsidian "arrowheads" under analysis were collected north and east of the town of Olancha (Campbell 1937).

Deep Springs Valley, California, University of California, Davis Collection. Deep Springs Valley is situated between the White and Inyo Mountains of California near central Nevada's western border. The 106 obsidian points examined for this study derive from surface collection of artifacts found during a stratified random sample of the six major biotic communities making up Deep Springs Valley and surrounding watershed. Surveyed areas range in elevations from approximately 1,500 m (4,950 ft) to 3,350 m (11,000 ft). The Deep Springs Valley and surrounding watershed region encompass Lake Shore, Desert Scrub, Pinyon-Juniper, Upper Sagebrush, Sub-Alpine Bristlecone-Limber Pine, and Alpine Tundra biotic communities (Delacorte 1990:69–71, 75, 398). Figure 5.4 is a view of Deep Springs Valley facing southwest.

The Deep Springs Valley study was intended to describe the archaeological remains of the region and identify variability in human adaptive strategies over time (Delacorte 1990:1). Thus, research perspective was macro-scale, focusing on biotic communities rather than individual sites. To determine in which biotic communities the loaned obsidian points were found, provenience data contained in the University of California, Davis, Museum of Anthropology Deep Springs Valley artifact catalog (Delacorte 1984) were cross-referenced to the designated biotic community alphabetic symbols (Delacorte 1990:73). Most obsidian points, 55 percent (n=58), were found in Lake Shore community. Eighteen percent (n=19) were found in Pinyon-Juniper community. Obsidian points were distributed relatively equally, about 8 percent each, in Desert Scrub, Upper Sagebrush, and Sub-Alpine Bristlecone-Limber Pine communities. Only 4 percent of the obsidian points were retrieved from the Alpine Tundra community.

Death Valley National Park, California, Collection. The Death Valley National Park sample for sites west of the study area includes 191 points collected from eight localities in the 3.4 million acres that the national park comprises. Most (66 percent) of the sample was collected from a "prehistoric camp" (Iny441) situated on a ridge south of Waucoba Spring in Saline Valley, California. In 1965, Tadlock (1965, University of California Archaeological Site Survey Record [ASSR]) excavated a "surface midden" approximately 27x54 m by 30 cm deep to mitigate disturbance from proposed spring development. The midden comprised two strata from which he collected chipped stone tools, debitage, groundstone, and ceramics. Most

Figure 5.4. Deep Springs Valley. The Inyo Mountains form the horizon.

chipped stone artifacts were obsidian, but some chert artifacts were also present (Clough, H., 1977, BLM California Desert Project ASSR).

The remaining 62 points were collected during compliance projects in seven Death Valley localities. Eight points were retrieved during excavation of a rockshelter in Grapevine Canyon, Iny378. The shelter was occupied during the ethnohistoric period. Ten points were collected from sites located during a park boundary fence-line survey through the Grapevine Mountains near Willow Spring in Nye County, Nevada. Six points are from sites in the Grapevine Mountains in Inyo County, California. A sample comprising 31 points was retrieved from a temporary camp area on Mesquite Flat near Stovepipe Wells in Inyo County, California. Three points were collected near Little Grapevine Creek, 5 points from the Furnace Creek Fan, and 1 point from the Eagle Borax mine. The latter three sites are west of the Amargosa Range in Inyo County, California (L. Johnson, 2004, personal communication).

Sarcobatus Flat, Nevada, Joshua Tree National Park Collection. Sarcobatus Flat comprises the acreage separating the NTTR and Death Valley National Park. West Pahute Mesa drains into the highly alkaline flatland. Secondary deposits of Obsidian Butte Volcanic Center source obsidian varieties have been retrieved from Sarcobatus Flat. Figure 5.5 is an aerial view of Sarcobatus Flat with the Grapevine Mountains of Death Valley National Park in the background. The five points making up the sample were collected during the Campbell expeditions in the area.

South of the Study Area Sample

The sample from sites south of the study area is the smallest, comprising only 66 artifacts from about 15 sites. All are surface sites, probably temporary camps, but documentation describing the collection locations is sparse. All sites are in the Mojave Desert.

Death Valley National Park, California, Collection. The 15 points making up the sample were collected from three areas in Death Valley National Park—the Panamint Range, Amargosa Valley, and Ash Meadows. Five points of the points were retrieved from Iny3044, situated on the south toe of the Panamint Range. In the late 1950s, A. P. Hunt and C. B. Hunt collected the 10 points from six sites in Ash Meadows and the Amargosa Valley. Five sites are temporary camps in dunes along the Amargosa River. Three points were found at a camp near Crystal Pool in Ash Meadows (L. Johnson, 2004, personal communication).

Figure 5.5. Aerial photo of a dust storm on Sarcobatus Flat, viewed from above West Pahute Mesa. The Grapevine Mountains in Death Valley National Park are visible on the horizon.

Nevada and California miscellaneous sites, Joshua Tree National Park Collection. The Campbell expeditions of the 1930s and 1940s included reconnaissance of several southern California and southern Nevada desert valleys. In addition to the larger Campbell point collections from Big Smoky Valley and Owens Valley, smaller numbers of points that they collected from surface sites throughout the region were analyzed. The areas, gen-eral descriptions of locations, and numbers of points analyzed are summarized in Table 5.1.

East of the Study Area Sample

The sample from sites east of the study area is the largest, comprising 740 artifacts collected from 19 sites between 1916 and 1994. O'Malley Shelter, Conaway Shelter, and Pine Park Shelter are rock shelters used for temporary camping, but only O'Malley Shelter contained substantial cultural deposits indicating thousands of years of use. Most sites are villages or hamlets that Fremont culture peoples occupied from about 700 to 1,000 years ago. These are Evans Mound, Median Village,

Table 5.1. Additional southern Great Basin obsidian point collection sites

Region	Location	No. of Points
Saratoga Spring	south end of Death Valley, Calif., southern foothills of Black Mountains, Calif.	1
Mesquite Valley	west of southern Spring Mountain Range, Nevada, east of Kingston Range, Calif.	26
Paradise River Valley	north of Paradise Range, Calif., southeast of Superior Valley, Calif.	7
Hinkley District	northwest of Barstow, Calif., southeast of Harper playa	1
Newberry Spring	northeast foothills of Newberry Mountains southeast of Yermo, Calif.	1
Crucero District	Mojave River Wash, Calif.	2
Mesquite Spring	northwest Mesquite Hills, Calif., southeast end of Mojave River Wash, Calif.	2
Joshua Tree National Park	800,000-acre national park south of Twentynine Palms, Calif.	7

Paragonah Mounds, Kanosh Mound, the Marysvale sites, the Garrison site, and Pharo village.Two small surface sites in the Escalante Valley are recent temporary camps, probably occupied by Southern Paiute or Shoshone peoples.

Conaway Shelter, Nevada (26Ln126), Desert Research Institute, Reno Collection. Conaway Shelter is in east-central Nevada on the east face of the Delamar Mountains. The 48 obsidian points analyzed for this study were retrieved during archaeological excavation of the site in 1969. Excavation revealed 14 distinct strata; alluvial deposits separated the 7 occupation strata contained within the shelter (Fowler et al., 1973:57–62).

Distinct hearths were encountered in only three of the 7 cultural strata—Stratum I, Stratum IV, and Stratum V—but charcoal was present in all 7 strata. Samples were retrieved from 5 of the occupation surfaces, including the uppermost surface, Stratum I, and the lowest surface, Stratum VII. Calibrated radiocarbon dates indicate that the shelter was intermittently occupied from 30 B.C. through A.D. 1720. Charcoal from Stratum IV returned a date of A.D. 900, Stratum V dates to A.D. 1010, and the Stratum VI sample dated to 100 B.C. (Fowler et al. 1973:58–62).

Faunal remains were discovered in all strata as well. There were butchered remains of bighorn sheep (*Ovis canadensis*) in all 7 strata, and mule deer (*Odocoileus hemionas*) remains were found in Strata I, III, IV, V, VI, and VII. Cottontail rabbit (*Sylvilagus audoboni*) bones were located in Strata I, II, III, IV, V, and VII and black-tailed jackrabbit (*Lepus californicus*) remains in Strata I, II, IV, V, and VII. Pygmy rabbit (*Sylvilagus idahoensis*) remains were retrieved from Strata III, IV, and V (Fowler et al. 1973:65–67).

More than 8,000 artifacts were collected during excavation of Conaway Shelter. Ceramics sherds were found in Strata I through V. Virgin Pueblo wares were retrieved from Strata IV and V, Parowan Fremont wares from Strata II through V, and Shoshone ware from Strata I through IV. Chipped stone artifacts, which include 72 projectile points, were encountered in all 7 strata, but most were found in Stratum V. Obsidian artifacts dominated, composing 88 percent of all identifiable points and 60 percent of all debitage. Other artifacts retrieved from the shelter deposits include manos, metates, awls, bone ornaments, gaming pieces, and cordage fragments. The authors concluded that "Desert Archaic peoples" were the first to use Conaway Shelter, followed by the Virgin Pueblo peoples, then the Parowan Fremont, whose use of the shelter overlapped with Shoshonean culture peoples. Shoshonean use of the shelter was heaviest during the most recent times (Fowler et al., 1973:62–67).

O'Malley Shelter, Nevada (26Ln418), Desert Research Institute, Reno Collection. O'Malley Shelter is about 30 km east of Conaway Shelter in Clover Valley, Nevada near the Nevada-Utah border. The shelter is situated at an elevation of 1,615 m (5,300 ft) in a vegetation transition zone between big sagebrush alliance and pinyon pine-Utah juniper alliance. The 332 obsidian points analyzed for this study were collected during excavation of the shelter in 1970 (Fowler et al. 1973:7–9).

O'Malley Shelter contained 21 strata comprising alternating layers of cultural deposits (10 strata) and slopewash alluvium (11 strata). The research team divided the strata into seven cultural units based on analysis of diagnostic artifacts retrieved from cultural deposits. Four "historic pits" in Unit VII, the uppermost unit and includes the surface, intruded into Unit VI. Charcoal samples submitted for radiocarbon assay were retrieved from ash lenses or ash pits uncovered in Units I through V. The two charcoal samples recovered from Unit I returned calibrated radiocarbon dates of 5150 B.C. and 4570 B.C. Three samples retrieved from Unit II dated to 2680 B.C., 1970 B.C., and 1990 B.C. The single samples from Units III and IV returned dates of 1790 B.C. and 1020 B.C., respectively, and the two samples recovered from Unit V dated to A.D. 1060 and A.D. 1080. Based on the radiocarbon dates and characteristics of the shelter deposits, the researchers deduced that O'Malley Shelter was intermittently occupied for the past 7,000 years (Fowler et al. 1973:9–15,55).

More than 12,000 animal bone fragments were recovered from O'Malley Shelter. It is unclear, however, whether or not all of the faunal remains bore evidence of preparation for consumption by the shelter occupants. Faunal remains retrieved from all cultural units include mule deer, bobcat (*Lynx rufus*), various bird species, blacktailed jackrabbit, cottontail rabbit, pygmy rabbit, antelope ground squirrel (*Citellus* *leucurus*), wood rat (*Neotoma lipida* and *Neotoma cinerea*), and Botta pocket gopher (*Thomomys botta*). Bighorn sheep bones were found in all cultural units except Unit IV, mountain meadow mouse (*Microtus montanus*) in all units but Unit III, and coyote (*Canis latrans*) remains were absent only in Units III and IV. Desert tortoise (*Gopherus agassizi*) and domesticated cattle (*Bos taurus*) remains were found in Units VI and VII, one wolf (*Canis lupus*) bone was retrieved from Unit II, and two fragments of American bison (*Bison bison*) bone were recovered from Unit I. Rabbit species remains dominated all cultural units (Fowler et al., 1973:49–51).

O'Malley Shelter deposits contained more than 60,000 artifacts. Most (56,286) are debitage resulting from chipped stone tool manufacture and repair activities. A total of 438 projectile points were collected, and most were manufactured from obsidian as indicated by the 332 O'Malley points analyzed for this study. Bifaces, however, are the most common chipped stone tool recovered from the site. Other chipped stone tools include drills, knife blades, and scrapers. Ground stone artifacts include 25 metates and 51 manos and mano fragments (Fowler et al., 1970:19–46).

Ceramics were retrieved from Unit IV through Unit VI deposits. Of the 796 sherds and vessels found in O'Malley Shelter, Parowan Fremont wares predominated, composing 73 percent of the entire collection. Shoshone ware made up 14 percent, and Virgin-Kayenta Pueblo wares, 12 percent. Only seven sherds were collected from Unit IV, comprising five Snake Valley grayware sherds (Parowan Fremont) and two Shinarump brownware sherds (Virgin-Kayenta Pueblo). Most ceramics (53 percent) were found in Unit V, where wares manufactured by all three cultural groups were discovered. Once again, Parowan Fremont wares were predominant (85 percent). Virgin-Kayenta Pueblo wares appeared in higher frequency (12 percent) than Shoshone ware (2 percent) in the unit, and two Sevier Fremont sherds were also found. Parowan Fremont wares also dominated in Unit VI (59 percent), but Shoshone ware made up a dramatically higher percentage (29 percent) of the unit ceramics collection. Only 12 percent of Unit VI ceramics were Virgin-Kayenta Pueblo wares, but one of the ceramics artifacts was a North Creek grayware jar, the only complete vessel found in O'Malley Shelter (Fowler et al., 1970:15–19).

Other artifacts recovered from O'Malley Shelter include bone awls, bone beads, bone pendants, bone gaming pieces, shell beads, arrow shaft fragments, snare sticks, cordage, basket fragments, a bighorn sheep scapula tool, and pieces of red and yellow hematite pigment. Two scraps of buckskin, likely moccasin remnants, were located in Unit VI. More than 80 historic items that include cloth scraps, buttons, nails, and .22 caliber shell casings were found in Unit VII near the shelter's surface. The researchers attribute the items to use of the shelter by hunters, cowboys, and railroad workers. Considering that an arrow shaft fragment, basket fragments, and shell beads were also located in Unit VII (Fowler et al. 1970:47–54), however, it seems possible that Native Americans deposited at least some of the historic artifacts in the shelter during the ethnohistoric period.

Escalante Valley, Utah (42Ws2613 and 42Ws2615), State of Utah, School and Institutional Trust Lands Administration, Salt Lake City Collection. The five points analyzed from the Escalante Valley were collected in 1992 and 1993 by Lead Archaeologist Kenny Wintch, Division of State Lands and Forestry. During inventory of the area in 1992, several sites were located in the transition zone from big sagebrush to pinyon pine-Utah juniper at the southeast edge of the valley (IMACS Site Form, Wintch, K. 1992). To mitigate disturbance from the federal action proposed for the project area, the sites were excavated during the fall of 1992 and summer of 1993 (letter from K. Wintch to author dated 19 February 2003).

The five points included in this study were retrieved from two small, temporary camps. Site excavations revealed that each camp comprised a lithic scatter and hearth. Chipped stone tools unearthed from the sites included projectile points, drills, bifaces, and utilized flakes. A grinding stone was found at one of the camps (IMACS Site Form, Wintch, K. 1992). Based on diagnostic artifacts retrieved from the sites, Wintch (letter to author dated 19 February 2003) believes the camps were used during the late prehistoric period.

Evans Mound, Utah (42In40), Southern Utah University, Cedar City Collection. Evans Mound is a large Fremont village site in the Parowan Valley of southwestern Utah. The site is on an alluvial fan near Summit Creek at an elevation of 1,772 m (5,812 ft). Beginning in the 1960s with excavations that the University of California, Los Angeles, and Southern Utah University conducted, Evans Mound has been the center of extensive archaeological research. In the 1970s, the University of Utah continued archaeological excavation of the village (Dodd 1982:7–9). The 200 points examined in this study were collected during the 1960s research.

Radiocarbon dates and ceramics types excavated from Evans Mound deposits indicate that the village was occupied from A.D. 1050 through A.D. 1150. During the 100-year occupation, about 25 adobe pit structures were constructed to house village inhabitants. Early dwellings were circular, and later dwellings, square to rectangular. Maximum diameters ranged from 3.7 to 4.9 m. Evans Mound residents dug pits from about 0.5 to 1 m deep to form house foundations. A few of the foundation floors and walls were lined with adobe, but most were earthen. Clay-lined fire pits were placed in the centers of the dwellings, and wood posts supported adobe superstructures. The deceased were often buried beneath the floors, and in the center of the village, new houses were built on top of earlier dwellings, eventually creating a mound (Dodd 1982:17–32, 37, 104–105; Pecotte 1982:117, 120).

Other features at the Evans Mound village were adobe granaries and outdoor-use areas. Granary floors were covered with either cobbles or adobe rubble. Adobe partitions divided the interiors, and sandstone slabs covered the tops. Outdoor-use areas adjoined dwellings, and fire pits in some suggest that cooking took place in the spaces. Posts at the ends of one of the use areas indicate that at least some may have been covered with ramadas (Dodd 1982:39).

Plant macrofossils retrieved from dwellings, middens, baskets, and ceramics vessels indicate that the Evans Mound residents consumed both wild and cultivated vegetation. Maize (*Zea* sp.) was most common, suggesting that villagers relied heavily on their crops. But wild grass remains such as wild rye (*Elymus* sp.) and ricegrass (*Acnatherum hymenoides*) were also abundant. Other common wild plant macrofossils retrieved from the village include goosefoot (*Chenopodium* sp.), bulrush (*Scirpus* sp.), pinyon pine (*Pinus edulis*) nuts, several species of sunflower (*Helianthus* sp.) seeds, amaranth (*Amaranthus* sp.), serviceberry (*Amelanchier* sp.), elderberry (*Sambucus caerulea*), and currant (*Ribes* sp.). Cultivated bean remains (*Phaseolus* sp.) were also encountered (Barnett 1982:95–102; Dodd 1982:106).

Analysis of processed faunal remains indicates that mule deer, bighorn sheep, and pronghorn were common large mammals that Evans Mound villagers consumed. Rabbits and birds were also important to the villagers' diets. A wide variety of tools that include awls, scrapers, antler-tine flakers and polishers, and weaving tools were created from large mammal bones. Residents also manufactured animal-bone pendants, whistles, gaming pieces, and shell ornaments. Remains of a great horned owl (*Bubo virginianus*) and nine magpies (*Pica pica*) had been placed alongside human remains in a burial beneath one of the dwellings (Dodd 1982:104; Metcalfe 1982:79–92).

Several ceramics that include bowls, jars, cups, pipes, and figurines were unearthed from the Evans Mound site. Snake Valley graywares dominated the ceramics assemblage. A negligible number of intrusive types were found, and these derived from cultural groups to the north, east, and south. Intrusive wares include Great Salt Lake grayware, North Creek grayware, and Sevier grayware (Dodd 1982:41–57). Other vessels retrieved from the site include fragments of more than 50 baskets (Walling 1982:95). Chipped stone tools such as points, knives, and drills and groundstone tools that include manos, metates, and abraders were prolific throughout the village site.

Pine Park Shelter, Utah (42Ws155), University of Utah, Salt Lake City Collection. Pine Park Shelter is in southwest Utah in the Dixie National Forest, approximately 20 km (12.5 miles) east of O'Malley Shelter in Nevada. The shelter lies at an elevation of about 1,980 m (6,500 ft) in the pinyon pine-Utah juniper vegetation alliance. The 38 points analyzed for this study were collected in 1951 during University of Utah excavation of the site (Rudy 1954).

Shelter deposits were shallow, reaching a maximum depth of 90 cm in the center and comprising only two strata. Stratum I, the lower unit, averaged about 58 cm in depth. Researchers segregated Stratum I into upper and lower levels because there appeared to be two separate cultural surfaces toward the rear of the shelter.

Stratum II averaged 14 cm with a maximum depth of 28 cm. There was cattle dung throughout the first 5 cm of surface deposits (Rudy 1954:2–3).

Only thin ash lenses were found in the strata, suggesting that the shelter was occupied sporadically and for very short periods. Ceramics were found throughout the deposits with most (53 percent) sherds encountered in Stratum I. Parowan Fremont wares, specifically Snake Valley gray and Snake Valley black-on-gray, dominated both strata, composing 53 percent (n=125) of total ceramics sherds. Virgin and Kayenta Pueblo wares make up 23 percent of all sherds recovered and Southern Paiute ceramics comprise 12 percent of the ceramics collection. Parowan Fremont wares decreased in Stratum II, Pueblo types remained about the same, and Southern Paiute ware increased. About 12 percent of recovered sherds were not identifiable. A Fremont ceramics figurine was recovered from the Stratum II deposits (Rudy 1954:4, 17–19).

Chipped stone tools, especially points and knife blades, were the most abundant artifact types recovered from the shelter deposits. Other chipped stone artifacts include drills, gravers, and scrapers. About 74 percent of these artifacts were made of obsidian. Groundstone implements were limited to eight metates and nine manos. Only one mano and metate were found in Stratum I (Rudy 1954:8–17, 19–22).

Other artifacts recovered from the shelter include three bone awls, a bone-flaking tool, two bone ornaments, two bone and four wood gaming pieces, two wood pegs, three basket fragments, three pieces of cordage, and three fragments of processed animal hide. Plant food remains were found in Stratum II and include pinyon pine cones and nut shells, acorns, and two maize cob fragments and a maize kernel. Remains of consumed animals were scarce, limited to a few splintered, unidentifiable bone fragments. Petroglyphs had been carved into the southeast shelter wall. A depiction of a horse's head led the researchers to conclude that Southern Paiute shelter occupants had created the artwork (Rudy 1954:7, 19–22).

Median Village, Utah (42In124), University of Utah, Salt Lake City Collection. Median Village is a Parowan Fremont residential site at the southeast end of the Parowan Valley in southwest Utah, about 2 km south of Evans Mound. Excavated by the University of Utah in the late 1960s, the village was situated on an alluvial fan near Summit Creek at an elevation of 1,780 m (5,850 ft). Before archaeological excavation, the site had been heavily damaged by modern agricultural activities (Marwitt 1970:7–8). The 14 obsidian points included in this study were recovered during the university excavations.

Median Village comprised 14 semi-subterranean pit dwellings, 2 surface structures, 2 outdoor-use areas, and 1 multi-unit storage structure. As at Evans Mound, superposition of dwellings indicated that no more than 5 structures were contemporaneously occupied. Pit structure foundations were circular to oval in shape, from 20 to 45 cm deep and 4.5 to 6 m in diameter. Adobe-lined fire pits were placed in the center of the earthen floors. Four vertical posts embedded in the floor were the primary support for the superstructures. Superstructures were constructed of what were described as leaner posts covered with adobe in some dwellings and in others, grass, cornstalks or bark daubed with mud was used to insulate the dwellings. Burials were discovered beneath two of the pit structures (Marwitt 1970:9, 48–50).

The two surface dwellings were oval with slightly depressed floor surfaces about 5 m in diameter and shallow, unlined, centrally located fire pits. Superstructures were constructed of adobe, but there was no evidence of a support system. Only a single granary of coursed adobe divided into three clay-lined bins was discovered at Median Village. Researchers speculated that there had been other granaries that were destroyed during the landowner's agricultural efforts. Two rectangular outdoor use areas, one measuring 6.5x6 m and the other—about 4.5x3.5 m—were situated among the pit structures. The larger use area contained three fire pits and the smaller, only one. Two post holes located in the larger use area suggest that a ramada may have covered the space (Marwitt 1970:23, 37, 50–51).

A charred structural support from the stratigraphically earliest dwelling at Median Village returned a radiocarbon date of A.D. 900±90. A charred support post from one of the later structures yielded a date of A.D. 960±100. Site abandonment was estimated at A.D. 1020 based on the presence of three structures positioned above the younger dwelling and an estimated use life of 20 years per structure. Ceramics retrieved from Median Village support the projected occupation period. Snake Valley grayware, the earliest Parowan Fremont ceramics, comprised 99 percent of the entire collection. The most common intrusive (0.3 percent) was North Creek grayware (Madsen 1970:54–55; Marwitt 1970:8).

The presence of large quantities of maize macrofossils and the multi-unit granary led the researchers to conclude that Median Village residents were agriculturists, heavily reliant on cultigens. Faunal remains unearthed from cultural deposits, however, indicate that the villagers depended greatly on hunting for subsistence. The most common animal remains that had been processed for consumption were mule deer (47 percent), but bones of rabbits and hares were also abundant, composing 42 percent of recovered faunal remains. Bighorn sheep remains made up 7.8 percent of the collection of faunal remains. Lesser quantities of bird and small mammal bones were also present (Marwitt 1970:8–9; Dalley 1970a:127).

Ceramics artifacts recovered from Median Village include bowls, jars, pitchers, pipes, and figurines. A large number of awls, scrapers, stone-flaking tools, gaming pieces, pendants, beads, and rings were manufactured from animal bones. Ground stone artifacts include metates, manos, balls, discs, and pendants. Points, knife blades, scrapers, and gravers were among the 2,065 chipped stone tools collected from the village site. Only about 9 percent of these were manufactured from obsidian, and the remainder, from chert. The chipped stone tool category with the highest percentage (26 percent) manufactured from obsidian is points (Adovasio 1970:75–96; Dalley 1970b:96–127; Madsen 1970:55–68). The 14-point sample included in this study represents 25 percent of the Median Village obsidian point collection.

Paragonah Mounds, Utah (42In43), University of Utah, Salt Lake City Collection. When initially described in 1872, Paragonah Mounds, on the east edge of the central Parowan Valley along Paragonah Creek, comprised more than 400 mounds. By 1915, when the first archaeological reconnaissance in the state of Utah took place, only 40 to 50 of Paragonah's mounds had not been completely razed during the intervening decades of agricultural and community development. Because of the extent of the site and the imminent threat of destruction to the remaining mounds, Paragonah Mounds became the focus of the first archaeological excavations in the Parowan Valley (Judd 1926:36, 54; Marwitt 1970:5, 8).

In 1915, Judd (1926:1,36–38), sponsored by the Smithsonian Institution, Bureau of American Ethnology, conducted test excavations of four mounds at Paragonah in one and a half days. A single-room, rectangular, adobe dwelling measuring about 6x2 m was uncovered from beneath the first mound. A narrow, sloped, adobe bench ran along the base of one wall, and arrow points, ceramics sherds, and bone awls were discovered on the earthen floor. Trenching of a second mound revealed a similar dwelling measuring 4x2 m. A metate and a sandstone disk about a half meter in diameter lay among the sherds on the dwelling floor. Shovel probes of a third mound revealed squash seeds, bone awls, and ceramics.

Judd (1919:3; 1926:54–58) returned to Paragonah Mounds in 1916 for more-extensive research focusing on The Big Mound, the largest mound that remained in the area. Twelve single-room rectangular structures, 2 two-room rectangular structures, and 4 circular structures, all constructed of adobe, were unearthed. Rectangular dwellings measured from 2.6 to 10.7—m in length by 1.7 to 2.5 m in width, and circular dwellings were about 4.6 m in diameter. Excavations revealed that rectangular dwellings inhabited at a later time had been built on top of the leveled remains of earlier dwellings.

An ashy midden containing bone awls, unworked mammal bone fragments, ceramics sherds, stone tools, and construction refuse was exposed as well. Also discovered were outdoor spaces ("courtyards") between the dwellings that contained several fire pits that had been used for cooking. A coiled basket, shattered ceramics vessels, large quantities of worked bone and stone tools, and charred corncobs and husks were retrieved from beneath the collapsed roof of one of the circular structures (Judd 1919:3; 1926:54–58).

In 1917, the University of Utah and the Smithsonian Institution sponsored Judd's (1919) return to Paragonah to complete excavation of the Big Mound. He focused his research on documenting the variability in structures as related to function and social organization. He identified the rectangular structures, constructed through layering of adobe on the ground surface, as dwellings, used for sleeping and storage. Rebuilding of the surface dwellings was common, likely because inadequate roof drainage allowed precipitation to run down the sides of the house, eventually melting the adobe walls. New houses were rebuilt on top of the razed ruins of the old structures, thus maintaining the original configuration of the village.

Residents of the Big Mound village constructed brush courtyard shelters by the adobe dwellings. A rectangular frame of posts was built and poles laid against the horizontal roof posts at an angle from the ground and across the flat roof. Brush covered the roof and at least three sides of the structure. Circular fire pits were placed in the center of the courtyard "hut," and the areas were used for cooking and other household tasks (Judd 1919:9–11).

The Big Mound residents also constructed at least three ceremonial structures in their village that Judd (1919:12–15) called kivas. In contrast to the elaborate Pueblo kivas that were built with considerable communal effort, the Paragonah kivas exhibited less care in construction methods. Greater effort was used to build the individual adobe residences. The kivas were circular and subterranean, with mud floors and walls. Access was through a hole in the roof, which was level with the courtyard floor. At least one adobe-rimmed fire pit was placed in the center of each kiva. Like the surface structures, new kivas were constructed on top of the ruins of older kivas. Based on the amount of rebuilding, Judd (1919:22) surmised that people had occupied the Big Mound village for "many decades" before final abandonment.

The Big Mound village residents were both skilled hunters and horticulturists. Judd (1919:15–21) noted that bone artifacts, which comprised both worked tools and meal remnants, dominated at Paragonah Mounds. He tentatively identified the bones of deer, elk, bear, pronghorn, desert bighorn, bison, and "many smaller mammals" in the artifact assemblage. Squash, maize, beans, and pinyon nuts were the more prevalent plant food remains. Bone items that the mound residents made and used include awls, painted gaming pieces, rings, and pendants. Corrugated ceramics were present in limited quantities, and painted black-on-gray vessels, some with fugitive red designs, were common. The Big Mound residents also made clay figurines and pipes. Ground stone implements included hammers, pipes, jar covers, balls, metates, and manos. The 22 obsidian points composing the sample examined in this study were among the chipped stone tools Judd collected from the Big Mound village at Paragonah.

Marysvale 3 and 7, Utah (42Pi1 and 42Pi2), University of Utah, Salt Lake City Collection. In 1937, Gillin (1941) conducted test excavations on seven sites in central Utah, among which were sites that he designated Marysvale 3 and Marysvale 7. The Marysvale sites were situated along Bullion Creek, east of the Tushar Mountains. Marysvale 3, a mound site, was on the valley floor, and Marysvale 7, in the mountain foothills at the mouth of Bullion Canyon. The Marysvale 3 mound was created through prehistoric reconstruction of structures on top of abandoned structures, like other Fremont mound sites.

Marysvale 3 comprised four occupation strata. The earliest structure was apparently a pit house, though flooding had obliterated most of the cultural remains. There was a charcoal-covered occupation surface above the pit structure. Two rectangular adobe dwellings, House I and House II, had been built over the earlier occupation surface. House I had been constructed before House II but had been renovated when House II was built, apparently as an extension of House I. "[T]amped adobe" covered the floor surfaces in both dwellings, and an adobe-rimmed circular fire pit was uncovered in the original floor of House I. A surface structure had been built on top of the ruins of House I. Artifacts retrieved from Marysvale 3 include ceramics sherds, bone game pieces, bone awls, stone balls, chipped stone knives and points, and a bone pipe. Five of the obsidian points in the Marysvale sample were retrieved from the Marysvale 3 mound site.

Marysvale 7, a small village site, was situated 2.5 miles west of Marysvale 3. Six pit structures, one semi-subterranean house, four kivas, and five surface dwellings were uncovered during site excavation. Only five of the small, shallow pit structures were excavated. These were rectangular with smoothed earth floors lacking post holes. Gillin (1941:7–9) notes that only two pit structures appeared large enough for habitation, and one of these contained a "hearth lens." The other pit structures were closer in size to storage features.

One semi-subterranean dwelling with an adobe-coated rimmed fire pit and adobe floor was also found. Based on the positions of the postholes, the presence of collapsed wood beam structural supports, and pieces of burned adobe adhering to the supports, Gillin (1941:9–10) inferred that the superstructure had been rectangular, built with freestanding wattle and daub walls and a flat roof. The roof had been constructed of corn stalks and willow stems woven into the support beams.

Gillin (1941:10–12) excavated three of the four Marysvale 7 kivas. The kivas were rectangular, semi-subterranean structures with plastered adobe floors and walls, adobe-rimmed centrally placed fire pits, and ventilator shafts. He notes that the structures resembled "Steward's kivas at Kanosh." Metates, ceramics sherds, and clay figurines were among the artifacts located in the kivas. The five surface dwellings were rectangular with freestanding adobe walls but lacked fire pits. Four of the structures were single-room dwellings, and one comprised two rooms. Manos and metates were among the artifacts found in the surface dwellings. Other artifacts located at the site include five different types of projectile points, knives, scrapers, clay and bone game pieces, clay pipes, bone pendants, awls and whistles, maize cobs, and shell beads (Gillin 1941:31–33). Animals that site occupants consumed included cottontail rabbit, jackrabbit, squirrel, beaver, porcupine, deer, pronghorn, bison, grebe, goose, and sage grouse (Allen 1941:45–46).

It is not clear in Gillin's (1941:7–15, 42) description of the Marysvale 7 village, which, if any, of the structures were used contemporaneously. He does note, however, that a cultural stratum was positioned on top of the collapsed roof fill in a kiva and "tramped down by inhabitants passing over the abandoned site," suggesting that the kivas were abandoned before occupation of the surface dwellings. The pit structures were also filled with cultural "rubbish," which suggests these were abandoned before final occupation of the site. These data suggest that the occupational history of Marysvale 7 likely resembled that of Marysvale 3. Based on the qualities of corrugated ceramics located at the sites, he hypothesized that Marysvale 3 was occupied before Marysvale 7, which was likely inhabited "well into the twelfth century, A.D."

Kanosh Mounds, Utah (42Md1 and 42Md2), and Sevier Lake, Utah (42Md3, 42Md5, and 42Md6), University of Utah, Salt Lake City Collection. From 1930 through 1933, Steward (1936:5) conducted archaeological research in western Utah, sponsored by the University of Utah and the Smithsonian Institution. Among the sites that he excavated were Kanosh Mounds and the Sevier Lake sites, which comprised "adobe-walled rooms . . . arranged in small aggregates." He noted that the structures and configurations of the sites were similar to those that Judd (1919; 1926) had excavated from the Parowan Valley mounds from 1915 through 1917.

Material remains at Kanosh and Sevier Lake were also quite like those found in the Parowan Valley. The predominant ceramics types at the Kanosh and Sevier Lake sites were plain grayware, corrugated grayware, and decorated black-on-gray ware. These types were also abundant at Paragonah. Tapering, square-shouldered, armless, clay figurines—usually unfired—were common. Large numbers of sandstone, granite, lava, pumice, flint, and obsidian stone balls were frequently found in dwellings (Steward 1933:10–16, 23–28, 38, 59). Steward (1933:35) noted that the most common projectile point type of the region was "notched from the corners so as to leave a broad tang and barbs." He collected the 20 Kanosh obsidian artifacts and the 12 Sevier Lake obsidian artifacts composing the sample from the sites during his 1930s excavations.

Pharo Village, Utah (42Md180), University of Utah, Salt Lake City Collection. Pharo Village is in upper Round Valley near Pharo Creek in central Utah. The site is situated on the boundary between the physiographic Great Basin and Colorado Plateau. In 1967, archaeologists excavated the site with funding that the National Science Foundation provided (Marwitt 1968:v, 1).

Pharo Village was a small hamlet occupied by Fremont culture maize horticulturists. The site comprised three rectangular, semi-subterranean, pit dwellings with centrally located fire basins, two outdoor surface-use areas, and surface structures of coiled adobe. Two human burials and one dog burial were found in borrow pits from which soil for building the adobe structures had been extracted (Marwitt 1968).

Archaeologists retrieved charred maize fragments from the Pharo village cultural deposits. Large quantities of worked and fragmented desert bighorn and mule deer bones were also unearthed, indicating that hunting was important to the subsistence of the site residents. Marwitt (1968: 5) hypothesized that the site residents seasonally hunted and gathered in the Pavant Range to the west of the village but mainly relied on the natural resources found in Round Valley's ecological niches.

Sevier grayware was the dominant ceramics type encountered at Pharo Village, but Snake Valley grayware and Ivie Creek black-on-white ware were also present in limited quantities. Clay pipes, chipped stone tools, worked bone tools, and groundstone artifacts that included stone balls were common artifacts. Two clay figurines and one bone figurine were also found (Marwitt 1968). Archaeologists collected the 26 points making up the Pharo Village sample during the 1967 excavation.

Garrison Site, Nevada (26WP6, WP7, and WP12), University of Utah, Salt Lake City Collection. The Garrison site is in White Pine County, Nevada, about "100 yards from Utah." Before excavation, the site comprised 17 "low, irregularly-shaped oval mounds" and several "shallow bowl-shaped depressions" situated along a former channel of Snake Creek on the east side of the Snake Range. In 1952, University of Utah archaeologists excavated nine of the structures composing the Fremont village (Taylor 1954:4–7). The 14 obsidian points making up the Garrison site collection were collected during the excavation.

Excavation of three depressions revealed the foundations of rectangular, single-room, semisubterranean (0.5 m deep), adobe-walled dwelling with thick layers of ash and charcoal covering the compacted dirt floor. The remains of surface dwellings—some single-room and some multiroom, a dwelling type that Steward had designated the Kanosh house—were excavated from the mound areas. The largest rooms in the surface dwellings were about 2x3 m with adobe walls about 2 m high. Floors were compacted earth, and roofs were constructed from poles, branches, twigs, and grass. Fire pits were absent in all surface dwellings, but thin ash and charcoal lenses were discovered on the floor surfaces of several rooms (Taylor 1954:7–8, 32–33).

Artifacts retrieved during excavation include ceramics, chipped stone tools, and groundstone implements. Snake Valley graywares were the most common ceramics types, but other Fremont regional types, specifically Sevier graywares and Salt Lake graywares, were also present. Chipped stone tools included projectile points, knives, drills, and scrapers. Worked bone and shell artifacts that include bone awls, gaming pieces, and beads and *Olivella* shell beads were also recovered (Taylor 1954:37–57).

Analysis of flora macrofossils indicated that residents of the Garrison site consumed cactus, squaw bush berries, ricegrass seeds, and wild buckwheat seeds. Animal remains that had been processed for consumption included bison, desert bighorn, pronghorn, mule deer, jackrabbit, gopher, ground squirrel, fish, and several bird species. Dog and coyote remains were also identified (Taylor 1954:58–61). Based on the sparse cultural remains in middens and dwellings, Taylor (1954:9) deduced that the Garrison village site had been briefly occupied during a single period.

Summary

Nine public institutions and federal agencies contributed about 1,700 obsidian artifacts, mostly projectile points, from 34 Great Basin sites or areas. These agencies and institutions include Nevada State Museum, Carson City; American Museum of Natural History, New York; University of California, Davis; Joshua Tree National Park, California; Death Valley National Park, California; Desert Research Institute, Reno; State of Utah School and Institutional Trust Lands Administration, Salt Lake City; Southern Utah University, Cedar City; and University of Utah, Salt Lake City. The sites from which archaeologists collected the points were situated in a variety of environments that include playa margins, sagebrush steppe, and pinyon-juniper forest. Site types include surface artifact scatters, open camps, rockshelters, and villages across a broad region encompassing portions of the central, eastern, western, and southern hydrographic Great Basin. Although no point typology exists that encompasses the broad region, use of a single metric classification system is necessary to maintain consistent data. A classification system developed for Monitor Valley, Nevada, provides a set of neutral metric discriminants to evaluate the broad-based artifact sample.

THOMAS'S (1981) MONITOR VALLEY PROJECTILE POINT CLASSIFICATION SYSTEM

Amick (1999:162) notes that during the entire twentieth century, the primary objectives of lithics analysis tended toward "descriptive classification and chronology building." In attempting to meet these goals, Great Basin archaeologists constructed "as many typologies as there are research questions." By the 1970s, the many projectile point typologies proposed over the past decades, which seem to vary from valley to valley, had become a major source of confusion and frustration. In effort to alleviate the problem, a generalized, chronology based classification system was published in the early 1980s to categorize Great Basin projectile points manufactured within the past 6,000 years of prehistory.

As a result of his 1970s archaeological research in central Nevada, Thomas (1981) developed a projectile point chronology for Monitor Valley. He based his chronology on changes in point styles he observed in the projectile point sample (about 400 points) recovered from Gatecliff Shelter. Thomas (1981:7–8, 11, 13) isolated quantifiable, "time-sensitive" attributes differentiating point types and correlated the types with associated radiocarbon dates obtained from charcoal and wood samples retrieved from the shelter strata. He called these "temporal types," which he defined as "morphological types that are found consistently to be associated with a particular time span in a given area."

Thomas (1981:14, 24, 26) tested the classification system with projectile points collected from Monitor Valley surface and shelter sites. He was able to assign more than 95 percent of the sample to temporal types identified in Gatecliff Shelter. Using the classification system, named the Monitor Valley key, he examined Great Basin point metric data on file at the American Museum of Natural History, New York. These data were compiled during earlier analyses of more than 7,000 Great Basin points collected from 34 sites. The Great Basin sample classification results were similar to the Monitor Valley sample results.

The Monitor Valley key relies on a series of measurements to assign a particular point to temporal type. These measurements include total length, axial length, maximum thickness, weight, maximum base width, neck width, proximal shoulder angle, and notch-opening angle. Several measurements are calculated to obtain ratios necessary to classify some temporal and morphological types, which are maximum base width to maximum width, basal indentation ratio (axial length to maximum length), and maximum width position (percent of maximum length from base to position of maximum width). Thomas (1981:14–15, 25) noted, however, that because of use damage and refurbishing, the only relatively stable metric attributes for most points are thickness, base width, and neck width.

The Monitor Valley key differentiates three point classes, which are shoulderless, side-notched, and corner-notched. Shoulderless temporal point types are Cottonwood triangular, Cottonwood leaf-shaped, and Humboldt. Reference is made to a potential fourth shoulderless type found in Monitor Valley, the Triple T concave base, but because there was no adequate sample, the type is not included in the Monitor Valley key. Desert side-notched and large side-notched types constitute the side-notched class. Corner-notched types include Rosegate, Elko corner-notched, Elko eared, Gatecliff contracting stem, and Gatecliff split stem types (Thomas 1981:15–26). Metric discriminants defining the temporal types are summarized in Table 5.2.

The Monitor Valley Temporal Types. Thomas (1981:27–37) grouped Monitor Valley point types into "series" based on stratigraphic association. The latest is the Desert series, which includes the Desert side-notched, Cottonwood triangular, and Cottonwood leaf shaped morphological types. Radiocarbon dates from associated organic materials retrieved from Monitor Valley sites indicate that Desert series points occur in post-A.D. 1300 contexts. Thomas (1981:27) notes, however, that Desert series points occur as early as A.D. 1150 in the eastern Great Basin. Figure 5.6 shows a selection of Desert series points from Monitor Valley.

Rosegate series points, which include the Eastgate expanding stem and Rose Spring morphological types, precede the Desert series in Monitor Valley. There, Rosegate points were found in contexts dating from A.D. 700 through A.D. 1300. Limited evidence from two eastern Great Basin sites suggests that Rosegate points were manufactured before A.D. 650 and use of the temporal type persisted into historic times

Table 5.2. Summary of metric discriminants defining Thomas's (1981) Monitor Valley temporal types

Class	Temporal Type	Length Total (LT)	Thickness	Weight	Width Base (WB)	Width Neck (WN)	Width Base/ Width Maximum (WB/WM)	Proximal Shoulder Angle (PSA)	Notch Opening (NO)	Basal Indentation Ratio (BIR)	Maximum Width Position (MWP)
Shoulderless	Cottonwood triangular	< 30mm	< 4 mm	≤ 1.5 g	–	–	> .90	–	–	–	–
Shoulderless	Cottonwood leaf-shaped	< 30mm	< 4 mm	≤ 1.5 g	–	–	–	–	–	–	> 15%
Shoulderless	Humboldt	≤ 30mm	≤ 4 mm	≤ 1.5 g	–	–	≤ .90		–	< 0.98	–
Side-notched	Desert-side notched	–	–	≤ 1.5 g	–	–	> .90	> 130°	–	–	–
Side-notched	Large-side notched	–	–	> 1.5 g	–	–	–	> 150°	–	–	–
Corner-notched	Rosegate	–	–	–	≤ 10mm	WN ≤ WB - 0.5mm	–	90° ≤ PSA ≤ 130°	–	–	–
Corner-notched	Elko corner-notched	–	–	–	> 10mm	–	–	110°≤ PSA ≤ 150°	–	> 0.93	–
Corner-notched	Elko split stem	–	–	–	> 10mm	–	–	110°≤ PSA ≤ 150°	–	≤ 0.93	–
Corner-notched	Gatecliff contracting stem	–	–	> 1.0 g	–	–	–	≤ 100° OR	> 60°	> 0.97	–
Corner-notched	Gatecliff split stem	–	–	> 1.0 g	–	–	–	≤ 100° OR	> 60°	≤ 0.97	–

Figure 5.6. Desert series points from Monitor Valley (Thomas 1988:201).

in that region (Thomas 1981:30–32). Figure 5.7 illustrates selected Rosegate points from Monitor Valley.

Figure 5.7. Rosegate series points from Monitor Valley (Thomas 1988:205).

Elko series points include both Elko corner-notched and Elko eared morphological types. Of all temporal types retrieved from Monitor Valley, Elko points were the most numerous (Thomas 1988:204). Radiocarbon dates from Gatecliff Shelter and Monitor Valley sites indicate that the temporal type was used from about 1300 B.C. through A.D. 700. Thomas (1981:32–33) notes that radiocarbon dates from other central and western Great Basin sites containing Elko points tend to support the Monitor Valley data. Use of Elko series points in the eastern Great Basin preceded the central and western Great Basin use of the type, however, with radiocarbon dates indicating a beginning use period as early as 8000 B.C. Some evidence indicates that Elko series points were used in historic times (Thomas 1981:13, 32–33). Figure 5.8 illustrates Monitor Valley Elko series points.

Thomas (1981:22–24) defined Gatecliff series points, which include the Gatecliff contracting stem and Gatecliff split stem morphological types, as "medium to large contracting stem projectile points." The Gatecliff contracting stem temporal type corresponds to the Elko contracting stem and Gypsum morphological types. He subsumed Pinto, Little Lake, Silent Snake, and Bare Creek eared morphological types under Gatecliff split stem. Radiocarbon dates from two shelters in Monitor Valley suggest a beginning date of about 3000 B.C. for the type. Several radiocarbon dates from Gatecliff Shelter indicate that use of the Gatecliff type terminated at around 1300 B.C. Figure 5.9 illustrates Monitor Valley Gatecliff series points.

The Humboldt series is poorly defined because it includes shoulderless, lanceolate, concave-base artifacts of variable function (Thomas 1981:17–18). Thomas considered Humboldt series points "relatively poor time marker[s]" because the type was apparently used throughout the past 6,000 years of Great Basin prehistory. The type was rare in Monitor Valley sites containing stratified deposits. Based on the few radiocarbon dates retrieved from material associated with Humboldt series points in Gatecliff Shelter, Thomas assigned the points to the period from 3000 B.C. to A.D. 700. Figure 5.10 illustrates Monitor Valley Humboldt series points.

Thomas (1981:18–19) essentially defines the large side-notched temporal type as all

Figure 5.8. Elko series points from Monitor Valley (Thomas 1988:212–213).

Figure 5.9. Gatecliff series points from Monitor Valley (Thomas 1988:214).

Figure 5.10. Humboldt series points from Monitor Valley (Thomas 1988:215).

side-notched points that are not Desert side-notched points. The temporal type subsumes the Northern, Bitterroot, Madeline Dunes, Elko, and Rose Spring side-notched morphological types. Only 15 large side-notched points were recovered from Monitor Valley sites. Thomas (1981:19) notes that "we have little to offer in terms of temporal information; but they [large side-notched points] are certainly older than Desert Side-notched points." Thus, he assigns the large side-notched temporal type to "pre-A.D. 1300." Figure 5.11 illustrates Monitor Valley large side-notched points.

Words of Caution

Thomas (1981:8,24,37–38) warned that "there are important spatial and temporal limitations" for the Monitor Valley typology. First, the temporal type classification system is chronologically restricted to the past 6,000 years ("post-Mazama") of Great Basin prehistory. Earlier points ("pre-Mazama") that were absent in the Monitor Valley sample should be excluded from evaluation when using the Monitor Valley key. Second, the typology is geographically restricted, applicable only to the central and western Great Basin. Morphological types that "are nearly identical" were manufactured in the eastern Great Basin, but "the temporal duration for several of the types is markedly different." Finally, the Monitor Valley key is applicable solely to point collections, not isolated specimens. Thomas (1981:38) felt that despite these limiting factors, the "relatively objective [metric] criteria" would provide archaeologists with a common "language" in future efforts in classifying points.

THE MONITOR VALLEY KEY AND GREAT BASIN POINT SAMPLES

Although Thomas (1981:37) warned that pre-Mazama points should be excluded from analysis under the Monitor Valley key, most of

Figure 5.11. Large side-notched points from Monitor Valley (Thomas 1988:216).

the collections examined in this study contain significant numbers of early point types. With the exception of point collections from eastern Great Basin sites, the collections generally comprise isolated specimens and very small samples (less than five) collected from individual surface sites widely dispersed over very broad regions (e.g. Owens Valley, Nevada Test and Training Range, Deep Springs). There are no data to classify a collection from a site as pre-Mazama or post-Mazama other than point types, which is rather circular research considering the purpose of the metric analysis. In addition, there is no similar typology for pre-Mazama points. Thus, all points were evaluated using the Monitor Valley key with the hope that pre-Mazama types would fall out of key.

All of the 1,700 artifacts included in the study were metrically evaluated by the author to maintain maximum consistency in results. After analysis, collections were either photographed or scanned. Surface site collections were grouped by temporal type and depositional site collections were grouped first by stratigraphic unit and then by temporal type in the figures. Appendix C contains all metric data, point type determinations, comments, and photos.

The Study Area Sample

The 301 artifacts composing the study area sample derive from sites on the NTTR and NTS. The NTTR points are either isolate occurrences or very small collections from surface sites that lack temporal control and are widely dispersed over the 3 million acres that make up the military reservation. The Nevada State Museum's Mud Lake collection and Tippipah Spring points are also isolates and surface collections. Mud Lake lies on the northwest corner of the NTTR, and Tippipah Spring is in the NTS on the north face of Shoshone Mountain. Although the study area sample derives from sites in the central Great Basin just south of Monitor Valley, the sample contains a large percentage of pre-Mazama point types. Thus, as Thomas (1981:37–38) warned, the utility of the Monitor Valley key in classifying the study area sample is limited.

The first problem appeared when classifying points of the Great Basin stemmed type. Nearly all of this pre-Mazama type do not fall out of key but meet the Monitor Valley metric discriminants for the Gatecliff contracting stem temporal type. When visually comparing Great Basin stemmed points to the Gatecliff points illustrated in Thomas's (1983; 1988) Monitor Valley volumes, it is immediately apparent that stem length would likely distinguish the two types. Thus, stem length was added to the attributes measured for this study, and a category labeled "questionable classification" was added to the temporal type or out-of-key classification scheme to accommodate pre-Mazama types. Justice's (2002) California-Great Basin point volume was consulted to assist in pre-Mazama and out-of-key point type determinations.

Two more point types key as the Gatecliff contracting stem type but are visually dissimilar. The first is an anomalous large, basal-notched point collected from Stonewall Flat on the NTTR in an area where pre-Mazama points are dominant. The second is a post-Mazama type that Adovasio (1970:75) labeled Parowan basal-notched during analysis of the Median Village chipped stone artifact assemblage. Although the point type is uncommon (4 percent) in the study area sample, it is quite common east of the study area, especially in Utah. Justice (2000:336–339) includes this type in the Rosegate series. Figure 5.12 illustrates point types that key as the Gatecliff contracting stem temporal type.

Because temporal control was lacking in the study area sample, classification of pre-Mazama bifurcate stemmed points was difficult. Using the Monitor Valley key, all of these morphological types key as either Elko eared or Gatecliff split stem temporal types. Although none fall out of the Monitor Valley key, some of the bifurcate stemmed points are visually dissimilar. The differences are substantially more subtle, however, than is the case with contracting stem points. Some bifurcate stemmed points are quite thick and exhibit fewer and larger flake scars than others, suggesting these might be the pre-Mazama Pinto temporal type.

Basgall and Hall (2000:240) define Pinto points as "a somewhat uniform group of relatively large, comparatively thick projectile points, characterized by robust hafting elements, basal indentations or notches, and minimal pressure retouch." They also identify stem length as a significant attribute differentiating the Pinto type from Elko eared and Gatecliff split stem types, which emphasizes the significance of this metric attribute in point type metric analyses. Basgall and Hall (2000) provide the

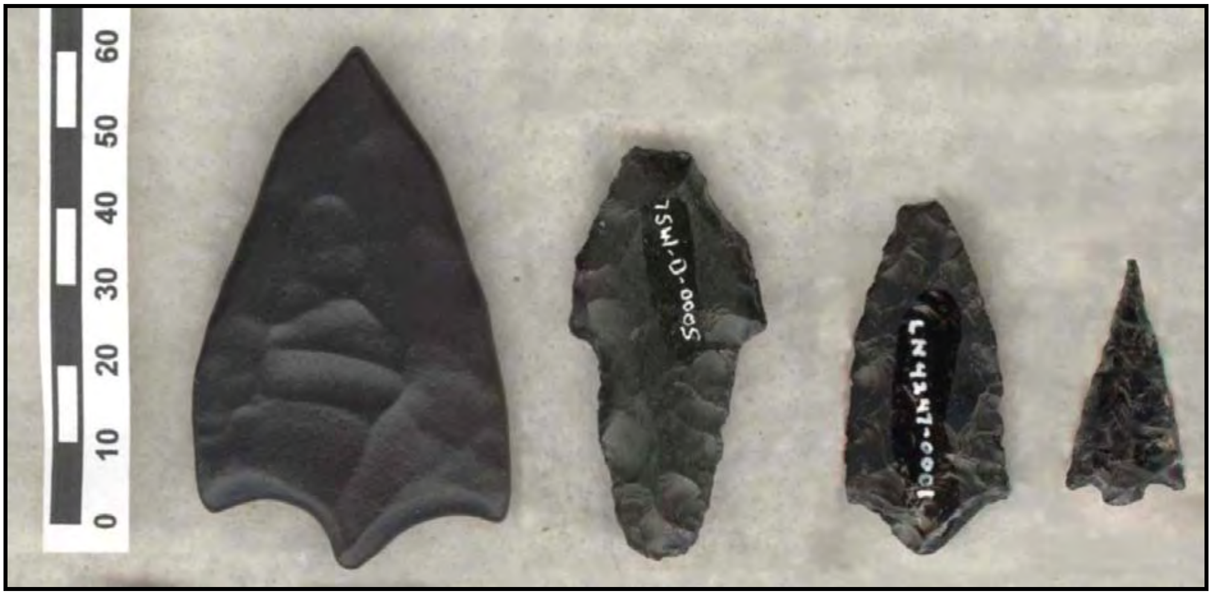


Figure 5.12. Points keying as the Gatecliff contracting stem temporal type. From left to right, unknown large basal-notched, Great Basin stemmed, Gatecliff contracting stem, Parowan basal-notched.

metric ratios (stem length to maximum length and base width to maximum width) and shoulder angles that distinguish Pinto points from the Elko eared and Gatecliff split stem temporal types.

Only about 25 percent of the study area bifurcate stemmed points meet all of the Pinto type metric criteria. Those points that meet more of the Pinto criteria than the metric ranges that Basgall and Hall (2000:267) quantify as differentiating Elko and Gatecliff types from Pinto types are classified as Pinto. Thus, the bifurcate stemmed point classifications for the study area sample are the most tentative.

Classifying shoulderless points was also problematic but affected a smaller percentage of the sample because these morphological types are relatively uncommon in the study area sample. The single Great Basin fluted point in the sample keys was a Humboldt point. More problematic is a shoulderless concave base type collected from sites in surface association with Great Basin stemmed points. Some resemble Justice's (2000:Plate 1, 80–85, 422) Black Rock concave base type, and these typically fall out of the Monitor Valley key. Examples of these types are shown in Figure 5.13. Also, some small, shoulderless, concave base points key as the Cottonwood leaf shaped variety of the Desert series. Although the maximum width position for these points is greater than 15 percent, Thomas (1981:16) describes the temporal type variety as "basally rounded." The Cottonwood leaf shaped label is retained, however, because the points were collected from contexts in surface association with other Desert series points.

Few difficulties arose in classifying corner-notched points in the study area sample. Three Great Basin stemmed points similar to Justice's (2000:Plate 1, 101–115, 423) Borax Lake type key as the Elko corner-notched temporal type. The points are distinguishable from the Elko type, however, because stem length and neck width are robust in comparison. Two points key as Elko points because of base width but are much closer in all other attributes to Rosegate points. Bettinger and Eerkens (1999:232–234) note that the Monitor Valley Rosegate basal width parameters limit the utility of the typology in eastern California.

Of the 301 points making up the study area sample, 10 percent fall out of the Monitor Valley key and 33 percent were determined to be of questionable classification. Figures, text, and metrics contained in Justice (2000) were used to classify the points that were out of key and of questionable classification. With the exception of the Parowan basal-notched type, all of these are early (pre-Mazama) types that Thomas (1981) stated should be excluded from Monitor Valley key evaluation. Later (post-Mazama) types comprise 51 percent of the sample. Thirteen artifacts exhibit extreme breakage and wear and thus are untypable. Table 5.3 summa-

Figure 5.13. Early concave base shoulderless points in the NTTR collection.

rizes the identifiable point types and quantities in the study area sample.

North of the Study Area Sample

The sample north of the study area comprises 138 points. The 82 points from Alta Toquima Village, 59 percent of the sample, were collected from controlled contexts. The Mount Jefferson Research Natural area and Big Smoky Valley points are isolates or small collections from surface sites. These compose 41 percent of the sample. The Monitor Valley key is of slightly greater utility in classifying this sample, likely because a percentage of the total sample meets Thomas's (1981) criteria for maximum utility of the Monitor Valley typology. Nine percent fall out of key, and 20 percent are of questionable classification.

The Big Smoky Valley point sample comprises primarily pre-Mazama point types collected during the Campbell (1939) expedition that are, of course, questionably classified using the Monitor Valley key. Classification problems are much like those encountered with the study area sample. Most of the Great Basin stemmed types key as Gatecliff contracting stem points. The bifurcate stemmed points that Campbell

Table 5.3. Point type determinations and quantities in the study area sample

POINT TYPE	QUANTITY
Early (pre-Mazama) Types	
Great Basin fluted	1
Great Basin stemmed	99
Winged crescent	1
Unknown large basal-notched	1
Undetermined large shoulderless concave base	8
Pinto	20
Later (post-Mazama) Types	
Large side-notched series	7
Humboldt series	17
Undetermined medium-size leaf shaped	1
Gatecliff series	26
Elko series	35
Rosegate series (includes Parowan basal notched)	43
Desert series	24

(1939) collected from "Pinto sites" key as either Elko eared or Gatecliff split stem temporal types. Again, only some of these meet all of the Basgall and Hall (2000) metric discriminants differentiating the Pinto type. Large, shoulderless points that Campbell (1939) labeled "Yuma Folsom" key as the Humboldt temporal type if the base is concave and fall out of key if the base is relatively flat. Figure 5.14 illustrates the "Pinto" and "Yuma Folsom" points.

Although the Alta Toquima Village point sample met Thomas's (1981) site criteria, 10 percent of the points fell out of key. About half of these are a small, shoulderless type, slightly thick (4.2 mm to 5.0 mm) for the Cottonwood series and too short (less than 30 mm) and triangular in shape to meet the Humboldt discriminants. The out-of-key small shoulderless points are within the metric ranges of Justice's (2002:439) Cottonwood triangular type. Figure 5.15 illustrates these points.

Also out of key are three points most similar in appearance and metric attributes to Justice's (2002:437) metrics for the Parowan basal-notched type. Two artifacts exhibit use wear more consistent with a hafted knife blade than a point. Table 5.4 is a list of point types and quantities for the sample from sites north of the study area.

West of the Study Area Sample

The 433 artifacts composing the sample from sites west of the study area are either partial collections from stratified sites, small surface site collections, or isolate occurrences. Despite the assorted contexts, the Monitor Valley key was more effective in classifying the western sample than the samples from the sites closest to Monitor Valley. Only 7 percent fell out

Figure 5.14. Campbell's (1939) "Pinto" and "Yuma Folsom" points from Big Smoky Valley.

Figure 5.15. Out-of-key Cottonwood points from Alta Toquima Village.

Table 5.4. Point type determinations and quantities north of the study area

POINT TYPE	QUANTITY
Early (pre-Mazama) Types	
Great Basin stemmed	18
Undetermined large shoulderless	1
Undetermined large weak-shouldered concave base	1
Undetermined large shoulderless concave base	2
Pinto	5
Later (post-Mazama) Types	
Large-side notched series	3
Humboldt series	7
Gatecliff series	9
Elko series	8
Rosegate series (includes Parowan basal notched)	8
Desert series	71

of key, and 17 percent were questionably classified. The lower percentage of questionable classifications is because of the smaller percentage of pre-Mazama points making up the sample.

Once again, most questionable classifications are pre-Mazama point types, most of which were collected during the Campbell (1937) Owens Valley expeditions. Great Basin stemmed points typically key as Gatecliff contracting stem points, Great Basin fluted points key as Humboldt points or fall out of key, and Pinto points key as Elko eared or Gatecliff split stem points. Unique to the west of the study area sample are two, large leaf-shaped points found during the Campbell (1937) expedition in surface association with Great Basin stemmed points. These presumably pre-Mazama types fall out of the Monitor Valley key. Figure 5.16 shows pre-Mazama points from Owens Valley.

A problem in classifying some post-Mazama types using the Monitor Valley key is more pronounced in the western sample, however. As in Bettinger's and Eerkens' (1999) study results, misclassification of Rosegate points occurs because basal widths are slightly robust. All other discriminants are within the Rosegate series range, as is general appearance. But in addition to misclassification into the Elko series, several Rosegate points with bases slightly greater than 10 mm and proximal shoulder angles of less than 100° key into the Gatecliff series. The Rosegate series points that key as Elko series points are most similar in appearance and metric attributes to Justice's (2002:323–324, 436–437) Rose Spring corner-notched type, and the points keying into the Gatecliff series most closely correlate with the Eastgate expanding stem type.

As in the other samples,several slightly thick or long Cottonwood points fall out of key. Six percent of the sample comprises stemmed artifacts exhibiting wear patterns consistent with drills or hafted knife blades. Table 5.5 summarizes point types and quantities for the sample from sites west of the study area.

South of the Study Area Sample

The sample from sites south of the study area is the smallest, comprising only 66 artifacts. Most of these (70 percent) are Desert series points. Points falling out of key compose 14 percent of the sample, and those questionably classified using the Monitor Valley key, only 9 percent. The small percentage of questionably classified points is because of the small quantity of pre-Mazama point types included in the sample. The two Great Basin stemmed points in the sample key as the Gatecliff contracting stem type, and the two Pinto points key as Elko eared points. Both Pinto points meet the Basgall and Hall (2000) metric definition of the type.

Post-Mazama points falling out of key are three Cottonwood and two Rosegate types. The out-of-key Cottonwoods are slightly long (31.7 mm) or thick (4.3 mm and 4.7 mm). The neck of one Rosegate point was only 0.4 mm smaller than the base rather than the mini-

Figure 5.16. Owens Valley pre-Mazama points collected during the Campbell Expeditions.

Table 5.5. Point type determinations and quantities west of the study area

POINT TYPE	QUANTITY
Early (pre-Mazama) Types	
Great Basin fluted	2
Great Basin stemmed	52
Undetermined large shoulderless concave base	8
Undetermined large leaf shaped	2
Pinto	7
Later (post-Mazama) Types	
Large side-notched series	4
Humboldt series	12
Gatecliff series	19
Elko series	28
Rosegate series (includes Parowan basal notched)	46
Desert series	205

mum 0.5 mm that the Monitor Valley key requires. The proximal shoulder angle of the second Rosegate is slightly large, but all other metric discriminants meet the Monitor Valley Rosegate type parameters. All of the out-of-key post-Mazama points are congruent with Justice's (2002:436, 439) metrics for the types. Table 5.6 lists point types and quantities for the sample from sites south of the study area.

East of the Study Area Sample

The point sample from sites east of the study area is the largest, comprising 740 artifacts. Ninety-eight percent of the sample was collected from temporally controlled contexts. Less than 1 percent of the sample was retrieved from a pre-Mazama context. All of the sites, however, are in the eastern Great Basin, where Thomas (1981:37) warned that the morphological types are similar to the Monitor Valley temporal types, but the manufacture-and-use period is markedly different. Thus, one would expect that most points should correlate with morphological types defined by the Monitor Valley key, but the temporal duration of the types should differ significantly. This logical inference therefore is only partly accurate.

As Thomas (1981) suggested, temporal periods for manufacture and use of morphological point types identified in Monitor Valley are significantly different in the eastern Great Basin. At O'Malley Shelter, Elko points were retrieved from strata that radiocarbon dates indicate were occupied as early as 5150 B.C. The morphological type persists in all strata, including the historic-ethnohistoric unit. Figure 5.17 illustrates the earliest and latest Elko points retrieved from O'Malley Shelter.

The earliest O'Malley Shelter cultural unit containing large side-notched, Humboldt, and Gatecliff series points was radiocarbon dated to 2680 B.C. Like the Elko series, the Humboldt and Gatecliff series appear to have persisted into ethnohistoric times. Elko, Gatecliff, and large side-notched morphological types were also retrieved from Evans Mound, which was occupied from about A.D. 1050 to 1150. At Pine Park Shelter, those types were found in association

Table 5.6. Point type determinations and quantities south of the study area

POINT TYPE	QUANTITY
Early (pre-Mazama) Types	
Great Basin stemmed	2
Undetermined large shoulderless concave base (similar to Black Rock type)	3
Pinto	2
Later (post-Mazama) Types	
Large side-notched series	1
Humboldt series	1
Gatecliff series	2
Elko series	3
Rosegate series (includes Parowan basal-notched)	5
Desert series	46

with Fremont, Virgin-Kayenta Pueblo, and Southern Paiute ceramics.

At Conaway Shelter, Rosegate series points first appear in strata dating to A.D. 1010 and persist into historic times in both O'Malley Shelter and Conaway Shelter. The type was also present at Median Village, occupied from A.D. 900 through A.D. 1020. Desert series points are at even greater variance with the Monitor Valley temporal periods. The series pre-dates Rosegate series points at O'Malley Shelter, with the earliest strata in which the Cottonwood type appears dating to 1790 B.C. Desert series points are contemporaneous with Rosegate series points at Median Village, Evans Mound, and at Conaway Shelter in the stratum dating to A.D. 1010. Desert series points persist through historic times at both Conaway and O'Malley shelters. Figure 5.18 illustrates the earliestCottonwood types in comparison to Humboldt series points from the same cultural unit.

Although the temporal periods differ for Monitor Valley morphological types in the eastern Great Basin, a contracting stem morphological type not found in Monitor Valley dominates the east of the study area collections. This is the Parowan basal-notched point, which Justice (2002:336) notes is prolific at Fremont, Virgin Pueblo, and Kayenta Pueblo sites. The type composes 39 percent of the sample. Parowan basal-notched points weighing less than 1 gram fall out of key, and those weighing more than 1 gram key as the Gatecliff temporal type. The Parowan basal-notched type is the primary cause for the high failure rate of the Monitor Valley key in the sample from sites east of the study area. Also falling out of key are slightly thick, slightly heavy, or slightly long Cottonwood points. The Cottonwoods that are slightly large under the Monitor Valley key but within Justice's (2002:439) metric ranges of the type are more common in the east sample than in any of the other samples under analysis. The points are especially common at Fremont sites that include Median Village, Pharo Village, Paragonah Mounds, and Conaway and O'Malley shelters in strata dating from A.D. 1010 through post- A.D. 1080. Because there are Parowan basal-notched points present, 26 percent of the post-Mazama sample is questionably classified as the Gatecliff temporal type. Smaller Parowan basal-notched points and the slightly large Cottonwood types compose most of the 23 percent of the sample that fall out of

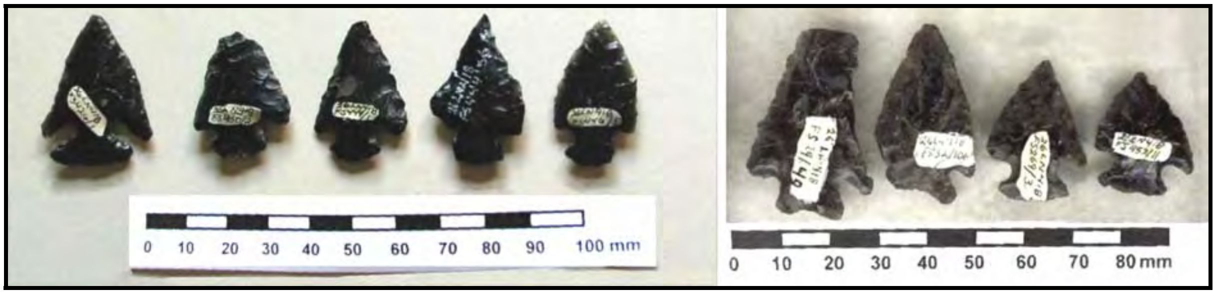


Figure 5.17. Elko Points retrieved from the earliest (left) and latest (right) strata in O'Malley Shelter.

Figure 5.18. Cottonwood and Humboldt points from Cultural Unit III, 1790 B.C., O'Malley Shelter.

Table 5.7. Point type determinations and quantities west of the study area

POINT TYPE	QUANTITY
Early (pre-Mazama) Types	
Elko series	7
Later (post-Mazama) Types	
Undetermined medium-size leaf shaped	4
Large side-notched series	9
Humboldt series	50
Gatecliff series	99
Elko series	76
Rosegate series (exclusive of Parowan basal-notched)	94
Parowan basal-notched	287
Desert series	112

key. Table 5.7 lists point types present in the sample from sites east of the study area.

Discussion

As Thomas (1981) predicted, the Monitor Valley key is extremely limited in accurately classifying projectile points collected from uncontrolled contexts and in classifying eastern Great Basin point types. Most out-of-key post-Mazama types are absent in Monitor Valley and most prevalent in the eastern Great Basin. Most pre-Mazama points do not fall out of key but are inaccurately classified as temporal types presumably manufactured several millennia later. Figure 5.19 shows percentages of out of key and questionable classifications per region due to indiscriminate use of the Monitor Valley key.

The primary error in the Monitor Valley typology misclassifications emerges with the Gatecliff temporal type discriminants. The key incorrectly assigns 22 percent of the 1,677 points in the artifact sample to the Gatecliff series. All of the misclassifications are contracting stem points weighing more than 1 gram, which includes most Great Basin stemmed types and many Parowan basal-notched points. All bifurcate, contracting stem points weighing more than 1 gram key as the Gatecliff split stem variety of the temporal type.

Based on these data, it is evident that what the Gatecliff "temporal type" truly defines is a very broad class of points that Great Basin people have manufactured since the beginning of prehistory. This class is contracting stem points. Thus, proximal shoulder angle, which is

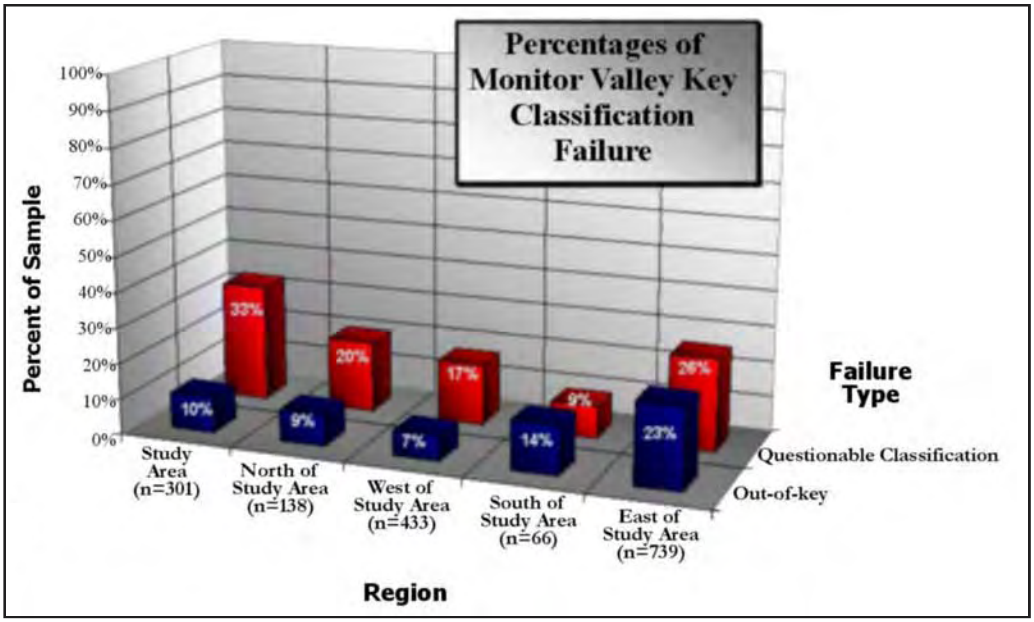


Figure 5.19. Failure rate of Monitor Valley Key for all samples.

the metric discriminant defining contracting stem point morphology, is not a metric attribute conveying "temporal sensitivity," as Thomas (1981:13) indicated.

Two hundred and thirty-one points fell out of the Monitor Valley key. Only 10 percent are pre-Mazama types. Most of the out-of-key pre-Mazama points are large, shoulderless types. Most out-of-key points (50 percent) are the post-Mazama Parowan basal-notched points weighing 1 gram or less. Shoulderless post-Mazama types compose 28 percent of all out-of-key points. Two-thirds of these are Cottonwood types. The remaining out-of-key points, less than 2 percent of the entire 1,677 point sample, are eccentric corner-notched and side-notched types.

Metric evaluation of the Great Basin point collections indicate that as Thomas (1981) warned, indiscriminate use of the Monitor Valley typology produces unreliable results. This presents Great Basin archaeologists with a significant paradox. Thomas (1981:11) noted that "the sky-rocketing importance of cultural resource management also fostered a new legalistic awareness of surface archaeology . . . the more one relies on surface sites, the greater the burden placed on time markers."

Unfortunately, most Great Basin surface sites contain few, if any, projectile points, certainly not the point "collections" meeting Thomas' (1981) criteria under which the Monitor Valley key is most useful. Also, surface sites from which many of the evaluated points were collected yielded all of the Monitor Valley temporal types. Point collections examined from later deposits at excavated sites exhibit a similar pattern. In contrast to the type use-type abandonment paradigm that temporal typologists advocate, these data suggest that variability in morphological point types used by Great Basin peoples increased through time. The only relatively clear temporal demarcation indicating type use and abandonment occurs with Late Pleistocene-Early Holocene (pre-Mazama) types such as Great Basin stemmed and Great Basin fluted points and later Holocene (post-Mazama) types that include Elko series, Gatecliff series, Rosegate series, and Desert series points.

In other words, prehistoric Great Basin peoples abandoned use of fluted and long-stemmed points at least 6,000 years ago. But by 1,000 years ago and most certainly by the ethnohistoric period, Great Basin peoples were using all of the Monitor Valley post-Mazama point types. Early twentieth-century publications documenting a unique relationship between a California Native American and a San Francisco physician offer compelling supportive evidence.

ARROWHEADS IN THE BOW-HUNTING EQUIPMENT SET

Saxton Temple Pope was an early twentieth century physician and medical professor at

California State University, San Francisco. Pope, apparently inspired by romantic tales of the exploits of Robin Hood, was fascinated with the bow and arrow. His avid interest, academic inclinations, and circumstances that placed him in regular contact with a Native California bow hunter resulted in what are likely the most thorough ethnographic accounts of traditional Native American bow and arrow manufacturing and hunting technology (Pope 1918; 1962[1923]; 2000[1923]).

In 1911, a frightened and ailing Yahi man, described as a "wild Indian" by local reporters, was taken into custody in Oroville, California. T. T. Waterman, an anthropologist at California State University, San Francisco, got guardianship of the so-called Stone Age man and brought him to the university. The man was named Ishi and remained at the university, employed as a museum janitor, until his death from tuberculosis in 1916 (Pope 2000[1923]:6–12).

Pope was hired as a surgery instructor at about the same time that Ishi arrived at the university. Ishi was highly susceptible to communicable illnesses and thus was frequently sick and under Pope's care. Pope slowly learned Ishi's language, Ishi learned English, and the two men became close friends. From 1912 through 1915, Ishi taught Pope to make Yahi bows, arrows, and arrowheads. He taught him how to shoot and hunt in the traditional Yahi way. Pope documented much of what Ishi taught him and expanded his bow and arrow research to include field experiments using New World and Old World bows and arrows curated at the museum (Pope 1918: 104–105; 2000[1923]: 11–13, 38).

Pope's (1918; 1962[1923]; 2000[1923]) documents provide archaeologists with data that metric evaluations lack—the material, technological, and behavioral context in which the arrowhead belongs. The arrowhead is a minor component of an equipment set linked to a range of socioeconomic activities. The basic equipment set comprises the bow and the arrow, which regional Native Americans used as weapons. Socioeconomic activities associated with the bow and arrow include equipment manufacturing, hunting, warfare, ceremonies, and gift giving. A tremendous amount of time and skill were required to produce a bow and arrow weapon set that would function as intended.

The Bow

Among the Yahi people, the men manufactured all the components of the weapons equipment set. Yahi bow making could take from several months to years. Ishi preferred using what he called mountain juniper for his bows. He obtained a suitable piece of wood by splitting a stave from a tree limb. The stave was then placed horizontally in a warm, sheltered place to season. Once seasoned, Ishi shaped the stave by scraping it with "flint or obsidian" and then smoothing it with sandstone. He backed his bows with macerated deer tendons, using glue made from boiled salmon skin to hold the sinew in place. After several days when the backing was completely dry, he filed and scraped the sinew smooth, reinforced the bowstring nocks with sinew, and laid the bow in sunlight for up to a few weeks to fully season. He spun the bowstring from thin threads of deer tendon (Pope 1918:105–109, 117). Figure 5.20 shows Ishi shaping a bow stave, the initial step in bow making.

The Arrow

Ishi manufactured arrows of varying sizes

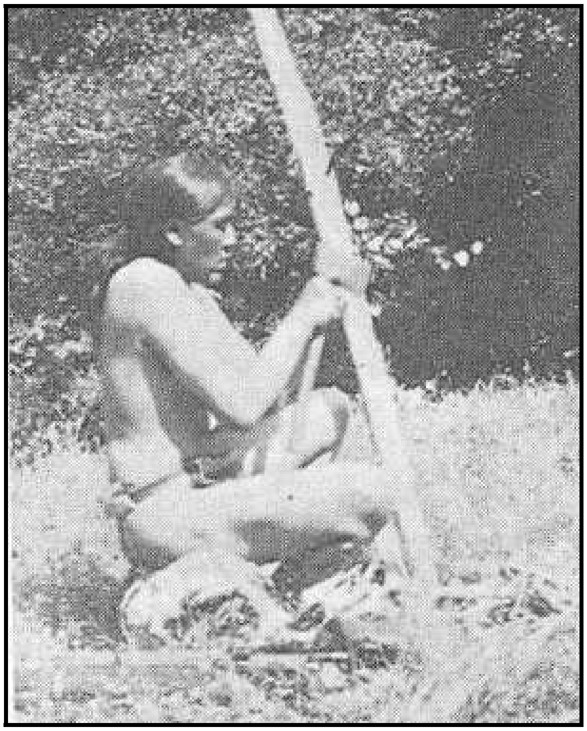


Figure 5.20. Ishi splitting a bow stave from a juniper tree limb (from Pope 2000[1923]:24).

depending on the intended function. Long arrows—about 36 inches (914 mm) long—with large heads were made for decorative purposes, gifts, or warfare. Ishi's hunting arrows were about 29 inches (737 mm) long, 0.34 inches (8.7 mm) in diameter, 330 grains (21 grams) in weight. These were made of long, straight hardwood shoots—such as witch hazel, dogwood, mountain mahogany, and wild mock orange—or of reed. Reed arrows were always fitted with a hardwood foreshaft, preferably of mountain mahogany, about 6 to 8 inches (152 to 203 mm) long. Foreshafts were often added to hardwood arrows as well. Before drilling the foreshaft socket onto the main shaft, which was accomplished with a bone awl, Ishi bound the end of the main shaft with cordage to prevent splitting. He then bonded the foreshafts into the main shaft socket with either salmon skin glue or resin (Pope 1918:110–112).

Manufacturing arrows that would fly true required a great deal of exacting labor. Ishi made his arrows in groups of five. He stripped the bark from hardwood shoots with his thumbnail, bound them together with cordage, and stored them horizontally to season for at least one week and up to one year. Once seasoned, Ishi straightened a shaft by pressing his thumbs against the convex edge of any curves and passed the area back and forth over embers or a heated stone for about a minute until the wood gave to the pressure and straightened. He smoothed the shaft by running it back and forth between two pieces of sandstone. He used a piece of obsidian to cut a nock into the end of the main shaft (Pope 1918:112).

Ishi painted designs on the main shafts and then fletched each arrow with three feathers of equivalent size. Although he preferred using eagle feathers for fletching, these were difficult to obtain. Suitable alternatives were hawk, buzzard, goose, heron, quail, pigeon, flicker, turkey, and jay feathers (Pope 1918:111, 113–114; 2000[1923]:20–22).

To manufacture fletches, Ishi split feathers lengthwise along the shaft and then scraped the shaft with an obsidian chip to "translucent thinness." He then trimmed the feather segments used for hunting arrows from 3.0 to 4.0 inches (76 to 102 mm) in length with a tapered width of 0.125 inches (3 mm) at the forward end to 0.5 inches (13 mm) at the nock end. Feathers used on war and ceremonial arrows could be as long as 1 ft (305 mm). Before binding the fletching to the shaft with lengths of extra fine sinew, Ishi soaked the trimmed feathers in water, which increased the flexibility of the trimmed feathers for ease in binding (Pope 1918:111, 113–115; 2000[1923]:20–22).

Figure 5.21 shows arrows that Ishi manufactured. Arrows 1 and 2 are target arrows made during his residence at the university museum, and 5 through 7 he made earlier while living his traditional life. He manufactured arrows 8 through 13 at the university museum. The longest are ceremonial and gift arrows (Pope 1962[1923]: Plate 10, 73–74).

The Arrowhead

Yahi men manufactured arrow points from materials that included bone, obsidian, "flint," glass, and wood, but obsidian was the preferred material. Obsidian cobbles were highly desired trade items among the Yahi because there was none of this toolstone in north-central California. Men traded dried fish, venison, or weapons for pieces of obsidian suitable for manufacturing points. Pope (1918:118; 2000[1923]:24) noted that Ishi quickly adopted more durable iron and steel arrowheads while residing at the university museum. He noted that the serrated edges of chipped obsidian points, however, were superior to the metal heads in causing the massive internal hemorrhaging necessary to kill large animals (Pope 1918:116–117, 136; 1962[1923]:73; 2000[1923]:22).

When making arrowheads, Yahi men sat in a circle in a warm, sunny, secluded spot at a distance from the residential camp. They painted their faces with mud and remained close-mouthed while working to protect themselves from sharp, airborne spall. Because missed shots resulted in broken heads, they manufactured large numbers of points before hunting trips. While hunting, they carried the points and extra sinew with them in small skin bags. They attached arrowheads to the arrows a few hours before the hunt (Pope 1918: 111, 117–118; 2000[1923]:23, 36).

Ishi manufactured and used a variety of arrowhead shapes and sizes depending on the type of animal he intended to hunt. He used blunt hardwood heads wrapped with sinew for hunting birds and small game. For hunting deer, bear,

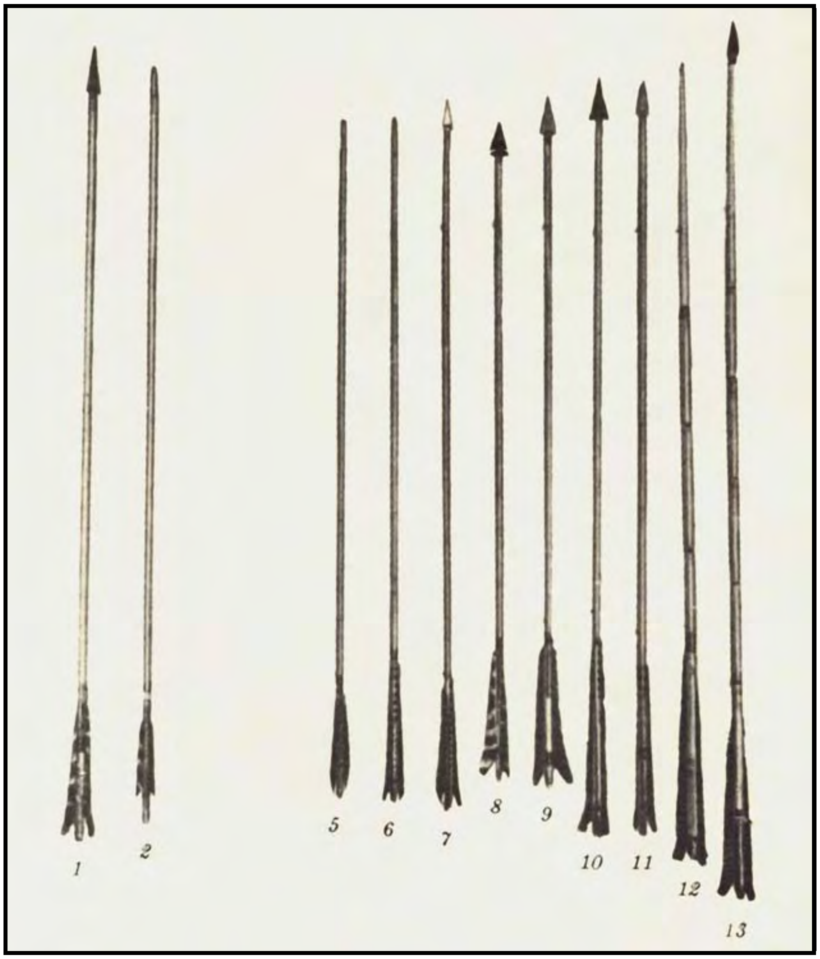


Figure 5.21. Arrows that Ishi made (from Pope 1962[1923]: Plate 10).

and "predatory animals," he used "sharp" heads ranging from about 25 mm to 51 mm long. Ishi's deer hunting points measured about 2 inches (51 mm) long by 0.875 inches (22 mm) wide by 0.125 inches (3 mm) thick. Bear hunting points were flat, ovate, and smaller than the deer points. Large oval blades hafted to short wood handles were used as knives and larger blades of similar shape bound to longer handles were used as spears. Long arrows tipped with "large spike-like heads" up to 3 inches (76 mm) long were manufactured for warfare and for gifts. Yahi males wore small arrowhead "charms" suspended around their necks. Medicine men also used the small points during healing procedures that required bloodletting (Pope 1913; 1918:110–111, 116–118, 136; 1962[1923]:73; 2000[1923]:22–24). Figure 5.22 illustrates a selection of Ishi's hunting, gift, and warfare arrowheads.

To make an obsidian point, Ishi began by shattering a cobble and then selecting a flake about 3 inches (76 mm) long by 2 inches (51 mm) wide by 0.5 inches (13 mm) thick. Protecting his hand with a piece of buckskin, he removed obsidian flakes by pressing against the edges of the large flake with a deer antler tine attached to a wood handle. He turned the obsidian to detach pieces from the opposite side and continued this until the point reached the desired shape. Ishi produced a finished hunting point in about 30 minutes (Pope 1918:116–117; 2000[1923]:23). Figure 5.23 demonstrates the position of Ishi's hands while manufacturing an obsidian point.

While on a hunting expedition, Ishi would carry from 5 to 60 arrows in a skin quiver. He attached a head to an arrow shaft by applying heated resin to a slot in the end of the foreshaft and then molded it around the point base. When the resin hardened, he bound the point to the shaft by wrapping sinew back and forth around the base tangs three times. He continued wrapping the sinew around the end of the shaft below the point base for about a half inch, and after the sinew dried, he smoothed it with sandstone. When he had tipped several arrows, Ishi was ready to begin a bow hunt (Pope 1918:118; 2000[1923]:24).

Bow Hunting

Pope (1918:126–127; 2000[1923]:29–31) noted that Ishi was extremely proficient at hunting small animals such as rabbit, squirrel, and quail. His small-game hunting expeditions were casual events. The major requirements were patience, persistence, and the ability to remain motionless for long periods. When hunting rabbits, Ishi walked quietly through the brush until he reached "good rabbit ground." He found cover and called the animals to him by imitating the sound of a wounded rabbit. This sound

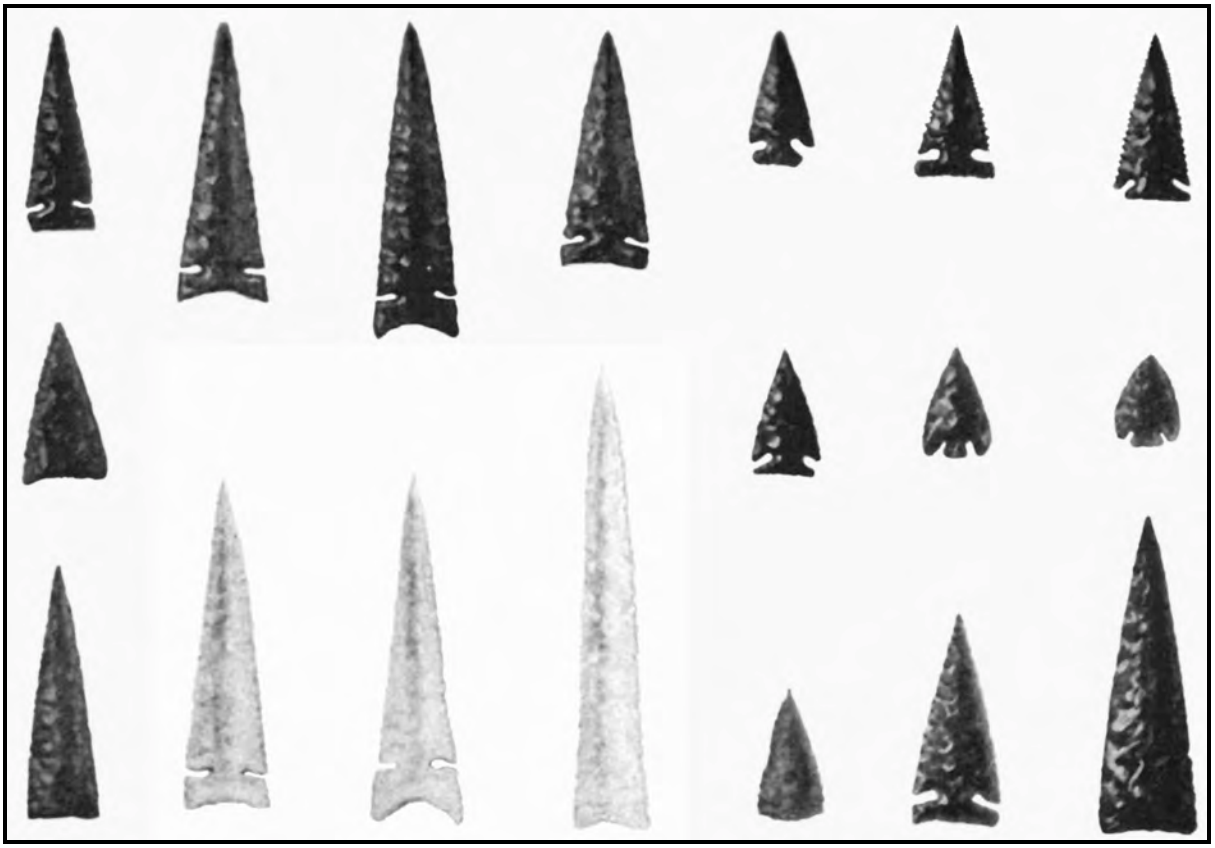


Figure 5.22. A sample of arrow points that Ishi manufactured (from Pope 1918: Plate 21). The smallest are about 1 inch (25 mm) long and the largest about 3 inches (76 mm). Materials include obsidian, flint, and glass.

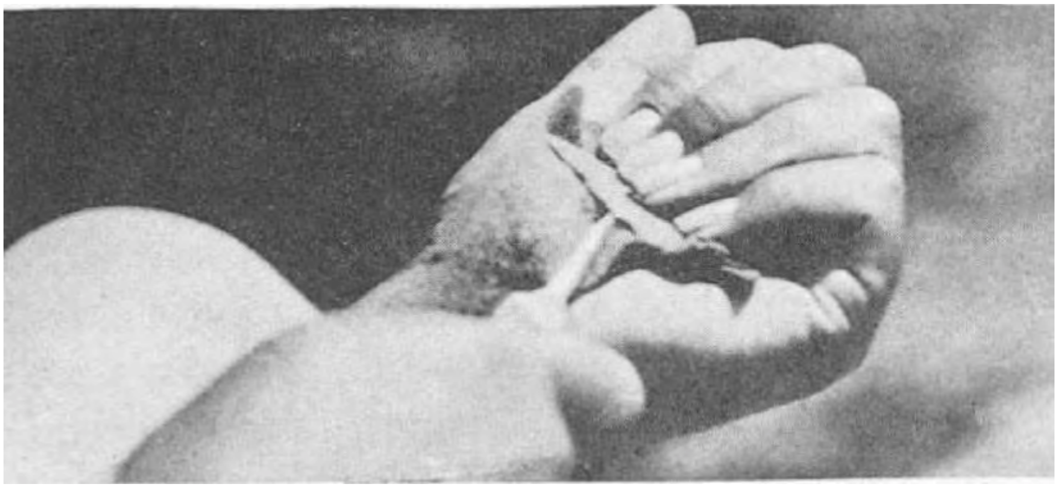


Figure 5.23. Ishi manufacturing an obsidian hunting point (from Pope 2000[1923]:34). A piece of buckskin protects his hand.

attracted not only other rabbits drawn to assist a supposedly wounded member of their species but also squirrels and predators like bobcats and coyotes, expecting a quick, easy meal. He generally shot animals when they were stationary and within 10 to 20 yards of his position. Arrows often passed through small animals, however, missing vital organs. Ishi would break a wounded rabbit's legs and lay the animal on the ground until it died of shock. Figure 5.24 shows Ishi calling to and shooting at prey.

Bow hunting for deer could be either a group or an individual effort. Before a deer hunt, Yahi men scouted areas for recent signs of the animals' presence, such as fresh trails, deer beds, watering holes, and salt licks. If the hunt was to be a group endeavor, they located outcrops and bushes along a fresh deer trail where they could secrete themselves to ambush the animals. If there were no natural features, hunt participants would construct blinds with stacked rocks (Pope 1918:127; 2000[1923]:33).

On the day before the hunt, Yahi archers cut their forearms and calves with small pieces of obsidian to increase their strength and courage. They abstained from eating fish and smoking because the animals could sense the resulting strong odors that lingered on the breath and body. On the morning of the hunt, they bathed, washed their mouths, and refrained from eating to further decrease any scents that would forewarn the animals of their presence (Pope 1918:126–127; 2000[1923]:32–33).

If a group deer hunt was undertaken, some of the hunters would position themselves behind the natural or constructed blinds while the rest of the hunting party began beating the brush about a mile away, driving the deer toward the ambush locations. The concealed hunters rose and shot the animals as they passed. Group hunts ended at noon, at which time the women joined the men at the kill area. The slain deer were skinned and butchered with obsidian knives. Hearts and livers were cooked and eaten at the butchering site, and the remaining meat was taken back to camp, where it was smoke-preserved (Pope 1918:127, 129; 2000[1923]:32–34).

When hunting deer by himself, Ishi approached the predetermined deer hunting grounds up wind and with considerable stealth. He sometimes decoyed deer by wearing a deer head stuffed with twigs and leaves. Positioning himself behind a low bush that hid his body but exposed the deer-head decoy, he bobbed up and down until a curious deer approached within shooting range. Ishi told Pope that in open ground, a hunter sometimes attached tall grass to the top of his head for camouflage while belly crawling within arrow range of a deer (Pope 1918:127–128; 2000[1923]:33–34).

Unlike deer hunting, bear hunts were almost always group endeavors. Although Ishi, in his youth, single-handedly killed a bear that he had inadvertently ambushed using an arrow and an obsidian knife, this was not the norm. Rather

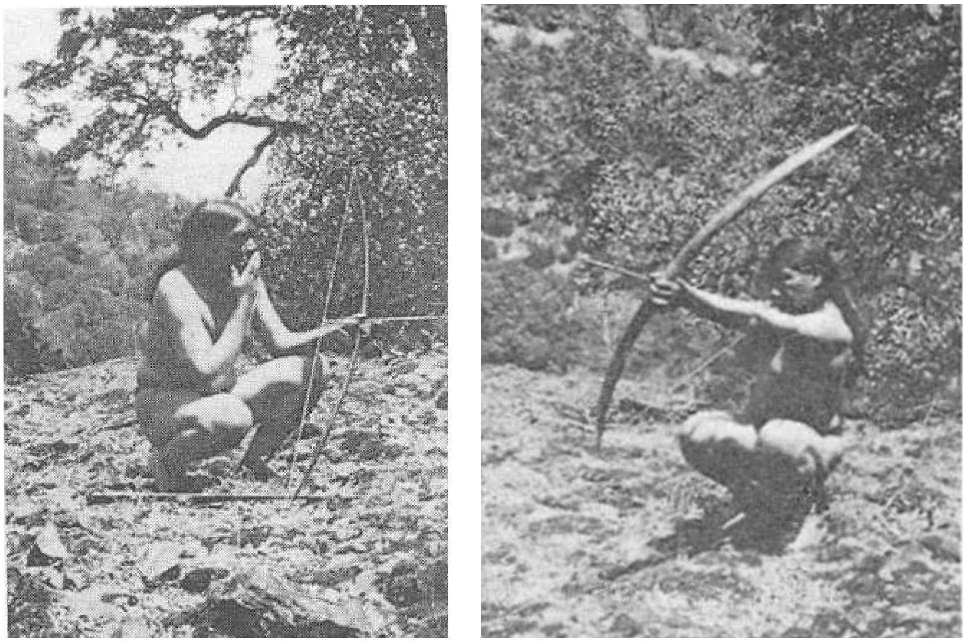


Figure 5.24. Ishi calling game (left) and in shooting position (right), from Pope (2000 [1923]:24).

than the ambush technique used in hunting small game and deer, the Yahi used baiting tactics for slaying bears. They avoided grizzlies but hunted all other species. On encountering a bear, the hunters surrounded the animal and built fires. They began shooting arrows at the bear, aiming for the mouth because they believed that blood from the mouth wounds would eventually choke the animal to death. When the bear charged toward a hunter, the hunter waved a burning stick at the enraged animal while the rest of the group continued shooting it with arrows. The bear eventually died of hemorrhage and fatigue (Pope 1918:129–130; 2000[1923]:35, 154–155).

Summary

Yahi bow hunters used a range of tactics and equipment depending on the animal species they intended to pursue. Bow-hunting strategies could include the use of blinds, ocular and aural decoy, and camouflage. Small game hunts were relatively casual events in which success was largely because of the skill of the individual hunter. In contrast, bow hunting for large animals was often a group event that required days of planning and preparation.

The Yahi bow hunting equipment set included a bow, several arrows, a pouch filled with arrowheads, knives, and spears. The hunter manufactured and used the same bow and hunting arrow type, regardless of prey. Arrow point types were variable, however, depending on the species of hunted game. Bear points were ovate and relatively short, deer points were triangular and about twice the length of bear points, and arrows used for slaying squirrels, quails, and other small animals had blunt, sinew-wrapped heads. The arrows used in warfare and given as gifts were longer than hunting arrows and tipped with heads about twice the size of hunting points.

The hunting tactics and hunting equipment described are distinctive of the Yahi people associated with Ishi. Based on the variability in Great Basin artifacts and features, it is likely that the tactics and equipment that various Great Basin hunters used differed in some ways from that of the Yahi. The concept that bow hunters employed different types of points to slay different animal species, however, seems to be a constant linked to differences in the anatomies and habits of different animals in relationship to the limitations of the bow-and-arrow weapons set. Perusing any modern American bow hunting equipment catalog illustrates that even today, arrowhead types are directly linked to the intended prey (i.e., target heads, small game blunt heads, small game field heads, large game broad heads). Informal discussions with Nellis AFB Native American Program tribal members during examination of the Nellis AFB artifact collection suggest that intended function created variability in point types manufactured by regional Shoshone and Paiute bow hunters as well.

A Few Shoshone and Paiute Comments on Arrowheads. A Utah Southern Paiute tribal elder identified two morphological types in the Nellis AFB artifact collection that his relatives had used. The first type he called eagle points, which key as the Elko corner-notched type. He picked up a large point, turned it upside down, and pointed out the resemblance to the rear view of a perched eagle. He stated that a man would have worn the point, which was quite large with rounded edges, around the neck as an ornament. He noted that eagle points were made in varying lengths, widths, and thicknesses depending on intended function. Smaller, sharper eagle points were used for hunting.

The second type that elicited specific comment on function was serrated-edge points that key as the Gatecliff contracting stem type. He stated that the point was used for hunting rabbits. The serrated edges could cut through tendon and disable the animals. This is particularly interesting in that Pope (1918:126) noted that arrows generally pass completely through small animals such as rabbits. The Yahi used blunt heads to stun small animals and then killed them by hand. It seems that Southern Paiute bow hunters may have had another method of compensating for the limitations of arrows in causing lethal hemorrhaging in small animals. Figure 5.25 shows the serrated-edge hunting point and the eagle point neck ornament.

Other comments about points in the Nellis AFB collection were less specific but equally intriguing. While examining several Great Basin stemmed points, the Southern Paiute tribal elder observed that “the guys who made these didn’t know how to make an arrowhead.” Archaeologists would certainly agree, considering that they classify the pre-Mazama types that he

Figure 5.25. Serrated-edge hunting point and "eagle" point neck ornament identified by a Southern Paiute tribal elder.

indicated as spear and dart points. Other Southern Paiute consultants noted that "the little people" made the very small side-notched and shoulderless types that key as Desert series points. This comment suggests that like the Yahi, who used small points as charms and for healing, Southern Paiute people believe that small points have supernatural attributes.

Point types appear to convey regional style preferences as well. Several points that key as the Gatecliff contracting stem type were identified by the Southern Paiute tribal elder as the style used by people living "on the other side of the mountain." Several Owens Valley Paiute elders agreed that "the Shoshone made the best arrowheads."

The limited information on arrow points gathered during brief and informal discussions with regional Great Basin Native Americans is in accord with the hunting knowledge that Ishi shared with Pope. Native American bow hunters used a variety of sizes and morphological types of arrow points. Much of the diversity in arrow points is linked to function. Local preferences apparently influenced point morphology as well. Comprehensive ethnographic research with regional Native Americans will likely illuminate additional aspects of function and preferences that affected Great Basin point morphology.

CONCLUSIONS

Using Thomas's (1981) Monitor Valley key, 1,677 points were metrically evaluated for this study. Results indicate that Great Basin projectile points are of limited use as chronological indicator artifacts. The type use-type abandonment paradigm that most Great Basin archaeologists espouse appears to occur only between Late Pleistocene-Early Holocene (pre-Mazama) types and later Holocene (post-Mazama) types. Among the post-Mazama types, which include Elko series, Gatecliff series, Rosegate series, and Desert series points, it appears that variability in point morphology increased through time and Great Basin hunters did not abandon use of any of the post-Mazama types. By 1,000 years ago, Great Basin people were using all of Thomas's (1981) Monitor Valley post-Mazama point types.

Thomas (1981:7) stated that "contemporary American archaeology has … three primary and sequentially ordered" goals: to establish absolute culture chronologies, reconstruct prehistoric lifeways, and explain cultural processes. Perhaps, after a century of research, we have done the best that we can with lithic technology in addressing Great Basin chronology issues and it is time to address more compelling aspects of Great Basin prehistory. Thomas (1981:10) notes that projectile point types might be significant of not only time and space, but of function, technology, and ethnicity. Based on Pope's (1963[1923]; 2000[1923]) bow-hunting experiences with Ishi and informal discussions with regional Native Americans, there is no doubt that arrow-point morphology was affected by function, technology, and ethnicity.

Amick (1999:161) states that "current challenges in middle-range research include learning what factors condition variation in lithic technology and establishing the validity and reliability of our classification systems . . . . Additional middle-range challenges concern the need to link observations about lithic artifacts to patterns of human behavior and linking those behaviors with theoretical concepts." Unfortunately, we cannot return to the days of Pope and Ishi when linking specific behaviors to specific artifacts was readily apparent. We can attempt to understand functional perceptions of artifacts, however, through the descendants of the Great Basin peoples who used them.

Future point studies should combine scientific analysis methodologies and Native American perceptions of point types and point functions. Tribal representatives participating in the Nellis AFB Native American Program have provided a great deal of insight regarding artifact function. Ethnographic and ethnohistoric research focusing on hunting equipment is sure to yield data comparable to the extensive information that Pope learned from Ishi.

REFERENCES CITED

Adovasio, J.
1970 Chipped Stone Artifacts. In Median Village and Fremont Cultural Variation, edited by J. D. Jennings, pp. 75–96. *University of Utah Anthropological Papers*, Number 95. University of Utah Press, Salt Lake City.

Allen, G. M.
1941 Analysis of the Animal Bones. In Archaeological Investigations in Central Utah, Joint Expeditions of the University of Utah and the Peabody Museum, Harvard, University, pp.45–46. *Papers of the Peabody Museum of American Ethnology and Archeology, Harvard University*, Vol. XVII, No. 2.

Amick, D. S.
1999 Chapter 14: Using Lithic Artifacts to Explain Past Behavior. In *Models for the Millennium, Great Basin Anthropology Today*, edited by C. Beck, pp. 161–170. University of Utah Press, Salt Lake City.

Barnett, P. R.
1982 Plant Macrofossil Analysis. In Final Year Excavations at the Evans Mound Site, edited by J. D. Jennings, pp.95–102. *University of Utah Anthropological Papers*, Number 106. University of Utah Press, Salt Lake City.

Basgall, M. E., and M. C. Hall
2000 Morphological and Temporal Variation in Bifurcate-Stemmed Dart Points of the Western Great Basin. *Journal of California and Great Basin Anthropology*, Vol. 22, No. 2, pp. 237–276.

Bettinger, R. L., and J. Eerkens
1999 Point Typologies, Cultural Transmission, and the Spread of Bow and Arrow Technology in the Prehistoric Great Basin. *American Antiquity*, Volume 64, Number 2, pp. 231–263.

Campbell, E.
1937 Owens River Valley District artifact catalog. Manuscript on file, Joshua Tree National Park, Twentynine Palms, California.

1939 Lake Tonopah/Big Smoky Valley field notes. Manuscript on file, Joshua Tree National Park, Twentynine Palms, California.

1949 Two Ancient Archaeological Sites in the Great Basin. *Science*, Volume 109, p. 340.

Dalley, G. F.
1970a Faunal Remains. In Median Village and Fremont Cultural Variation, edited by J. D. Jennings, pp. 127–133. *University of Utah Anthropological Papers*, Number 95. University of Utah Press, Salt Lake City.

1970b Worked Bone and Antler. In Median Village and Fremont Cultural Variation, edited by J. D. Jennings, pp. 96–127. *University of Utah Anthropological Papers*, Number 95. University of Utah Press, Salt Lake City.

Delacorte, M. G.
1990 *The Prehistory of Deep Springs Valley, Eastern California: Adaptive Variation in the Western Great Basin.* Ph.D. dissertation, University of California, Davis.

Dodd, W. A. Jr.
1982 Final Year Excavations at the Evans Mound Site, edited by J. D. Jennings. *University of Utah Anthropological Papers*, Number 106. University of Utah Press, Salt Lake City.

Fowler, D. D., D. B. Madsen, and E. M. Hattori
1973 Prehistory of Southeastern Nevada. *Desert Research Institute Publications in the Social Sciences*, No. 6. Reno, Nevada.

Gillin, J.
1941 Archaeological Investigations in Central Utah, Joint Expeditions of the University of Utah and the Peabody Museum, Harvard, University. *Papers of the Peabody Museum of American Ethnology and Archeology, Harvard University*, Vol. XVII, No. 2.

Grayson, D. K.
1993 *The Desert's Past.* Smithsonian Institution, Washington, D. C.

Haarklau, L.

2004 *Ethnohistoric Period Winter Camps in the South-Central Great Basin: An Archaeological Guide.* Prewitt and Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA63-00-D-0006. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

2001 *Investigation of Geochemical Variability in Obsidian Raw Material And Artifact Sources on the North Nellis Air Force Range, Nevada.* Prewitt and Associates, Inc. Prepared for the U.S. Air Force, Air Combat Command, Contract No. DACA63-95-D-0051. Copies available from 99 Civil Engineering Squadron/Environmental Flight, Nellis Air Force Base, Nevada.

Judd, N. M.

1926 Archaeological Observations North of the Rio Grande. *Smithsonian Institution Bureau of American Ethnology Bulletin* 82. Government Printing Office, Washington.

1919 Archaeological Investigations at Paragonah, Utah. *Smithsonian Miscellaneous Collections*, Volume 70, Number 3. Smithsonian Institution, Washington.

Justice, N. D.

2002 *Stone Age Spear and Arrow Points of California and the Great Basin.* Indiana University Press, Bloomington and Indianapolis.

Madsen, D. B.

1970 Ceramics. In Median Village and Fremont Cultural Variation, edited by J. D. Jennings, pp. 54–75. *University of Utah Anthropological Papers*, Number 95. University of Utah Press, Salt Lake City.

Marwitt, J. P.

1970 Median Village and Fremont Cultural Variation, edited by J. D. Jennings. *University of Utah Anthropological Papers*, Number 95. University of Utah Press, Salt Lake City.

Metcalfe, D. W.

1982 Worked and Unworked Faunal Remains. In Final Year Excavations at the Evans Mound Site, edited by J. D. Jennings, pp.79–92. *University of Utah Anthropological Papers*, Number 106. University of Utah Press, Salt Lake City.

Pecotte, J. K.

1982 Appendix: Human Skeletal Remains. In Final Year Excavations at the Evans Mound Site, edited by J. D. Jennings, pp.117–128. *University of Utah Anthropological Papers*, Number 106. University of Utah Press, Salt Lake City.

Pendleton, L. S.

1979 *Lithic Technologies in Early Nevada Assemblages*. M.A. thesis, California State University, Long Beach.

Pope, S.T.

1913 Making Indian Arrow Heads. In *Forest and Stream*, p.795, Dec. 20, 1913.

1918 Yahi Archery. In *University of California Publications in American Archaeology and Ethnology,* Vol. 13, No. 3, pp. 103–152.

1962 [1923]*Bows and Arrows*. University of California Press, Berkeley and Los Angeles. [Original published as A Study of Bows and Arrows. *University of California Publications in American Archaeology and Ethnology*, Volume 13, Number 9.]

2000 [1923]*Hunting with the Bow and Arrow*. Sylvan Toxophilite Classics. [Original published as “Hunting with the Bow and Arrow.” J. H. Barry Co.]

Rudy, J. R.

1954 Pine Park Shelter, Washington County, Utah. *University of Utah Anthropological Papers* No.18. University of Utah Press, Salt Lake City.

Steward, J. H.

1936 Pueblo Material Culture in Western Utah. *The University of New Mexico Bulletin*, Number 287. University of New Mexico Press, Albuquerque.

Taylor, D. C.

1954 The Garrison Site. *University of Utah Anthropological Papers* No.16. University of Utah Press, Salt Lake City.

Thomas, D. H.

1981 How to Classify the Projectile Points from Monitor Valley, Nevada. In *Journal of California and Great Basin Anthropology*, Volume 3, No. 1, pp.7–43.

1982 The 1981 Alta Toquima Village Project: A Preliminary Report. *Social Sciences Center Technical Report Series* No. 27. Desert Research Institute and the American Museum of Natural History.

1983 The Archaeology of Monitor Valley: 2. Gatecliff Shelter. *Anthropological Papers of the American Museum of Natural History New York* Volume 59: Part 1.

1988 The Archaeology of Monitor Valley: 3. Survey and Additional Excavations. *Anthropological Papers of the American Museum of Natural History, New York*, Volume 66: Part 2.

Tuohy, D. R.

1968 Early Man in Western North America. *Eastern New Mexico University Contributions in Anthropology*, Vol. I, No.4, edited by C. Irwin Williams, pp.27–38.

1969 Breakage, Burin Facets, and the Probable Technological Linkage Among Lake Mohave, Silver Lake, and Other Varieties of Projectile Points in the Desert West. Miscellaneous Papers on Nevada Archaeology Number 6. *Nevada State Museum Anthropological Papers Number 14*, edited by D. L. Rendall and D. R. Tuohy, pp. 133–152.

1978 *Preliminary Report on the Excavation of Lowe Cave, Nye County, Nevada*. Archaeological Services, Nevada State Museum, Carson City, Nevada.

Walling, B. A.

1982 Basketry. In Final Year Excavations at the Evans Mound Site, edited by J. D. Jennings, pp.92–95. *University of Utah Anthropological Papers*, Number 106. University of Utah Press, Salt Lake City.

Wood, R. C.

1973 *The Owens Valley and the Los Angeles Water Controversy: Owens Valley as I Knew It*. Pacific Center for Western Historical Studies, University of the Pacific, Stockton, California.

Worman, F. C. V.

1969 *Archaeological Investigations at the U.S. Atomic Energy Commission's Nevada Test Site and Nuclear Rocket Development Station*. Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico.

RESULTS OF THE REGIONAL OBSIDIAN PROJECTILE POINT SOURCING STUDY

6

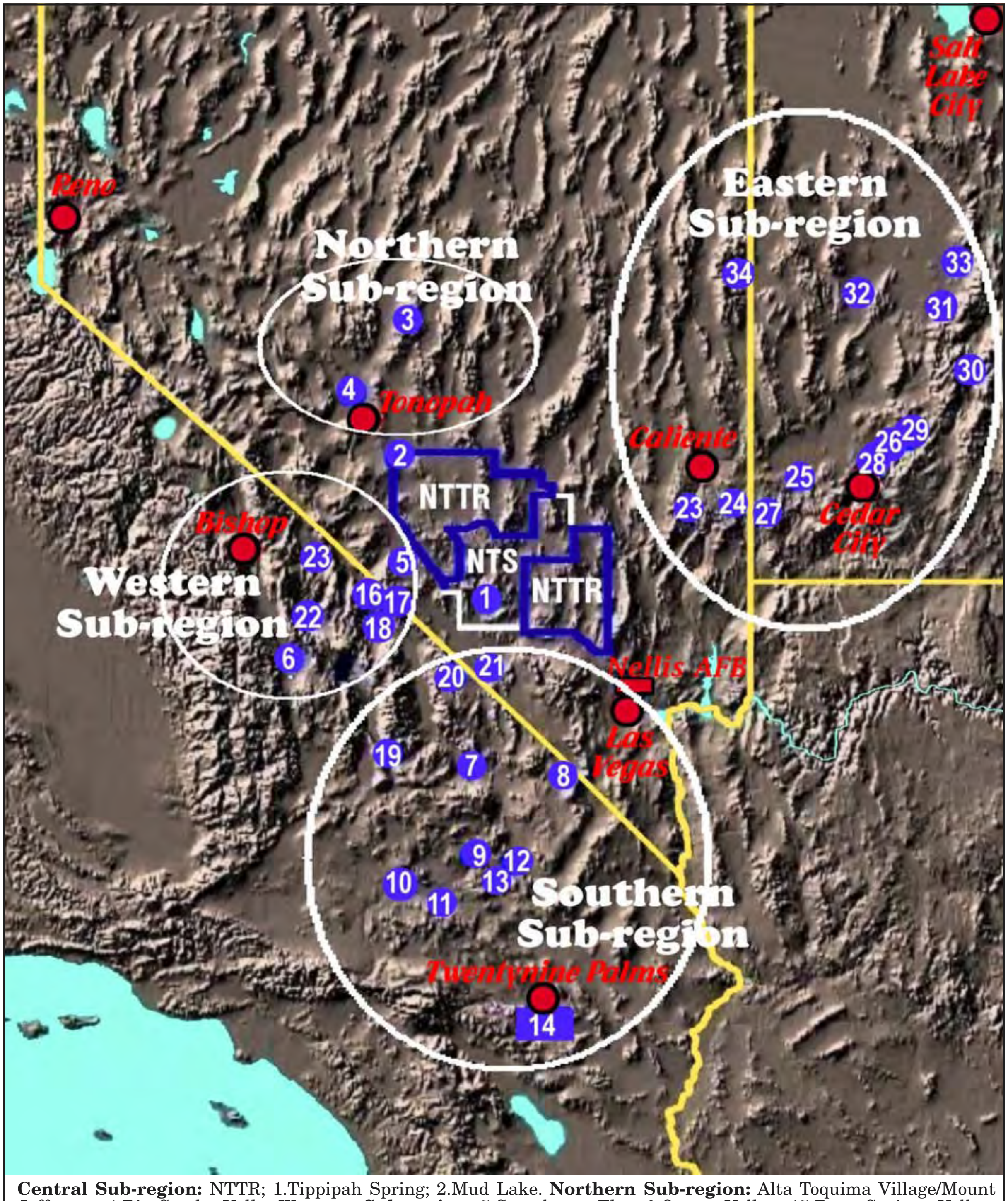
Lynn Johnson and Lynn Haarklau

Research objectives of the regional obsidian point sourcing study include evaluating the archaeological significance of obsidian sources on and in the vicinity of the Nevada Test and Training Range (NTTR) and documenting patterns in the conveyance and use of obsidians procured from these sources across both time and space. Previous research (Haarklau 2001; Kolvet et al. 2000) has shown that artifacts made of obsidian from sources as far away as 370 km have been recovered from prehistoric sites on NTTR. Determining whether conveyance of obsidian from sources on and in the vicinity of the NTTR-Nevada Test Site (NTS) study area—particularly obsidian varieties from the Obsidian Butte source—was reciprocal was also a goal of the current study. To meet these research objectives, a large sample of nearly 1,700 obsidian artifacts, primarily projectile points, was subjected to XRF analysis. Projectile points were chosen for the sourcing study for several reasons. Because they remain in toolkits for longer periods than most other chipped stone tool types, source profiles for projectile point assemblages are more likely to reflect the full range of obsidian sources used. Furthermore, because projectile points are gross temporal markers, sourcing data can be used to determine if patterns in procurement, conveyance, and use of obsidian changed over time. As discussed in Chapter 5, the sample subjected to XRF analysis consists of artifacts from 35 sites or areas distributed throughout the southern half of the Great Basin region (Figure 6.1).

To track patterns in procurement, conveyance, and use of obsidian across space more efficiently, the sample is divided into groups from five Great Basin sub-regions. These are the study area or Central Sub-region, comprising NTTR and NTS; the Western Sub-region, extending from Sarcobatus Flat just west of NTTR westward to Death Valley, Saline Valley, Deep Springs Valley, and Owens Valley; the Northern Sub-region, lying north of NTTR and including Big Smoky Valley and the Mount Jefferson Research Natural Area; the Southern Sub-region, comprising the southernmost floristic Great Basin and Mojave Desert; and the Eastern Sub-region, an area east of NTTR covering portions of southeastern Nevada and southwestern Utah (see Figure 6.1).

The artifact sample from each sub-region is further divided into two groups, early (pre-6,000 B.P.) and late (post-6,000 B.P.), to determine whether patterns in the use of obsidian changed over time. Reasons for considering only two gross temporal periods are discussed in Chapter 5. The early interval sample consists of artifact types that were in use before 6,000 B.P. The early artifact sample includes Great Basin fluted, Concave Base, Great Basin Stemmed series, and Pinto series point types, as well as a few other chipped stone tools, such as crescents, that were found in association with early point types. Artifacts included in the post-6,000 B.P. (later) sample include large side-notched, Humboldt series, Gatecliff series, Elko series, Rosegate series, Parowan Basal-notched, and Desert series points, and several chipped stone tools recovered from post-6,000 B.P. contexts.

Unfortunately, the sample is unevenly distributed across space and time, introducing biases that hinder evaluations of source use patterns. For example, the Eastern Sub-region sample is the largest, comprising 45 percent of the entire artifact sample, but pre-6,000 B.P. point types are virtually absent in the sample. Thus, there are no comparative data for



Central Sub-region: NTTR; 1.Tippipah Spring; 2.Mud Lake. **Northern Sub-region:** Alta Toquima Village/Mount Jefferson; 4.Big Smoky Valley.**Western Sub-region:** 5.Sarcobatus Flat; 6.Owens Valley; 15.Deep Springs Valley; 16.Grapevine Canyon; 17.Grapevine Mountains; 18.Mesquite Flat; 22.Saline Valley. **Southern Sub-region:** 7.Saratoga Spring; 8.Mesquite Valley; 9.Paradise River Valley; 10.Hinkley district; 11.Newberry Spring; 12.Crucero district; 13.Mesquite Spring; 14.Joshua Tree National Park; 19.Panamint Range; 20.Amargosa Valley; 21.Ash Meadows. **Eastern Sub-region:** 23.Conaway shelter; 24.O'Malley shelter; 25.Escalante Valley; 26.Evans Mound; 27.Pine Park shelter; 28.Median Village; 29.Paragonah Mounds; 30.Marysvale; 31.Kanosh Mounds; 32.Sevier Lake; 33.Pharo Village; 34.Garrison site.

Figure 6.1. Map of archaeological sites and districts by sub-region.

pre-6,000 B.P. obsidian source use for the Eastern Sub-region. In addition, percentages of occurrences of Eastern Sub-region obsidian artifact sources in the sample are inflated, which is apparent in the Figure 6.2 bar chart. Nonetheless, 69 geochemically distinct obsidian sources and source varieties were identified in the study sample, 47 from 34 known obsidian source areas and 21 from sources for which the geologic parent source is unknown (Appendices C and D). The sources and percentages of occurrence in the entire artifact sample are discussed in the following text. Figure 6.3 shows the general locations of the obsidian sources occurring in the sample.

GREAT BASIN SOURCES USED TO MANUFACTURE SAMPLE ARTIFACTS

Study Area Sources

All of the obsidian sources in or adjoining the study area—described in Chapters 2 and 3—occur in the artifact sample. These include the Obsidian Butte Volcanic Center, Oak Spring Butte, South Kawich Range, Goldfield Hills, Shoshone Mountain, Tempiute Mountain, Kane Springs Wash Caldera, South Pahroc Range, Crow Spring, and Devil Peak sources. Of these, the Obsidian Butte Volcanic Center source appears the most frequently.

Artifacts manufactured from all varieties of the Obsidian Butte Volcanic Center, Nevada, source comprise 8.5 percent of the entire artifact sample. Variety 5 (formerly Unknown C), formed during the latest eruption of the volcanic field, was the most-used variety, occurring in 40 percent of all artifacts manufactured from Obsidian Butte glass. Obsidian Butte Variety 3 and Variety 2 (also called Airfield Canyon) were the next most frequently used varieties, appearing in relatively equal amounts, respectively 27 percent and 26 percent of the Obsidian Butte source artifacts. Artifacts manufactured from Variety 4 make up only 7 percent of all Obsidian Butte source artifacts, and Variety 1, the earliest erupted variety, was not used to manufacture any of the points or tools in the sample. One piece of ethnohistoric period debitage from the Jerome Spring winter camp (Chapter 4; Appendix D), however, was

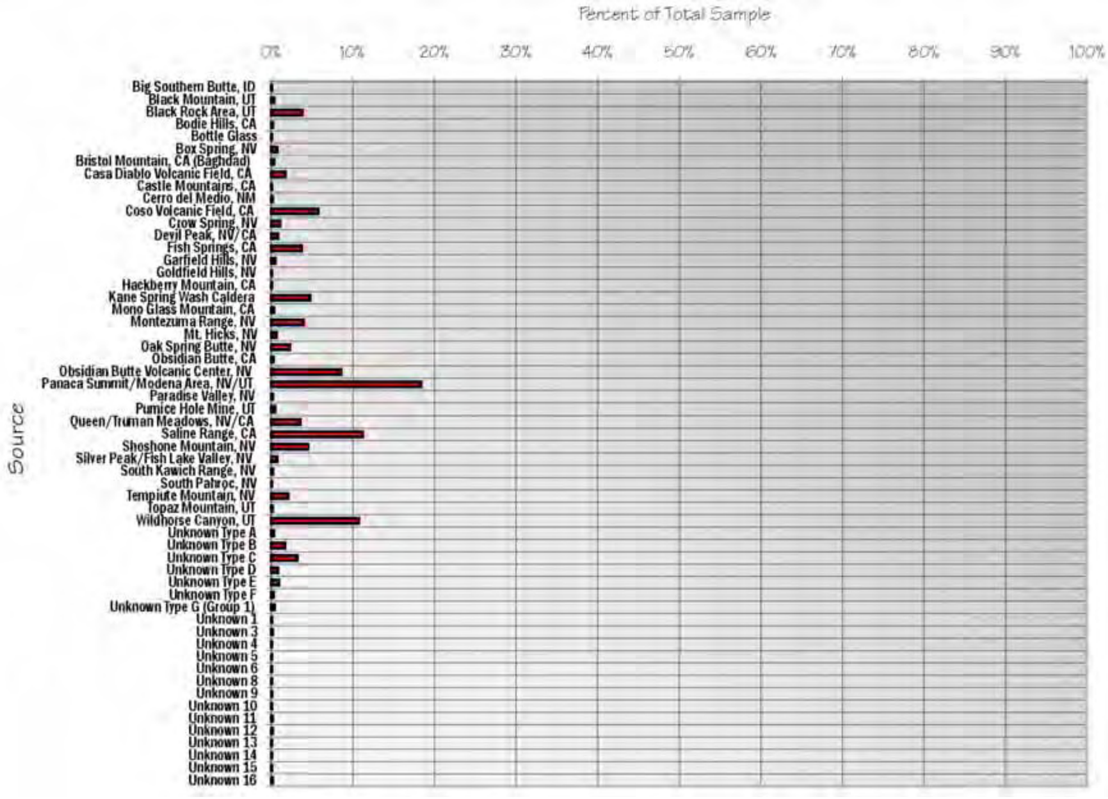
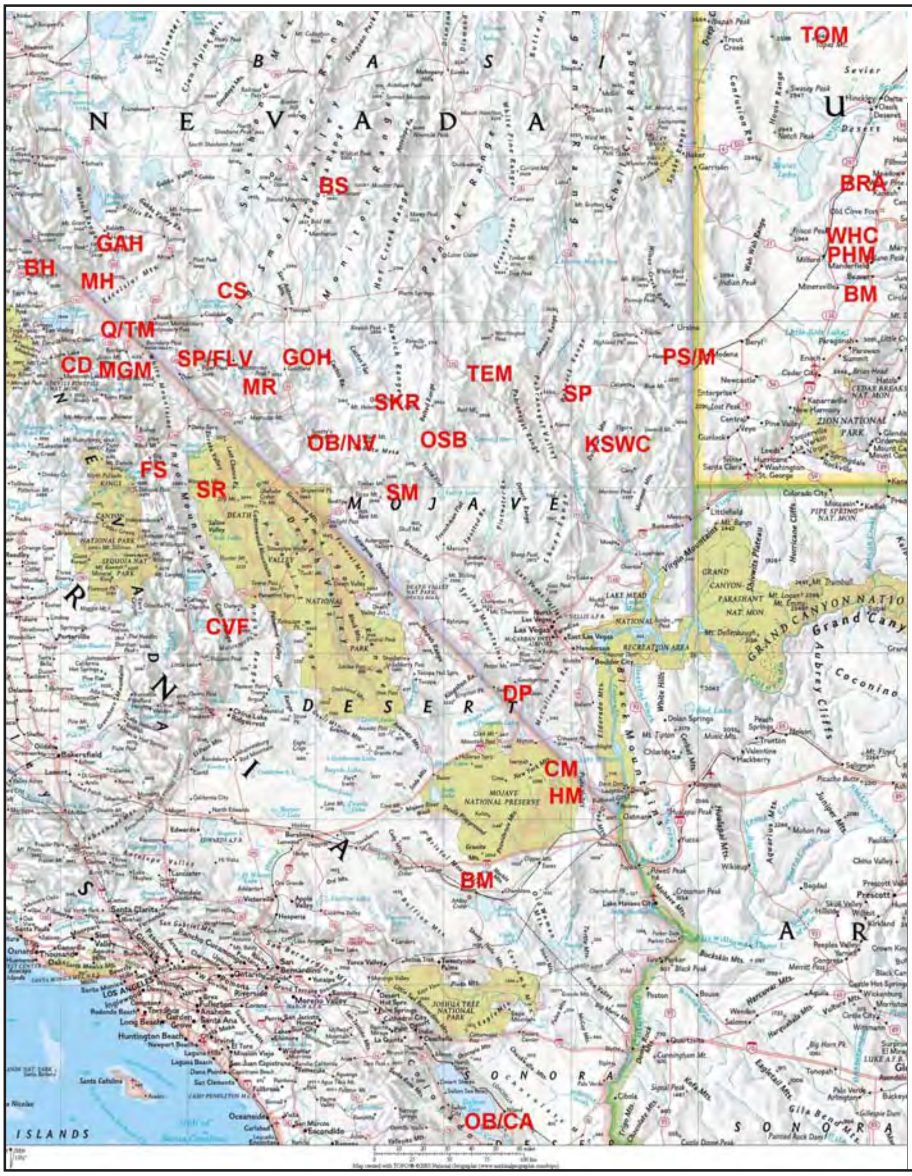


Figure 6.2. Percentages of all obsidian sources occurring in the artifact sample.



Key to Abbreviations

BH:	Bodie Hills, CA
BLM:	Black Mountain, UT
BRA:	Black Rock Area, UT
BRM:	Bristol Mountain, CA
BS:	Box Spring, NV
CD:	Casa Diablo, CA
CM:	Castle Mountains, CA
CS:	Crow Spring, NV
CVF:	Coso Volcanic Field, CA
DP:	Devil Peak, NV-CA
FS:	Fish Springs, CA
GAH:	Garfield Hills, NV
GOH:	Goldfield Hills, NV
HM:	Hackberry Mountain, CA
KSWC:	Kane Spring Wash Caldera, NV
MGM:	Mono Glass Mountain, CA
MH:	Mt. Hicks, NV
MR:	Montezuma Range, NV
OB/CA:	Obsidian Butte, CA
OB/NV:	Obsidian Butte Volcanic Center, NV
OSB:	Oak Spring Butte, NV
PHM:	Pumice Hole Mine, UT
PS/M:	Panaca Summit-Modena, NV-UT
PV:	Paradise Valley
Q/TM:	Queen-Truman Meadows, CA-NV
SM:	Shoshone Mountain, NV
SP/FLV:	Silverpeak-Fish Lake Valley, NV
SKR:	South Kawich Range, NV
SP:	South Pahroc, NV
SR:	Saline Range, CA
TEM:	Tempiute Mountain, NV
TOM:	Topaz Mountain, UT
WHC:	Wildhorse Canyon, UT

Figure 6.3. Approximate locations of obsidian sources occurring in the sample. Three sources lie outside the area shown in the map. These are the Paradise Valley source in northern Nevada, the Big Southern Butte, Idaho source, and the Cerro del Medio, New Mexico, source.

detached from a piece of Obsidian Butte Variety 1 obsidian.

Kane Springs Wash Caldera is the next most frequently occurring of the study area sources, comprising nearly 5 percent the entire obsidian artifact sample. Variety 1 was used to manufacture about 46 percent of the Kane Springs Wash Caldera source artifacts. Variety 2 was used to make 54 percent of the Kane Springs Wash Caldera obsidian artifacts.

Appearing almost as frequently as the Kane Springs Wash Caldera source is the Shoshone Mountain source, constituting 4.5 percent of all artifact sources. The Oak Spring Butte and Tempiute Mountain sources are about equal in percentages of occurrence in the artifact sample. Oak Spring Butte obsidian artifacts make up 2.3 percent of the sample, and 2 percent of the sample was manufactured from Tempiute Mountain obsidian. Crow Spring and Devil Peak obsidians were used to manufacture about 1 percent of the artifacts. The least-used of the study area sources are South Kawich Range, South Pahroc, and Goldfield Hills, all occurring as the sources of less than 0.2 percent of the sample.

Montezuma Range, Nevada

The Montezuma Range is in south-central Esmeralda County, west of Goldfield, Nevada, lying about 20 km west of the northwestern boundary of the NTTR northern ranges. Geological study of the source is minimal. Dickerson (2003:13) reports that obsidian occurs in alluvium on the north and west sides of the Montezuma Range, as well as in a perlite deposit on the south side of the range. Macdonald et al. (1992:141, 172) report trace element data from XRF analysis of an obsidian cobble collected from an alluvial fan in the vicinity of Clayton Ridge, which lies to the west of the Montezuma Range. Nearly 4 percent of the obsidian artifacts in the sample was manufactured from Montezuma Range volcanic glass. Figure 6.4 is a photograph of the Montezuma Range.

Silverpeak-Fish Lake Valley, Nevada

The Silverpeak-Fish Lake Valley obsidian source erupted from the Silver Peak Volcanic Center, which is situated in Esmeralda County, Nevada, in the central part of the Silver Peak Range. The obsidian source lies approximately 60 km (37 miles) west of the northwestern boundary of the NTTR northern ranges. The volcanic center was active between 4.8 and 6.0 million years ago and is part of a late Miocene and Pliocene volcanic province in western Nevada and eastern California. The province is characterized by a suite of slightly alkaline potassic lavas distinct from volcanic rocks in the rest of the Great Basin (Robinson 1972; Robinson et al. 1976; Stewart et al. 1974).

The rhyolite of Cottonwood Springs and the Esmeralda Formation, two geologic units found in the Silver Peak region, reportedly contain obsidian (Robinson 1972; Robinson et al. 1968; Robinson et al. 1976; Stewart et al. 1974). Pliocene obsidian-bearing rocks associated with flows and domes of fine-grained rhyolite extruded from vents along a ring fracture zone. Although these domes and flows are mostly devitrified, black glassy obsidian is locally abundant within the Tertiary flow-banded rhyolite (Tr). The best exposures are found on the south and east sides of the caldera (Robinson 1972; Robinson et al. 1976; Stewart et al. 1974). Obsidian also occurs as many "tear-shaped spheroids" in a layer of massive, coarse-grained, white pumice lapilli tuff that locally caps the uppermost unit of the Esmeralda Formation (Robinson et al. 1968:588).

Pebble- to fist-sized obsidian nodules are weathering out of rhyolite on Rhyolite Ridge northeast of the caldera (M. Reheis personal communication 2003). Obsidian nodules initially used to characterize the Silverpeak geochemical type were collected from tailings at the Silverpeak Mine during the Monitor Valley Project (Hughes 1983:403, Table 1). According to Thomas (1983:396), the Silverpeak source consists of a scatter of small nodules on

Figure 6.4. The Montezuma Range, Esmeralda County, Nevada.

the east side of Clayton Valley in the vicinity of the town of Silverpeak. Moore (1997:78) reports that nodules of Silverpeak obsidian are also found in alluvial deposits along State Route 265 at the south end of Big Smoky Valley. Obsidian nodules measuring up to 7 cm also occur in alluvial deposits in several places in northern Fish Lake Valley (Eerkens and Glascock 2000; Moore 1994, 1997; Weight 1950). Silverpeak-Fish Lake Valley obsidian was used to manufacture less than 1 percent of the artifacts in the sample.

Mt. Hicks, Nevada

The Mt. Hicks (also Mount Hicks), obsidian source is on the east side of Mt. Hicks in Mineral County, Nevada, approximately 150 km west-northwest of the northwest corner of NTTR. Obsidian samples used to chemically characterize this source were collected by the roadside in Alkali Valley (Jack and Carmichael 1969). Moore (1994, 1997:74) reports obsidian occurs as float on the northeast and southeast sides of Mt. Hicks and that material in both primary and secondary contexts is located on other parts of the mountain. The source is in the pinyon-juniper zone and several archaeological sites, including rock-lined house pits, have been documented in the vicinity (J. Martinez, personal communication 2003; Moore 1997:74). Mt. Hicks obsidian was used to manufacture 39 percent of the typable points recovered from Hidden Cave, and thus represents the dominant source found in the Hidden Cave projectile point assemblage (Hughes 1985:335). The Mt. Hicks obsidian source is also mentioned in several other reports (Ericson et al. 1976; Jack 1976; Jackson 1974; Sappington 1981b). Mt. Hicks obsidian was used to manufacture less than 1 percent of the 1,644 artifacts in the sample.

Garfield Hills, Nevada

The Garfield Hills obsidian source is near Hawthorne, Mineral County, Nevada, approximately 135 km northwest of NTTR. Geochemical characterization of the Garfield Hills (also known as Hawthorne) glass type was initially based on the analysis of nodules collected from alluvial deposits in several places east of Hawthorne (Hughes 1985; Moore 1995, 1997; Sappington 1981b). These nodules were presumed to be from a geologic source in the Garfield Hills that had completely eroded away (Moore 1997). But obsidian nodules were recently found in situ in the basal part of a "pink rhyolitic tuff/ignimbrite" in the northern part of the Garfield Hills (J. Moore, personal communication 2003). The slope below this tuff exposure is mantled with nodules eroded from the outcrop. Nodules are also found in secondary contexts in several areas along U.S. Highway 95, including the Ammunition Depot in Walker Lake Valley and near Kincaid in Soda Springs Valley (Moore 1995, 1997). Garfield Hills obsidian is represented only in the projectile point sample from the northern sub-region. Less than 1 percent of the points in the entire sample was manufactured from Garfield Hills glass.

Box Spring, Nevada

The Box Spring source is at the north end of the Monitor Playa, just east of the Toquima Range in Nye County, Nevada (Thomas 1983:394–395), about 130 km north of the northern boundary of the NTTR northern ranges. Here, obsidian is found in alluvial deposits at the base of the Toquima Range. Diffuse scatters of small nodules no larger than 3 cm in diameter are found in several ephemeral streambeds in the vicinity, with the densest concentration occurring at Box Spring. Hughes (1983:403) reports obsidian nodules with the trace element profile of Box Spring obsidian are also found on a volcanic butte 4.8 km east of Box Spring. According to Thomas (1983:393), the small size of available nodules constrains the types of artifacts that can be manufactured from obsidian from the Box Spring source.

Bodie Hills, California

The Bodie Hills obsidian source is in the Bodie Hills, which lie north of Mono Lake in Mono County, California, near the town of Bridgeport. The source area is approximately 185 km west-northwest of the northwestern corner of the NTTR northern ranges. Here, obsidian cobbles measuring up to 20 cm in diameter are found in an environment dominated by sagebrush (Bieling 1992). But the Bodie Hills also support broad stands of pinyon pine. Exploitation of high-quality obsidian found in this extensive source area has been the subject of many archaeological investigations (Basgall 1989; Bieling 1992; Ericson 1981, 1982; Ericson et al. 1976; Jackson and Ericson 1994; Nelson 1984; Singer and Ericson 1977). This research has shown that Bodie Hills obsidian was conveyed over the west central Sierra Nevada to the Central Valley and central California coast. Bodie Hills glass was also conveyed in a northerly direction, accounting for nearly 20 percent of the typable obsidian points recovered from Hidden Cave, approximately 160 km to the north northwest (Hughes 1985:335). Less than 1 percent of the entire obsidian artifact sample was manufactured from Bodie Hills source glass.

Casa Diablo, California

The Casa Diablo source area, situated within the Long Valley Caldera in Mono County, California, is approximately 160 km west of the NTTR. Obsidian in the Casa Diablo area is found in resurgent domes that formed within the caldera California. 0.71 to 0.60 million years ago (Bailey et al. 1976:732). In a pioneering obsidian sourcing study, Jack (1976:203; Jack and Carmichael 1969: Table 1) chemically characterized a number of sources of obsidian toolstone found in California and western Nevada based on data from a few geologic specimens from each area. Obsidian found in the Long Valley Caldera was thought to represent a single Casa Diablo geochemical type but was later shown to comprise several chemically distinct varieties.

Hughes (1994:263) first detected the geochemical variability in artifact assemblages from sites in the western Great Basin. X-ray fluorescence analysis of 200 geologic specimens collected in 1989 from 26 outcrops and quarrying loci in the Casa Diablo area resulted in the characterization of three distinct Casa Diablo obsidian varieties, termed Lookout Mountain, Sawmill Ridge, and Hot Creek or Prospect Ridge. Like those from a number of other Great Basin source areas, these obsidian varieties are distinguished by their strontium and barium concentrations.

Lookout Mountain glass and Sawmill Ridge glass were extensively exploited compared to Prospect Ridge. Reynolds (1997:5) reports that most procurement sites are associated with primary occurrences of obsidian. These sites are found in eight localities from Lookout Mountain south to Obsidian Hill. Although the quality of available obsidian is generally high, the best toolstone is found in the northern part of the source area. In addition to artifacts recovered from numerous prehistoric sites east of the Sierra Nevada in Inyo and Mono counties, artifacts made of obsidian from the Casa Diablo source area have been found in the central Sierra Nevada, in the Central Valley, and on the central and south-central coast of California. This indicates that Casa Diablo glass was conveyed great distances, primarily to the west (Bouey and Basgall 1984; Basgall 1989). Slightly less than 2 percent of the obsidian artifacts in the study sample were manufactured from Casa Diablo obsidian. Sixty-one percent of these are the Lookout Mountain variety and 39 percent are the Sawmill Ridge variety. Figure 6.5 is a photo of Lookout Mountain.

Queen-Truman Meadows, California-Nevada

The Queen-Truman Meadows obsidian source, also known as the Queen or Truman-Queen source, lies at the north end of the White Mountains on the California-Nevada border, approximately 115 km due west of the northwestern corner of NTTR. The geologic context of obsidian in this source area has not been well studied. Masses of obsidian cobbles are eroding from alluvial deposits on hill slopes and along stream banks in Queen Valley and Truman Meadows (Ramos 2000:45). The only primary outcrop documented is near Queen Canyon and consists of "contiguous but highly fractured flows of obsidian within a rhyolite matrix" (Ramos 2000:43). The Queen-Truman Meadows source is in a productive resource area with a substantial water supply, spring-fed meadow, and massive stand of pinyon. The highest quality toolstone is found in the pinyon-juniper zone (Ramos 2000:46). Queen-Truman Meadows glass, although common at sites in southern Mono County and northern Owens Valley, was primarily conveyed to the east (Hughes and Bennyhoff 1986; Ramos 2000). About 3.5 percent of the artifact sample was manufactured from Queen-Truman Meadows obsidian.

Mono Glass Mountain, California

The Mono Glass Mountain source is on the east side of Long Valley in Mono County,

Figure 6.5. Lookout Mountain, Casa Diablo source area.

California, approximately 135 km west of NTTR. Rhyolitic rocks forming Glass Mountain Ridge were erupted between ca. 1.9 and 0.9 million years ago from the magma chamber beneath pre-caldera Long Valley (Bailey et al. 1976; Ericson et al. 1976:225, Fig. 12.1; Gilbert et al. 1968). Many primary and secondary deposits containing small to medium-sized obsidian nodules occur on and in the vicinity of Glass Mountain (Davis 1965; Hall 1983; Jackson 1985; Meighan 1955; Reynolds 1997).

Meighan (1955) reports the largest quarry site is at the east end of Black Mountain in the eastern foothills of Glass Mountain. Mono Glass Mountain obsidian was initially thought to have the same geochemical profile as glass from the Mono Craters source, but the two glass types can be distinguished based on barium concentrations. Steward (1933:262) notes that "Mono Lake obsidian, *piju"um*, came from Glass Mountain" and suggested the Owens Valley Paiute made most of their points from obsidian procured from this source.

Although many studies have shown that this source primarily was used locally, a few artifacts made of Mono Glass Mountain obsidian have been identified at sites in the western Sierra and the Central Valley, California (Jackson 1984; Moratto 1972). The Kudezika Paiute of Mono Lake traded salt, finished points, sinew-backed bows, rabbit-skin blankets, buffalo hides, pine nuts, baskets, red and white paint, and obsidian to the Yosemite Miwok in exchange for acorns, baskets, arrows, manzanita berries, and sow berries, as well as goods such as clamshell disc beads received from the Pacific Coast (Sample 1950:17). Less than 1 percent of the artifacts in the sample were manufactured from Mono Glass Mountain obsidian.

Saline Range, California

The Saline Range source area is in Inyo County, California, between 75 and 90 km west of Beatty, Nevada and 90–105 km west of the western boundary of NTTR. Rhyolites in the Saline Range have not been mapped in detail. Archaeologists have known since the mid 1970s that alluvial deposits in the eastern arm of Saline Valley below Steele Pass contain small nodules of obsidian and obsidian debitage (Ernst et al. 1975; Norwood et al. 1980). But it was not until the mid 1990s that geologic obsidian found in secondary contexts in this area was subjected to XRF analysis, and primary outcrops were unknown until fairly recently (Johnson and Wagner 1998).

The Saline Range, a remote volcanic tableland separating Saline and Eureka valleys in the northwestern portion of Death Valley National Park (DVNP), contains several primary outcrops that are sources of obsidian. Obsidian-bearing Pliocene rhyolite flows and ash flow tuffs of the Saline Range volcanics are found in the Steele Pass area (Figure 6.6), as well as on the western side of the Saline Range (Figure 6.7).

Figure 6.6. Obsidian source at Steele Pass on the east side of the Saline Range. The band of nodules on the slope is Saline Range Variety 3.

Figure 6.7. View toward the west side of the Saline Range. The main source area for Saline Range Variety 1 (Queen Imposter) is on the middle slope of the range in the background.

Although the amount of in-place obsidian in exposed flows is volumetrically low, cobble-sized nodules eroded from outcrops over the past several million years litter the slopes. In places, these nodules have been transported and extensively re-deposited in alluvium. All primary outcrops of tool-grade obsidian identified in the Saline Range thus far show evidence of prehistoric exploitation, as do many of the secondary deposits.

Because the geologic complexity of the Saline Range Volcanic Field presented substantial interpretive problems of the type Hughes and Smith (1993) and Wagner and Johnson (2002) discussed and likelihood of encountering geochemically distinct obsidian varieties in the Saline Range was high, sampling was intensive. Trace element data from more than 130 geologic specimens collected from 14 localities show that three chemically distinct obsidian types—Saline Range Variety 1, Saline Range Variety 2, and Saline Range Variety 3—are found in the Saline Range (Johnson et al. 1999a, 1999b). As with obsidian varieties found at a number of other source areas in the Great Basin, the three Saline Range varieties are best distinguished based on strontium (Sr) and barium (Ba) concentrations. Saline Range Variety 1 has the trace element fingerprint of a previously unknown glass type labelled Queen Impostor.

Queen Imposter obsidian was first recognized in 1986 when artifacts recovered from INY-30, a multi-component prehistoric site near Lone Pine, were analyzed (Basgall and McGuire 1988). This geographically unknown geochemical type was named Queen Imposter because the quantitative values for diagnostic trace elements overlap with those of the Queen obsidian source. The Queen and Queen Imposter glass types can be distinguished from one another based on iron/manganese ratios. For several years, Saline Range Variety 3 glass was called the Saline Valley geochemical type, likely because source samples first used to characterize this glass type were collected from secondary contexts in the eastern arm of Saline Valley.

Saline Range Variety 1 (Queen Imposter) is the most geologically abundant, geographically widespread, and archaeologically significant of the three Saline Range obsidian varieties. Several small outcrops containing small nodules (<5 cm) of Saline Range Variety 1 are found in the Steele Pass area on the east side of the range, where all three varieties of Saline Range obsidian occur. The main source area for Variety 1, however, is on the west side of the Saline Range and is the only variety that occurs on that face. Nodules of high-quality obsidian eroding from primary outcrops found on the west side of the Saline Range measure up to 25 cm in diameter, though most measure 15 cm or less. The Saline Range obsidian source is the subject of ongoing research by Wagner and Johnson. It was during the course of this research that the methodology used to locate and characterize obsidian sources during the current study was developed (Wagner and Johnson 2002).

About 11 percent of the artifacts in the entire sample were manufactured from Saline Range obsidian. Variety 1 (Queen Impostor) was most frequently used, making up almost 94 percent of the Saline Range source artifacts. Variety 2 occurs as the source of only 1 percent of the Saline Range obsidian artifacts, and about 5 percent of the Saline Range artifacts were manufactured from Variety 3.

Fish Springs, California

The Fish Springs obsidian source, shown in Figure 6.8, was called *Ta'kapi* by the Owens Valley Paiute (Steward 1933:262). The source is situated south of the Owens Valley town of Big Pine, in Inyo County, California, approximately 130 km west of NTTR. Here, obsidian is found in nodular form in a small perlite dome disturbed by historic mining (Norman and Stewart 1951:105). It was disturbed before archaeologists were able to document the size and amount of toolstone available at the source. Small nodules of toolstone quality material are available over a limited area. Prehistoric procurement and use of Fish Springs obsidian was primarily local (Basgall 1989; Richman and Basgall 1998). Stevens (2002) reports Fish Springs obsidian is common at high elevation sites in the southern Sierra Nevada 20 km or more to the west, and a few artifacts made of Fish Springs glass have been found in Death Valley (Johnson 2002a, 2002b, 2003). Fish Spring obsidian was used to manufacture nearly 4 percent of the obsidian artifacts in the 1,644 artifact sample.

Coso Volcanic Field, California

The Coso Volcanic Field lies in the south-

Figure 6.8. View of the Fish Springs Source in Owens Valley. The Fish Springs obsidian dome is at the base of the Sierran front.

western part of the Coso Range, south of Owens Valley in Inyo County, California. Situated on the China Lake Naval Weapons Center, this large obsidian source area is approximately 125 km west of the southwest boundary of NTTR. The Sugarloaf obsidian source, also known as the Coso Hot Springs or Coso source, was first described by (Farmer 1937) and later discussed by a number of investigators (Ericson 1977; Ericson et al. 1976; Harrington 1951; Heizer and Treganza 1944; Hughes and Bennyhoff 1986; Jack 1976; Jack and Carmichael 1969). In all of these studies, obsidian found in the Coso Range was assumed to represent a single geochemical type. Figure 6.9 is a photograph of the west face of the Coso Range.

During the past few decades, the Coso Volcanic Field has been intensively studied (Bacon et al. 1981; Duffield and Bacon 1981; Duffield et al. 1980; Eerkens and Rosenthal 2004; Elston and Zeier 1984; Gilreath and Hildebrandt 1997; Hughes 1988), primarily because of exploration and development of the Coso geothermal field. Volcanic activity occurred in the Coso Range between 1.5 million and 33,000 years ago, producing many pyroclastic deposits, explosion craters, debris flows, and rhyolite domes (Duffield et al. 1980). Toolstone quality obsidian is found in the Coso Range in both primary and

Figure 6.9. West face of the Coso Range, California.

secondary contexts, with primary obsidian occurring in thick flow bands emanating from steep rhyolite domes (Gilreath and Hildebrandt 1997:7).

Large boulders and slabs of high-quality glass are found at a several primary outcrops, and many tons of obsidian toolstone are still available. Although less extensive than secondary deposits, which are widely distributed over the local landscape, flows contain more artifact-quality material. But obsidian in secondary contexts, which reaches 30 cm in diameter, was also exploited. Hughes (1988) analyzed geologic obsidian specimens collected from 15 localities within the Coso Volcanic Field and identified intra-field variability, resulting in the trace element characterization of four distinct Coso subtypes that he labeled West Sugarloaf, Sugarloaf Mountain, West Cactus Peak, and Joshua Ridge.

Gilreath and Hildebrandt (1997:1) report that 150 quarry sites, 300 off-quarry sites, and 100 segregated reduction loci have been documented in the Coso source area. Excavations of 34 obsidian toolstone procurement sites in the Coso Volcanic Field revealed that use of Coso glass spanned the entire Holocene (Gilreath and Hildebrandt 1997). Obsidian from the Coso source area was conveyed great distances (235 km or more), as indicated by the recovery of artifacts made of Coso glass from prehistoric sites throughout central and southern California.

Nearly 6 percent of the artifacts in the sample were manufactured from Coso Volcanic Field obsidian. Most of these (72 percent) were manufactured from the West Sugarloaf variety of the source. The Sugarloaf variety makes up 18 percent of the Coso source artifacts. Only 6 percent were manufactured from the Joshua Ridge variety, and the West Cactus Peak variety was used to make about 3 percent of the artifacts.

Castle Mountains, California

The Castle Mountains obsidian source, also known as the Juan source, is in the Castle Mountains, which straddle the San Bernardino County, California-Clark County, Nevada, border. The source is approximately 110 km south of the southern boundary of the NTTR southern ranges. Obsidian occurs as small (generally 3 cm or less) nodules that are residual in the Cedar Top perlite deposit. Wright et al. (1954:67) describe the sequence of events that led to the formation of obsidian in perlite, which forms the central part of a circular plug-dome of rhyolite at the Cedar Top locality. The perlite has been mined commercially, apparently destroying all evidence of prehistoric exploitation at the primary source. Wilke and Schroth (1988, 1989) documented bipolar reduction of small obsidian nodules found in secondary contexts on the alluvial fans emanating from the north end of the Castle Mountains. Only 1 projectile point in the entire sample of 1,644 artifacts analyzed for this study was manufactured from Castle Mountains obsidian.

Bristol Mountains, California

The Bristol Mountains obsidian source lies just southwest of Mojave National Preserve, San Bernardino County, California, approximately 215 km south of the NTTR. The primary source is presumed to be Miocene rhyolite domes in the Bristol Mountains, but the domes are so eroded that obsidian nodules are now found only in secondary contexts (Shackley 1994, 1995). Near these domes, nodules up to 7 cm in diameter are found, though most are 5 cm or less. Obsidian nodules have been redeposited downstream to Bristol Lake and Bagdad Dry Lake, as far as 10 km from the primary source.

Nodule size and density of nodule deposits decrease with distance from source. As obsidian nodules were first noted in alluvial deposits near the town of Bagdad, the Bristol Mountains source is also referred to as the Bagdad source. Bristol Mountains obsidian comprises less than 1 percent of the entire artifact sample. Figure 6.10 is a view of the west face of the Bristol Mountains from Bagdad Dry Lake.

Hackberry Mountain, California

The Hackberry Mountain obsidian source has not been described but is presumably on or near Hackberry Mountain on the east edge of Mojave National Preserve in San Bernardino County, California. The source is approximately 130 km south of the southern boundary of NTTR. The Hackberry Mountain Volcanics (Ths) consist of interlayered lava flows, domes,

Figure 6.10. West face of the Bristol Mountains from Bagdad Dry Lake.

ash flows, dikes, and plugs of trachyte, trachydacite, and rhyolite erupted from the Woods Mountain volcanic center about 16 million years ago (McCurry 1988; McCurry et al.1995). One projectile point in the entire sample was manufactured from Hackberry Mountain obsidian.

Panaca Summit-Modena Area, Nevada-Utah

The Panaca Summit-Modena Area source is approximately 165 km east of NTTR. Panaca Summit-Modena Area glass apparently occurs in geologic contexts in a number of places east of Panaca, Lincoln County, Nevada, and is also found in alluvial deposits near Modena, Iron County, Utah (Dames and Moore 1994; Hughes 1994b; Moore 1995, 1997; Nelson 1984; Nelson and Holmes 1979; Rowley et al. 2002; Umschler 1975). According to Rowley et al. (2002), abundant boulders, cobbles, and pebbles of toolstone-quality obsidian have eroded out of the rhyolite flow member of the Steamboat Mountain Formation in the vicinity of Prohibition Spring.

The Steamboat Mountain Formation dates to 11 to 13 Ma. Here, obsidian nodules are found in extensive alluvial deposits that trend to the east, and manufacturing debris covers approximately 1 km^2. Projectile points made of obsidian from the Panaca Summit-Modena Area source have been recovered from sites in Death and Owens valleys as much as 380 km to the west (Basgall and Delacorte 2003; Johnson 2002). The Panaca Summit-Modena Area source occurs in 18 percent of the artifact sample.

Wildhorse Canyon and Pumice Hole Mine, Utah

The Wildhorse Canyon and Pumice Hole Mine obsidian sources are in the Mineral Mountains, Beaver County, Utah, approximately 250 km northeast of the northeastern boundary of NTTR. Lava domes, flows, and tuffs were erupted between 800,000 and 500,000 years ago along the crest of the Mineral Mountains. These rhyolitic rocks occur in three stratigraphically distinct sequences, the lowermost two of which are obsidian-rich (Lipman et al. 1978:134, 144). The Wildhorse Canyon and Bailey Ridge flows contain blocks of obsidian as much as 0.5 m across.

Analyses of obsidian samples collected from a number of localities in the Mineral Mountains show that two chemically distinct obsidian varieties, termed Wildhorse Canyon and Pumice Hole Mine, are found in the Mineral Mountains source area (Dames and Moore 1994; Lipman et al. 1978; Nelson 1984). Projectile points made of Wildhorse Canyon glass are found in the samples from all sub-regions except the southern. Nearly 11 percent of the artifacts in the study sample were manufactured from Wildhorse Canyon obsidian and less than 1 percent from the Pumice Hole Mine source.

Topaz Mountain, Utah

The Topaz Mountain obsidian source is in the Thomas Range, Juab County, Utah, approximately 335 km northeast of NTTR. The obsidian occurs in a vitrophyre at the base of the Topaz

Mountain Rhyolite, erupted between 6 and 7 million years ago. Nodules up to 15 cm in diameter are found in both primary and secondary contexts. Only two projectile points, both in the post-6,000 B.P. sample from the Eastern Sub-region, are made of Topaz Mountain glass. Arkush and Pitblado (2000:22) report obsidian from the Topaz Mountain source was commonly used to fashion artifacts found in the southern Great Salt Lake Desert and Tule Valley regions of northwestern Utah, and that this glass type dominates Paleoarchaic flaked stone tool assemblages in the Wildcat Mountain area. Less than 1 percent of the artifact sample was manufactured from Topaz Mountain obsidian.

Black Rock Area, Utah

The Black Rock Area obsidian source is in the Black Rock Desert of Millard County, Utah, approximately 290 km northeast of NTTR. Obsidian bearing rhyolite in the Black Rock Desert was erupted ca 2.5 million years ago (Dames and Moore 1994; Nelson 1984; Nelson and Holmes 1979; Wilkerson 1985). About 4 percent of the 1,644 artifact sample was manufactured from Black Rock Area obsidian.

Black Mountain, Utah

The Black Mountain source is in Beaver County, Utah, approximately 290 km east of NTTR. Obsidian nodules up to 15 cm in diameter occur in rhyolite domes near the Beaver County Airport south to Teddy's Valley. (Dames and Moore 1994; Rowley et al. 1978). Less than 1 percent of the artifact sample is made from Black Mountain glass.

Summary

The 1,644 points and tools comprising the artifact sample were manufactured from obsidian procured from more than 34 geochemically distinct source areas. The Panaca Summit-Modena Area, Nevada-Utah, source appears the most frequently, composing 18 percent of the entire sample. Artifacts manufactured from Saline Range, California, and Wildhorse Canyon, Utah, obsidians are the next most frequent, making about 11 percent of the sample. Obsidian Butte Volcanic Center, Nevada, obsidian artifacts constitute 8.5 percent of the sample. These data appear to imply that prehistoric Great Basin peoples of the broad region most frequently procured obsidian from these four sources to manufacture points. This is not necessarily the case.

The sample is unevenly distributed through time and space, especially with sites situated east of the NTTR-NTS study area, which accounts for the high percentages of eastern Great Basin sources in the sample. Thus, actual procurement patterns are obscured, and evaluation of diachronic patterns is precluded. Dividing the broad area where the artifacts were collected into sub-regions and discussing results for each sub-region ameliorates the data skew in most areas. Sub-region data provide more accurate depictions of diachronic patterns of prehistoric Great Basin obsidian source us, and identifies those areas where archaeologists should concentrate future obsidian research efforts.

EVALUATING SOURCE SIGNIFICANCE: DISCUSSION OF XRF RESULTS BY SUB-REGION

The objectives of this research are to evaluate the significance of Obsidian Butte Volcanic Center, Nevada, obsidian source through time and space, and to identify diachronic patterns of obsidian procurement for manufacturing projectile points in the region. To better evaluate actual diachronic procurement patterns for obsidian used to manufacture points and to evaluate diachronic use of the Obsidian Butte source, the sample has been divided into five sub-regions. These are the Central Sub-region sample, comprising the NTTR-NTS study area sample; the Northern Sub-region sample, which contains artifacts from sites north of the NTTR-NTS; the Western Sub-region sample, comprising artifacts from sites west of the NTTR-NTS; the Southern Sub-region sample, consisting of artifacts from sites south of the NTTR-NTS; and the Eastern Sub-region sample, which is composed of artifacts from sites east of the NTTR-NTS.

Central Sub-region (NTTR-NTS Study Area) Sample

The artifact sample from the NTTR-NTS study area, or Central Sub-region, consists of 297 projectile points and 1 winged crescent. The artifacts were recovered from surface sites or as isolates, mostly from the NTTR northern ranges. Also included are points from 26Ny3, Tippipah Spring, on the NTS and 26Ny1101, the Lowengruhn site on Mud Lake, which straddles the northwest corner of the NTTR and adjacent Bureau of Land Management (BLM) lands. The Central Sub-region projectile point sample comprises nearly one-fifth of the total sample and is nearly evenly divided between early (pre-6,000 B.P.) and later (post-6,000 B.P.) interval artifact types. Thus, the Central Sub-region sample should reasonably represent diachronic patterns of obsidian procurement for manufacturing projectile points in the region.

Twenty-four chemically distinct obsidian varieties from 19 known sources, plus 4 obsidian sources with unknown geologic provenance, were identified in the Central Sub-region sample. These data indicate that source use on and in the Central Sub-region is even more diverse than was documented in earlier studies (Buck et al. 1998; Haarklau 2001; Kolvet et al. 2000). Obsidian varieties from the Obsidian Butte Volcanic Center source area compose nearly a third of the combined pre- and post-6,000 B.P. study area samples. Thus, as Haarklau (2001) previously noted, Obsidian Butte Volcanic Center obsidian varieties appear to be the most frequently procured source in the study area through time. Table 6.1 lists obsidian point sources in relationship to time intervals in the Central Sub-region sample.

Obsidian Butte Volcanic Center obsidian was the most commonly used source for manufacturing projectile points during both the early and late intervals in the Central Sub-region. Nearly 40 percent of the projectile points assigned to the early group and more than 25 percent of those in the later group were made from Obsidian Butte glass. All four of the archaeologically significant Obsidian Butte varieties are represented in both the early and late samples from the study area, with Obsidian Butte Variety 5 accounting for nearly half of the early Obsidian Butte points. Although use of Varieties 2 and 3 decreased slightly sometime after 6,000 B.P., data indicate that the sharpest decline in source use from the early to later periods occurred with Variety 5. Obsidian Butte Variety 5 makes up nearly 18 percent of the early point sample and only 9 percent of the later interval point sample. Use of Variety 4 to manufacture points appears to have slightly increased after 6,000 B.P.

Other changes in patterns of obsidian procured to manufacture points took place between the two broad periods. Although the pre-6,000 B.P. sample constitutes slightly less than half of the Central Sub-region point sample, the source profile for early interval projectile points is more diverse, consisting of 20 different sources. Only 14 sources appear in the post-6,000 B.P. point sample. Present in the early point sample but absent in the later sample are the Goldfield Hills, Crow Spring, Queen-Truman Meadows, Mt. Hicks, Casa Diablo, Coso Volcanic Field, Castle Mountains, Unknown Type G, and Unknown 3 sources. The South Kawich Range, Fish Springs, and Unknown 6 sources occur in the post-6,000 B.P. point sample, but are absent in the pre-6,000 B.P. sample.

In addition to differences in sources that appear in the early and later point samples, there are also differences in frequencies of occurrence for the same sources. Sources occurring in both samples include Obsidian Butte Volcanic Center, Shoshone Mountain, Oak Spring Butte, Tempiute Mountain, Kane Springs Wash Caldera, Montezuma Range, Silverpeak-Fish Lake Valley, Saline Range, Bodie Hills, Wildhorse Canyon, and Unknown Type F. It appears, however, that the Obsidian Butte Volcanic Center, Montezuma Range, and Saline Range sources were more heavily used to manufacture points before 6,000 B.P., but the Shoshone Mountain, Oak Spring Butte, Tempiute Mountain, and Kane Springs Wash Caldera sources were used more frequently to manufacture points after 6,000 B.P. The Silverpeak-Fish Lake Valley, Bodie Hills, Wildhorse Canyon, and Unknown Type F sources occur in similar and lesser frequencies in both point samples, indicating that they were used minimally through time in the Central Sub-region.

Obsidian from four source areas—Obsidian Butte Volcanic Center, Montezuma Range, Shoshone Mountain, and the Saline Range—comprise nearly 75 percent of the early sample. The area encompassing these sources measures approximately 160 km northwest-southeast by 80 km northeast-southwest. Centered on Sarcobatus Flat, this core procurement zone encompasses the northern one-third of DVNP, the NTTR northern ranges, and the NTS. The four sources making up more than 80 percent

Table 6.1. Pre-6,000 B.P. and post-6,000 B.P. obsidian point source use in the Central Sub-region

Pre-6,000 B.P. Sample			Post-6,000 B.P. Sample		
Obsidian Source	No. of artifacts	% of sample	Obsidian Source	No. of artifacts	% of sample
Obsidian Butte Volcanic Center, Nevada, all varieties	53	37.5	Obsidian Butte Volcanic Center, Nevada, all varieties	41	26.1
(Obsidian Butte, Nevada, Variety 1)	(0)	(0.0)	(Obsidian Butte, Nevada, Variety 1)	(0)	(0.0)
(Obsidian Butte, Nevada, Variety 2)	(12)	(8.5)	(Obsidian Butte, Nevada, Variety 2)	(12)	(7.6)
(Obsidian Butte, Nevada, Variety 3)	(13)	(9.2)	(Obsidian Butte, Nevada, Variety 3)	(10)	(6.4)
(Obsidian Butte, Nevada, Variety 4)	(3)	(2.1)	(Obsidian Butte, Nevada, Variety 4)	(5)	(3.2)
(Obsidian Butte, Nevada, Variety 5)	(25)	(17.7)	(Obsidian Butte, Nevada, Variety 5)	(14)	(8.9)
Shoshone Mountain, Nevada	13	9.2	Shoshone Mountain, Nevada	40	25.5
Oak Spring Butte, Nevada	4	2.8	Oak Spring Butte, Nevada	27	17.2
South Kawich Range, Nevada	0	0.0	South Kawich Range, Nevada	3	1.9
Tempiute Mountain, Nevada	7	5.0	Tempiute Mountain, Nevada	20	12.7
Goldfield Hills, Nevada	1	0.7	Goldfield Hills, Nevada	0	0.0
Kane Springs Wash Caldera, Nevada (Variety 1 only)	1	0.7	Kane Springs Wash Caldera, Nevada (Varieties 1 & 2)	4	2.6
Crow Spring, Nevada	5	3.6	Crow Spring, Nevada	0	0.0
Montezuma Range, Nevada	25	17.7	Montezuma Range, Nevada	8	5.1
Silverpeak–Fish Lake Valley, Nevada	2	1.5	Silver Peak–Fish Lake Valley, Nevada	3	1.9
Saline Range, California (Varieties 1 & 2)	11	7.8	Saline Range, California (Variety 1)	4	2.6
Queen–Truman Meadows, Califonia-Nevada	7	5.0	Queen–Truman Meadows, California-Nevada	0	0.0
Mt. Hicks, Nevada	3	2.1	Mt. Hicks, Nevada	0	0.0
Bodie Hills, California	1	0.7	Bodie Hills, California	2	1.3
Casa Diablo, California	1	0.7	Casa Diablo, California	0	0.0
Fish Springs, California	0	0.0	Fish Springs, California	2	1.3
Coso Volcanic Field, California	1	0.7	Coso Volcanic Field, California	0	0.0
Castle Mountains, California	1	0.7	Castle Mountains, California	0	0.0
Wildhorse Canyon, Utah	1	0.7	Wildhorse Canyon, Utah	1	0.6
Unknown Type F	1	0.7	Unknown Type F	1	0.6
Unknown Type G	1	0.7	Unknown Type G	0	0.0
Unknown 3	2	1.5	Unknown 3	0	0.0
Unknown 6	0	0.0	Unknown 6	1	0.6
	n=141	100.0		n=157	100.0

of the post-6,000 B.P. sample are Obsidian Butte Volcanic Center, Shoshone Mountain, Oak Spring Butte, and Tempiute Mountain. The core procurement area containing the later sources measures 130 km east-west by 100 km north-south and centers on the Belted Range. Although the core procurement areas for both the early and later interval point samples are similar in size and two of the heavily used sources overlap (i.e., Obsidian Butte Volcanic Center and Shoshone Mountain), the obsidian procurement focus shifts between the two periods. The core procurement area for the pre-6,000 B.P. interval sample is focused on the low-lying lake basins on and in the vicinity of the NTTR northern ranges, but the focus of post-6,000 B.P. procurement activities apparently shifted to the east to incorporate mountainous areas in the Kawich, Belted, and Groom ranges.

Although the core procurement areas shifted from west to east between the early and later intervals, distances to procurement areas remained similar. Obsidian sources from which toolstone was most frequently procured to manufacture points in the Central Sub-region during both intervals are within the boundaries of the study area or not more than 30 km outside them. Use of more distant sources situated from 75 km to more than 250 km from the Central Sub-region was negligible through time. More distant sources are found to the west of the Central Sub-region, although in the early interval, distant sources lie toward the southwest, and in the later interval, distant sources tend to lie toward the northwest. The most distant source for both periods, however, is Wildhorse Canyon, to the east in Utah's Mineral Mountains.

In summary, Obsidian Butte Volcanic Center, particularly Obsidian Butte Variety 5, was the most frequently used source for manufacturing points during the entire span of prehistory in the Central Sub-region. Although less often procured than Obsidian Butte source obsidian, Shoshone Mountain, Montezuma Range, Oak Spring Butte, and Tempiute Mountain—all on or within 30 km of the NTTR—were also important sources of obsidian that prehistoric inhabitants of the Central Sub-region used to manufacture points. Data indicate that core procurement areas shifted through time from low-lying lake basins of the west Central Sub-region during the early interval to the mountainous terrain of the east portion of the Central Sub-region during the later interval. Sizes of core procurement areas and distances to procurement areas remained relatively similar.

Northern Sub-region Sample

The sample from the Northern Sub-region is small, making up less than 10 percent of the 1,644 artifact sample analyzed for the study. The sample comprises 134 points and 2 hafted knife blades associated with post-6,000 B.P. points. Approximately 20 percent of the points in the Northern Sub-region sample, all collected from sites around the playa at the southern end of Big Smoky Valley, were assigned to the pre-6,000 B.P. interval. The remaining 80 percent, which comprise the post-6,000 B.P. sample, are from Alta Toquima Village (26Ny920) and surface sites in the Mt. Jefferson Natural Research Area. Seventeen known source areas, as well as 3 sources with unknown geologic provenance, were identified in the Northern Sub-region sample. Table 6.2 lists obsidian sources identified in the early and later artifact samples from the Northern Sub-region.

The Obsidian Butte Volcanic Center source, a minimum of 105 km to the south, appears in both the early and later samples. Compared to the Central Sub-region sample, however, the source comprises smaller percentages of the Northern Sub-region sample. About 13 percent of the points in the entire Northern Sub-region sample geochemically correspond with varieties of Obsidian Butte obsidian. Obsidian Butte glass was used more frequently in the post-6,000 B.P. interval, comprising 14 percent of the sample, and only 7 percent of the pre-6,000 B.P. points were made from the Obsidian Butte obsidian.

Also in contrast to the Central Sub-region sample is the diversity in sources used to manufacture points during the early and late intervals. The later Northern Sub-region point sample exhibits greater diversity in sources than the early point sample. Points in the pre-6,000 B.P. sample were assigned to 8 known source areas and 1 source with an unknown geologic provenance. Fourteen known source areas, plus 2 that are unknown, are represented in the post-6,000 B.P. sample. Sources appearing in the pre-6,000 B.P. point sample but absent in the later artifact sample are Silverpeak-Fish Lake Valley, Saline Range, Fish Springs, and Unknown 14. Sources in the later sample but not in the early sample include Box Spring, Mt. Hicks, Tempiute Mountain, Oak Spring Butte, Mono Glass Mountain, Casa Diablo, Paradise Valley, Unknown 11, and Unknown Type G (Group 1). Projectile points manufactured from two Utah sources, the Black Rock Area and Wildhorse Canyon, are also present in the post-6,000 B.P. sample but absent in the early sample.

In the early sample, 75 percent of the points were manufactured from Montezuma Range, Crow Spring, Queen-Truman Meadows, and Silverpeak-Fish Lake Valley obsidian. These source areas are nearest, all within 60 km or less

Table 6.2. Pre-6,000 B.P. and post-6,000 B.P. obsidian point source use in the Northern Sub-region

Pre-6,000 B.P. Sample			**Post-6,000 B.P. Sample**		
Obsidian Source	No. of artifacts	% of sample	Obsidian Source	No. of artifacts	% of sample
Montezuma Range, Nevada	8	2 8.6	Montezuma Range, Nevada	1 5	1 3.9
Crow Spring, Nevada	7	25.0	Crow Spring, Nevada	5	4.6
Box Spring, Nevada	0	0.0	Box Spring, Nevada	11	10.2
Silverpeak–Fish Lake Valley, Nevada	3	10.7	Silverpeak–Fish Lake Valley, Nevada	0	0.0
Queen–Truman Meadows, California-Nevada	3	10.7	Queen–Truman Meadows, California-Nevada	33	30.5
Obsidian Butte Volcanic Center, Nevada (Varieties 3,5)	2	7.1	Obsidian Butte Volcanic Center, Nevada (Varieties 2,3,5)	15	13.9
Garfield Hills, Nevada	2	7.1	Garfield Hills, Nevada	6	5.6
Mt. Hicks, Nevada	0	0.0	Mt. Hicks, Nevada	4	3.7
Tempiute Mountain, Nevada	0	0.0	Tempiute Mountain, Nevada	4	3.7
Oak Spring Butte, Nevada	0	0.0	Oak Spring Butte, Nevada	1	0.9
Saline Range, California (Variety 1)	1	3.6	Saline Range, California	0	0.0
Fish Springs, California	1	3.6	Fish Springs, California	0	0.0
Mono Glass Mountain, California	0	0.0	Mono Glass Mountain, California	1	0.9
Casa Diablo, California	0	0.0	Casa Diablo, California	1	0.9
Paradise Valley, Nevada	0	0.0	Paradise Valley, Nevada	2	1.9
Wildhorse Canyon, Utah	0	0.0	Wildhorse Canyon, Utah	1	0.9
Black Rock Area, Utah	0	0.0	Black Rock Area, Utah	2	1.9
Unknown 11	0	0.0	Unknown 11	2	1.9
Unknown 14	1	3.6	Unknown 14	0	0.0
Unknown Type G (Group 1)	0	0.0	Unknown Type G (Group 1)	5	4.6
	n=28	100.0		n=108	100.0

of the playa in southern Big Smoky Valley and are found within a core procurement area that is approximately 85 km north-south by 105 km east-west. Obsidian Butte Volcanic Center, approximately 105 km to the southeast, and Garfield Hills, approximately 85 km to the northwest, are next in importance. The remaining sources for which the geologic provenance is known, Saline Range and Fish Springs, are approximately 110 km to the south and south-southwest of Big Smoky Valley. Thus, the inferred mobility range of pre-6,000 B.P. populations in Big Smoky Valley measures 185 km north-south by 160 km east-west. Of note is that nearly 86 percent of the early points from Big Smoky Valley are from sources found within the mobility range documented for the early period in the Central Sub-region. This suggests Big Smoky Valley was part of the same obsidian procurement and mobility systems as the early peoples occupying the NTTR-NTS study area, which focused on low-lying valleys.

Obsidian from four source areas—Queen-Truman Meadows, Montezuma Range, Obsidian Butte Volcanic Center, and Box Spring—make up close to 70 percent of the late interval sample. The first three sources lie between 140 and 165 km south and southwest of the Alta Toquima-Mt. Jefferson area, but the Box Spring source is local, situated on the east side of the Toquima Range in central Monitor Valley. The core procurement area for the post-6,000 B.P. interval measures approximately 165 km north-south and is 140 km wide at its widest point. When sources that make up another 20 percent of the later point sample—Garfield Hills, Crow Spring, and Tempiute Mountain—are included, the mobility range expands to measure 275 km east-west but holds constant at 165 km north-south.

The remaining seven geochemical types, six from known sources, each represent less than 2 percent of the late northern sub-region sample. Two of these, Black Rock Area and Wildhorse Canyon, lie approximately 350 km east of the

Alta Toquima-Mt. Jefferson area in western Utah. The Paradise Valley source is in the Santa Rosa Range in northern Nevada, approximately 200 km to the north. The Fish Springs, Casa Diablo, and Mono Glass Mountain sources lie between 190 and 210 km to the southwest, and the Oak Spring Butte source is 190 km to the southeast. The area encompassing all of the post-6,000 B.P. artifact sources measures 500 km east-west by 365 km north-south. The long distance sources suggest a shift in post-6,000 B.P. peoples' obsidian procurement and mobility systems, as in the Central Sub-region, to mountainous terrain to the east but also to the north.

In summary, peoples of the Northern Sub-region exploited the Obsidian Butte Volcanic Center source for obsidian to manufacture points. Later peoples apparently used the source more frequently than early peoples, but use of the source was less common through time than in the Central Sub-region. About 86 percent of the early period points from Big Smoky Valley are from sources within the mobility range documented for the early period in the Central Sub-region, suggesting Big Smoky Valley was part of the same system. Diversity in obsidian sources used was greater in the post-6,000 B.P. interval, however, which contrasts with the pattern in the Central Sub-region. Still, sources appearing in the later sample suggest a shift in mobility and procurement patterns to upland resources to the east and the north.

Western Sub-region Sample

The sample from the Western Sub-region comprises 410 artifacts, approximately 25 percent of the entire sample. Nearly half of the points are from prehistoric sites in the northern half of Death Valley National Park, primarily the Waucoba Spring site. Of the remainder, 106 are from sites in Deep Springs Valley, 109 are from sites surrounding Owens Lake in southern Owens Valley, and five are from Sarcobatus Flat, just west of the NTTR. Unlike the Central Sub-region sample, the Western Sub-region is unevenly distributed between early and late interval point types, with less than 20 percent assigned to the pre-6,000 B.P. group. Sixteen sources, 14 known and 2 unknown, appear in the Western Sub-region sample. Table 6.3 lists the sources appearing in the early and later artifact samples.

By far, most (nearly 92 percent) of the pre-6,000 B.P. point sample was collected from sites on the northeast remnant Pleistocene shorelines of Owens Lake. The other early points were recovered from sites or as isolates on the floor of Deep Springs Valley, primarily around the lake margin. The 337 artifacts in the post-6,000 B.P. sample include 326 points, 6 knives, 4 drills, and 1 flake tool. Nearly 38 percent of the later sample was collected from the Waucoba Spring Site (CA-INY-441), about 30 percent is from Deep Springs Valley and surrounding watershed, and approximately 12 percent is from southern Owens Valley. Projectile points from sites in Death Valley and vicinity make up slightly more than 20 percent of the later sample.

The Obsidian Butte Volcanic Center source appears in both the early and later artifact samples but in significantly smaller percentages than in the Central Sub-region and Northern Sub-region samples. Only one Pinto point collected from Deep Springs Valley in the early point sample and 7 percent of the points in the later sample, mostly collected from Sarcobatus Flat and the Grapevine Mountains area of DVNP, were manufactured from Obsidian Butte glass. This is surprising because secondary deposits of Obsidian Butte nodules have been found on Sarcobatus Flat, situated on the eastern border of the Western Sub-region. Also, the Obsidian Butte Volcanic Center source is closer to Deep Springs Valley (90 km) and Owens Valley (125 km) than the Mount Jefferson Natural Research Area (190 km) where the source appears in higher percentages. The low percentage of Obsidian Butte obsidian points in the Western Sub-region sample may be because of the presence of more high-quality obsidian toolstone sources in the region, topographic restrictions, cultural restrictions, differences in cultural interrelationships, or a combination of any or all of these variables.

In contrast to the Central Sub-region sample but similar to the Northern Sub-region sample, the Western Sub-region pre-6,000 B.P. point sample shows less diversity in sources than the later artifact sample. Eight known sources and 2 sources of unknown geologic provenance occur in the early point sample, and 13 known sources occur in the post-6,000 B.P. Western Sub-region artifact sample. Sources appearing in the early point sample but not in the later sample include Mt. Hicks, Unknown Type F, and

Table 6.3. Pre-6,000 B.P. and post-6,000 B.P. obsidian point source use in the Western Sub-region.

Pre-6,000 B.P. Sample			**Post-6,000 B.P. Sample**		
Obsidian Source	No. of artifacts	% of sample	Obsidian Source	No. of artifacts	% of sample
Coso Volcanic Field, Calif.	30	41.1	Coso Volcanic Field, Calif.	53	15.7
Saline Range, Calif. (Varieties 1,2,3)	15	20.5	Saline Range, Calif. (Varieties 1,2)	153	45.4
Fish Springs, Calif.	12	16.4	Fish Springs, Calif.	46	13.6
Casa Diablo, Calif.	8	10.9	Casa Diablo, Calif.	18	5.3
Queen–Truman Meadows, Calif.-Nevada	3	4.1	Queen–Truman Meadows, Calif.-Nevada	12	3.6
Obsidian Butte Volcanic Center, Nevada (Variety 5)	1	1.4	Obsidian Butte Volcanic Center, Nevada (Varieties 2,3,4,5)	24	7.1
Montezuma Range, Nevada	1	1.4	Montezuma Range, Nevada	6	1.8
Shoshone Mountain, Nevada	0	0.0	Shoshone Mountain, Nevada	12	3.6
Mt. Hicks, Nevada	1	1.4	Mt. Hicks, Nevada	0	0.0
Mono Glass Mountain, Calif.	0	0.0	Mono Glass Mountain, Calif.	4	1.2
Silverpeak–Fish Lake Valley, Nevada	0	0.0	Silverpeak–Fish Lake Valley, Nevada	3	0.9
Oak Spring Butte, Nevada	0	0.0	Oak Spring Butte, Nevada	2	0.6
Tempiute Mountain, Nevada	0	0.0	Tempiute Mountain, Nevada	2	0.6
Wildhorse Canyon, Utah	0	0.0	Wildhorse Canyon, Utah	2	0.6
Unknown Type F	1	1.4	Unknown Type F	0	0.0
Unknown 16	1	1.4	Unknown 16	0	0.0
Total	n=73	100.0		n=337	100.0

Unknown 16. Sources absent in the early sample but present in the later sample are Shoshone Mountain, Mono Glass Mountain, Silverpeak-Fish Lake Valley, Oak Spring Butte, Tempiute Mountain, and Wildhorse Canyon.

Nearly 90 percent of the pre-6,000 B.P. sample is from four sources. In order from highest to lower percentages of occurrence, these are Coso Volcanic Field, Saline Range, Fish Springs, and Casa Diablo. In contrast, these sources compose less than 10 percent of the Central Sub-region and about 7 percent of the Northern Sub-region pre-6,000 B.P. samples. Conversely, Central Sub-region pre-6,000 B.P. obsidian points manufactured from the four most common sources—Obsidian Butte Volcanic Field, Montezuma Range, Shoshone Mountain, and Saline Range—make up 23 percent of the Western Sub-region early point sample. The four most frequently used pre-6,000 B.P. sources in the Northern Sub-region—Montezuma Range, Crow Spring, Silverpeak-Fisk Lake Valley, and Queen-Truman Meadows—constitute less than 6 percent of the Western Sub-region early sample. The only significant overlap in used sources among the three regions during the pre-6,000 B.P. interval is the Saline Range source, which composes about 21 percent of the Western Sub-region early sample, 8 percent of the Central Sub-region early sample, and 4 percent of the Northern Sub-region early sample. These data suggest that, with the exception of the Saline Range source, mobility ranges for the Central and Northern Sub-regions did not significantly overlap with the Western Sub-region mobility range during the pre-6,000 B.P. interval.

Interestingly, less than 3 percent of pre-6,000 B.P. points manufactured from obsidian sources in the Central Sub-region are found in the Western Sub-region early sample. Nevertheless, a number of the Central Sub-region sources—which includes Obsidian Butte Volcanic Center, Shoshone Mountain, Montezuma Range, and Goldfield Hills—are closer to the sites where the early points were collected than are the Casa Diablo and Queen-Truman Meadows sources, which dominate the Western Sub-region sample. Furthermore, several other sources that include South Kawich

Range and Oak Spring Butte are closer to the sites than is the Mt. Hicks source. These data suggest that the mobility range of pre-6,000 B.P. populations in the Western Sub-region was oriented northwest-southeast. Although apparently quite narrow compared to the Central Sub-region and Northern Sub-region, the Western Sub-region pre-6,000 B.P. mobility range was approximately 250 km long. It should be noted, however, that most of the early point sample was collected from Owens Valley. Thus, the data are skewed to reflect the pattern for that area and are exclusive of early point sources for other areas in the Western Sub-region, such as Death Valley.

More than 80 percent of the post-6,000 B.P. artifact sample is from four sources. From highest percentage of occurrence to lower, these are the Saline Range, Coso Volcanic Field, Fish Springs, and Obsidian Butte Volcanic Center sources. The high percentage of occurrence of the Saline Range source in the later artifact sample is partly because of sample bias. Nearly half of the late sample is from the Waucoba Spring site, which is approximately 8 km west of a Saline Range source procurement locality, and more than 80 percent of the Waucoba Spring artifacts was manufactured from Saline Range obsidian. Thus, the percentage of occurrence for this source is somewhat inflated in the Western Sub-region post-6,000 B.P. sample.

Unlike the early point sample, the later sample includes sources to the east within the Central Sub-region. In addition to the Obsidian Butte Volcanic Center source, these include Shoshone Mountain, South Kawich Range, Tempiute Mountain, and Oak Spring Butte. With the exception of Mt. Hicks, all of the known Western Sub-region sources occurring in the pre-6,000 B.P. sample are also present in the post-6,000 B.P. sample. These data imply that although the north-south extent of the Western Sub-region mobility range remained relatively constant through time, the east-west boundary expanded significantly to include the mountainous terrain to the east in the later interval. It is interesting to note that Wildhorse Canyon, the easternmost source occurring in both the early and later interval samples in the Central Sub-region and the later interval sample in the Northern Sub-region, also appears in the post-6,000 B.P. Western Sub-region sample.

In summary, the Obsidian Butte Volcanic Field source appears in both the early and later point samples from the Western Sub-region but in lesser percentages than in the Central Sub-region and Northern Sub-region samples. Sources in the pre-6,000 B.P. sample indicate that little overlap in mobility ranges existed between early peoples of the Western Sub-region and the early peoples of the Central and Northern Sub-regions. The mobility range of Western Sub-region early peoples was long—250 km north to south—but narrow from east to west. Despite the geographical proximity of sources to the east, early peoples of the Western Sub-region used sources situated at greater distances to the north and the south. The early sample comprises mostly Owens Valley artifacts, however, and obsidian sources used in other parts of the Western Sub-region are virtually absent in the sample. Thus, the early sample indicates primarily pre-6,000 B.P. Owens Valley obsidian point source use.

The post-6,000 B.P. sample indicates that later peoples of the Western Sub-region used the northernmost and southernmost sources that appear in the early sample—which include Mt. Hicks, Casa Diablo, and Coso Volcanic Field—with much less frequency than earlier peoples. Unlike early peoples of the Western Sub-region, later peoples procured obsidian for point manufacturing from sources to the east that are in the Central Sub-region. Central Sub-region sources appearing in the later Western Sub-region sample include Shoshone Mountain, Oak Spring Butte, and Tempiute Mountain. These data indicate that there was significant overlap in procurement and mobility ranges of later peoples of the Western, Central, and Northern Sub-regions.

Southern Sub-region Sample

The Southern Sub-region sample is small, comprising only 62 obsidian points and 1 drill collected as isolated specimens and from small surface sites widely scattered throughout the region. The sample is unevenly distributed between pre-6,000 and post-6,000 B.P. artifacts. Eleven percent consist of early point types, and the other 89 percent making up the post-6,000 B.P. are primarily Desert series types. Despite the small sample size and lack of diversity in point types, 13 known source areas and 8 sources of unknown geologic provenance are represented in the Southern Sub-region sample. Table 6.4 lists obsidian sources identified in the early and later artifact samples from the Southern Sub-region.

All seven points composing the pre-6,000 B.P. sample were collected during the Campbell expeditions of the early 1930s. Six were retrieved from the Paradise River Valley district, near Fort Irwin, and one was collected from Tule Springs in the north Las Vegas Valley. Three sources appear in the early point Southern Sub-region sample. Five of the early types from Paradise River Valley were manufactured from Coso Volcanic Field glass, and one was made from Mt. Hicks obsidian. The Tule Springs point was manufactured from Kane Springs Wash Caldera, Variety 1 glass. Despite the small sample size, the pre-6,000 B.P. obsidian procurement pattern that emerges with the early points from Paradise River Valley resembles the Western Sub-region early pattern. Coso Volcanic Field and Mt. Hicks are the northernmost and southernmost sources in both samples, which suggests that the Southern Sub-region early peoples' mobility range significantly overlapped that of the early peoples of the Western Sub-region (i.e., Owens Valley). The distance from south to north is even greater for the Southern Sub-region, however, because the Mt. Hicks source lies approximately 350 km north of the Paradise River Valley. The Kane Springs Wash Caldera source is about 100 km northeast of Tule Springs.

The source profile for the post-6,000 B.P. sample of 57 points is diverse, with 15 chemically distinct glass types from 13 known source areas and 8 unknowns represented. The Obsidian Butte Volcanic Center source occurs in the later point sample, but with slightly less frequency than in the Western Sub-region post-6,000 B.P. sample. Most of the later points manufactured from the Obsidian Butte Volcanic Center glass were retrieved from sites in Ash Meadows, about 130 km south of the source.

Post-6,000 B.P. obsidian points manufactured from the Devil Peak source occur with the highest frequency in the Southern Sub-region

Table 6.4. Pre-6,000 B.P. and post-6,000 B.P. obsidian point source use in the Southern Sub-region

Pre-6,000 B.P. Sample			**Post-6,000 B.P. Sample**		
Obsidian Source	No. of artifacts	% of sample	Obsidian Source	No. of artifacts	% of sample
Coso Volcanic Field, Calif.	5	71.4	Coso Volcanic Field, Calif.	5	8.8
Devil Peak, Nevada	0	0.0	Devil Peak, Nevada	13	22.8
Bristol Mountain, Calif.	0	0.0	Bristol Mountain, Calif.	5	8.8
Shoshone Mountain, Nevada	0	0.0	Shoshone Mountain, Nevada	8	14.0
Obsidian Butte, Calif.	0	0.0	Obsidian Butte, Calif.	4	7.0
Obsidian Butte Volcanic Center, Nevada	0	0.0	Obsidian Butte Volcanic Center, Nevada (Varieties	3	5.3
Oak Spring Butte, Nevada	0	0.0	Oak Spring Butte, Nevada	2	3.5
Kane Spring Wash Caldera, Nevada (Variety 1)	1	14.3	Kane Spring Wash Caldera, Nevada (Variety 1)	1	<1.8
Mt. Hicks, Nevada	1	14.3	Mt. Hicks, Nevada	1	<1.8
Montezuma Range, Nevada	0	0.0	Montezuma Range, Nevada	1	<1.8
Hackberry Mountain, Calif.	0	0.0	Hackberry Mountain, Calif.	1	<1.8
Big Southern Butte, Idaho	0	0.0	Big Southern Butte, Idaho	1	<1.8
Cerro del Medio, New Mexico	0	0.0	Cerro del Medio, New Mexico	2	3.5
Unknown 1	0	0.0	Unknown 1	1	<1.8
Unknown 5	0	0.0	Unknown 5	1	<1.8
Unknown 8	0	0.0	Unknown 8	1	<1.8
Unknown 9	0	0.0	Unknown 9	1	<1.8
Unknown 10	0	0.0	Unknown 10	1	<1.8
Unknown 12	0	0.0	Unknown 12	2	3.5
Unknown 13	0	0.0	Unknown 13	1	<1.8
Unknown 16	0	0.0	Unknown 16	1	<1.8
Total	n=7	100.0		n=56	100.0

sample. Most of these points were retrieved from Mesquite Valley, which lies to the west of the Devil Peak source of the southern Spring Mountains on the Nevada-California border. The Shoshone Mountain source of the Central Sub-region appears in second highest frequency. This source occurs in points collected from Ash Meadows and Mesquite Valley. The Coso Volcanic Field source of the Western Sub-region and the Bristol Mountains source of the Southern Sub-region occur in next highest frequencies, mostly in points collected from sites in Mesquite Valley and the Panamint Range. The Oak Spring Butte source of the Central Sub-region appears as a source of points from sites in Ash Meadows and the Panamint Range.

A remarkably different obsidian procurement pattern emerges in points collected from the southernmost sites of the Southern Sub-region sample, most of which are in Joshua Tree National Park and near Mojave River Wash. Sources used to manufacture points from that area are extremely diverse and widespread, suggesting that the mobility range of later peoples of that area encompassed five western states. None of these sources occur in the Central, Northern, and Western Sub-region samples. The southernmost source is Obsidian Butte, California, which is the source nearest the area. Prehistoric peoples did not procure the Obsidian Butte, California, source at the eastern margin of the Salton Sea until after A.D. 1650 (Byrd 1998; Hughes 1994a).

The northernmost source is Big Southern Butte, Idaho, followed by the Mt. Hicks, Nevada, source. The source farthest east is Cerro Del Medio, New Mexico, which is the source of 2 of the 10 points presumably collected from the southernmost Southern Sub-region sites. It should be noted, however, that the Campbells collected all of the obsidian points manufactured from the extraordinarily distant sources in the 1930s. The collections and records have been moved from their original locations over the ensuing seven decades, and thus, it is quite possible that provenance information was misfiled or the artifacts mislabeled during the long period. XRF analysis of a larger sample of obsidian artifacts collected from the Joshua Tree National Park area would resolve this issue.

In summary, the Southern Sub-region sample is small and unevenly distributed over time and space. Nevertheless, several sources occur in the sample. The mobility ranges of the pre-6,000 B.P. peoples completely overlaps the mobility range of Western Sub-region early peoples. The Obsidian Butte Volcanic Center source is not represented in the early point sample but appears in the later point sample. Ash Meadows appears to be the area farthest south in which Central Sub-region sources were used to manufacture points. Sources of post-6,000 B.P. obsidian points in the southernmost Southern Sub-region indicate that procurement patterns of this area did not overlap with the Central, Northern, or Western Sub-region procurement patterns.

Eastern Sub-region Sample

Comprising 736 artifacts, the sample from the Eastern Sub-region makes up 45 percent of the entire project sample. Most artifacts (99 percent) were excavated from deposits in 3 rockshelters and 8 Fremont culture village sites. The rockshelters are Conaway Shelter, O'Malley Shelter, and Pine Park Shelter. Fremont village sites include Evans Mound, Median Village, Sevier Lake, Kanosh, Pharo Village, Garrison Site, Paragonah Mounds, and Marysvale. Most of the Eastern Sub-region sample (72 percent) comprises obsidian artifacts retrieved from deposits in O'Malley Shelter near Caliente, Nevada, and Evans Mound near Cedar City, Utah. Except for 7 points excavated from the earliest stratum in O'Malley Shelter, all are assigned to the post-6,000, comprising 736 artifacts, interval group. Thus, source data cannot adequately address change or continuity in obsidian procurement and use patterns for the Eastern Sub-region. Despite the lack of pre-6000 B.P. artifacts, 10 known and 7 geographically unknown sources occur in the Eastern Sub-region sample. These are listed in Table 6.5.

Only one artifact, recovered from O'Malley Shelter in a post-A.D. 1080 context, was manufactured from the Obsidian Butte Volcanic source of the Central Sub-region. The Oak Spring Butte and Tempiute Mountain sources of the Central Sub-region occur with the same frequency and in the similar contexts. One point from O'Malley Shelter was manufactured Oak Spring Butte obsidian, and one point from Pine Park Shelter—about 20 km east of O'Malley Shelter—was manufactured from Tempiute Mountain glass. These data indicate that the

Table 6.5. Comparison of pre-6,000 B.P. and post-6,000 B.P. obsidian source use in the Eastern Sub-region

Pre-6,000 B.P. Sample			Post-6,000 B.P. Sample		
Obsidian Source	No. of artifacts	% of sample	Obsidian Source	No. of artifacts	% of sample
Panaca Summit–Modena Area, Nevada-Utah	3	42.8	Panaca Summit–Modena Area, Nevada-Utah	299	41.0
Wildhorse Canyon, Utah	0	0.0	Wildhorse Canyon,Utah	171	23.5
Pumice Hole Mine, Utah	0	0.0	Pumice Hole Mine,Utah	7	1.0
Kane Springs Wash Caldera, Nevada (Variety 1)	0	0.0	Kane Springs Wash Caldera, Nevada (Varieties 1&2)	71	9.7
Black Rock Area, Utah	0	0.0	Black Rock Area, Utah	60	8.2
Black Mountain, Utah	0	0.0	Black Mountain, Utah	5	0.7
Topaz Mountain, Utah	0	0.0	Topaz Mountain, Utah	2	0.3
Obsidian Butte Volcanic Center, Nevada	0	0.0	Obsidian Butte Volcanic Center, Nevada (Variety 5)	1	0.1
Oak Spring Butte, Nevada	0	0.0	Oak Spring Butte, Nevada	1	0.1
Tempiute Mountain, Nevada	0	0.0	Tempiute Mountain, Nevada	1	0.1
South Pahroc, Nevada	0	0.0	South Pahroc, Nevada	1	0.1
Unknown Type A	0	0.0	Unknown Type A	5	0.7
Unknown Type B	2	28.6	Unknown Type B	25	3.4
Unknown Type C	2	28.6	Unknown Type C	50	6.9
Unknown Type D	0	0.0	Unknown Type D	13	1.9
Unknown Type E	0	0.0	Unknown Type E	15	2.1
Unknown 4	0	0.0	Unknown 4	1	0.1
Unknown 15	0	0.0	Unknown 15	1	0.1
Total	n=7	100.0		n=729	100.0

procurement pattern of the Eastern Sub-region did not significantly overlap that of the Central Sub-region. In fact, XRF analysis results for the remaining sample indicate that post-6,000 B.P. Eastern Sub-region obsidian procurement was highly localized, with little overlap with any of the other sub-regions.

The most-heavily used Eastern Sub-region source was Panaca Summit-Modena Area, constituting 43 percent of the pre-6,000 B.P. sample and 41 percent of the post-6,000 B.P. sample. Most interesting is that unlike the most frequently used sources in all other sub-regions, this source does not appear in any of the other sub-region samples. These data indicate that conveyance of Panaca Summit-Modena Area obsidian was to the northeast, east, and southeast. Wildhorse Canyon was the second most frequently used source, appearing as the source of about 24 percent of the post-6,000 B.P. artifacts. Wildhorse Canyon obsidian also appears in the Central, Northern, and Western Sub-region samples but in minor frequencies like the frequency of Central Sub-region sources in the Eastern Sub-region sample. The Kane Springs Wash Caldera source, which appears in negligible amounts in the Central and Southern Sub-region samples, composes 10 percent of the Eastern Sub-region sample. About 8 percent of the artifacts were manufactured from Black Rock Area obsidian. This source appears in the Northern Sub-region sample. The Eastern Sub-region obsidian procurement area measures about 230 km north-south by 175 km east-west.

All of the known Eastern Sub-region sources have been previously identified in archaeological assemblages from sites in eastern Nevada and western Utah (Hughes 1994a), so their presence in the Eastern Sub-region sample comes as no surprise. What is surprising, however, is the high frequency of occurrence in sources of unknown geological provenance. In all other sub-region samples, unknown sources generally occur in minimal frequencies. In the Eastern Sub-region, however, unknown sources make up almost 16 percent of the entire sample.

Unknown Type C was apparently a relatively heavily used source, composing 29 percent of the small pre-6,000 B.P. sample and 7 percent of the post-6,000 B.P. artifact sample. Unknown Type B is also somewhat common, appearing as the source of about 29 percent of the early points and a little more than 3 percent of later artifacts. Unknown Types A, B, C, D, and E occur in greatest frequencies in the Conaway Shelter, O'Malley Shelter, and Pine Park Shelter collections and somewhat less frequently in the Evans Mound collection. These data indicate that there is a comparatively sizeable gap in knowledge of the obsidian resource base of Eastern Sub-region prehistoric peoples. Unknown Types A through E are probably somewhere in the border area of southeastern Nevada, between Caliente and Mesquite, and the southwestern corner of Utah, south of Modena. Great Basin archaeologists interested in obsidian studies of the region should concentrate future research to locate unknown obsidian sources in that area.

To summarize, Obsidian Butte Volcanic Center comprises less than 1 percent of the Eastern Sub-region sample. The near absence of obsidian artifacts manufactured from obsidian sources in any of the other sub-regions indicates that the obsidian procurement and conveyance systems of Eastern Sub-region peoples was highly localized and did not significantly overlap with any of the other sub-regions. Panaca Summit-Modena Area appears to have been the most highly used Eastern Sub-region source through time, but none of this obsidian was conveyed to the west. A comparatively high percentage of geographically unknown obsidian sources appear in the sample, indicating that knowledge of the Eastern Sub-region obsidian resource base is less complete than is the case with the other sub-regions.

CONCLUSIONS

The primary purpose of this research is to determine the diachronic significance of the Obsidian Butte Volcanic Center source in the Great Basin. The secondary research purpose is to determine the diachronic significance of other study area sources compared to the Obsidian Butte Volcanic Center source. These are Shoshone Mountain, Oak Spring Butte, Tempiute Mountain, South Kawich Range, and Goldfield Hills. It is assumed that the further the distance that artifacts that were manufactured from the source are found, the higher the value that prehistoric peoples placed on the source. If artifacts are found in regions in which other high-quality obsidian is available, then the source is considered to have a higher-than-normal level of importance.

Obsidian Butte Volcanic Center is the only source in the entire 1,644 artifact sample, collected from a Great Basin-Mojave Desert sites in an area measuring 600 km north-south by 565 km east-west, that appears in all of the sub-region obsidian samples. In the Central Sub-region where the source is found, intensity of source use appears to decrease in the post-6,000 B.P. interval. About 38 percent of the pre-6,000 B.P. points and only 26 percent of the later sample were manufactured from Obsidian Butte Volcanic Center glass. This is in contrast to all of the other sub-regions samples in which use of the Obsidian Butte Volcanic Center source increased through time. In the Northern Sub-region where other obsidian sources are relatively scarce, 7 percent of the early sample and 14 percent of the later sample were manufactured from Obsidian Butte Volcanic Center obsidian. Although the Northern Sub-region is the greatest distance from the Obsidian Butte source—more than 150 km—artifacts manufactured from the glass compose the greatest percentages of a sub-region sample outside of the Central sub-region in which the source is found.

In the Western Sub-region where numerous sources of high-quality obsidian toolstone sources are found, 1 percent of early points and 7 percent of later points were manufactured from Obsidian Butte Volcanic Center glass. In the relatively obsidian-poor Southern Sub-region, no early points were manufactured from Obsidian Butte obsidian, but the source occurs in 5 percent of the later point sample. Even in the Eastern Sub-region where obsidian procurement was highly localized, the Obsidian Butte Volcanic Center source appears in the later point sample. These data indicate that prehistoric peoples throughout the broad region considered Obsidian Butte Volcanic Center a highly significant source of toolstone for manufacturing projectile points, especially after 6,000 B.P. Figure 6.11 compares percentages of occurrence of Obsidian Butte Volcanic Center obsidian in all sub-regions for the pre-6,000 B.P. and post-6,000 B.P. intervals.

The Wildhorse Canyon source of the Eastern Sub-region was the Great Basin source in

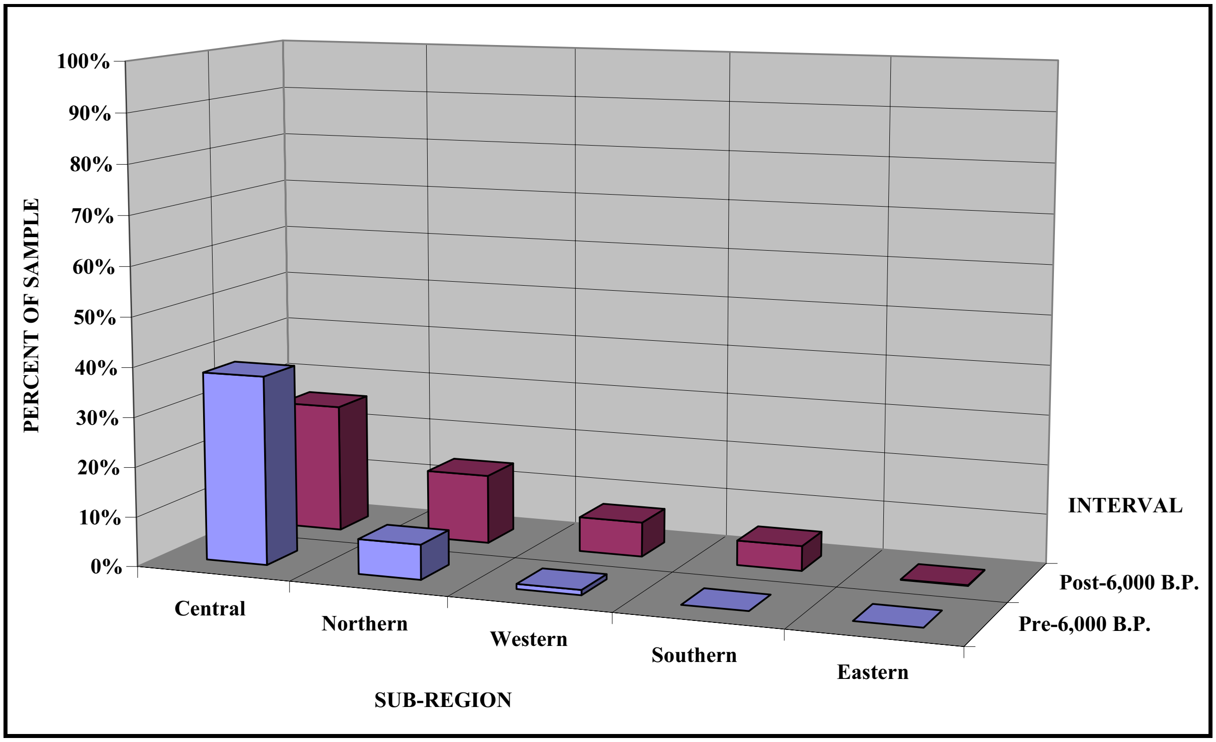


Figure 6.11. Obsidian Butte Volcanic Center source occurrence percentages in the sub-region samples.

the 600 km north-south by 565 km east-west macro-region that people conveyed over the greatest distance, at least 475 km to the west. In contrast, data indicate that prehistoric peoples conveyed Obsidian Butte Volcanic Center obsidian in all directions through a region measuring roughly 300 km north-south by 325 km east-west. In addition, Obsidian Butte source artifacts occur in all sub-region samples in higher percentages than the Wildhorse Canyon source, especially during the post-6,000 B.P. interval.

Although Obsidian Butte Volcanic Center obsidian was not conveyed over the greatest linear distance, it was conveyed with greater frequency over more acreage than any other obsidian source appearing in the 1,644-artifact sample. Based on these data, Obsidian Butte Volcanic Center glass was the most significant source to the prehistoric peoples of the Great Basin-Mojave Desert macro-region under study. Figure 6.12 outlines the approximate boundaries of the Obsidian Butte Volcanic Center source conveyance range.

The Shoshone Mountain source of the study area occurred in second-highest frequency in the artifact sample. Within the Central Sub-region, Shoshone Mountain obsidian was used to manufacture 9 percent of the early points and 26 percent of later artifacts, equaling the frequency of the Obsidian Butte source use for the latter interval. The Shoshone Mountain source appears in fewer sub-region samples, however, and in relatively low frequencies. The only sub-region peoples that appear to have acquired Shoshone Mountain source artifacts in significant amounts are the post-6,000 B.P. peoples of the Southern Sub-region. The Shoshone Mountain source is absent in the early sample but makes up 14 percent of the later sample. The Shoshone Mountain source is completely absent in the Northern and Eastern Sub-region samples and present only in the later interval sample of the Western Sub-region. These data indicate that the Shoshone Mountain source was less significant to the prehistoric peoples of the greater Great Basin-Mojave Desert region but was more significant than the Obsidian Butte source in the Southern Sub-region. Figure 6.13 shows the distribution of the Shoshone Mountain source in the sub-region samples.

The Tempiute Mountain source occurs in next highest frequency in the Central Sub-region sample, composing 5 percent of the early sample and 13 percent of the later sample. The source occurs in equal percentage as the

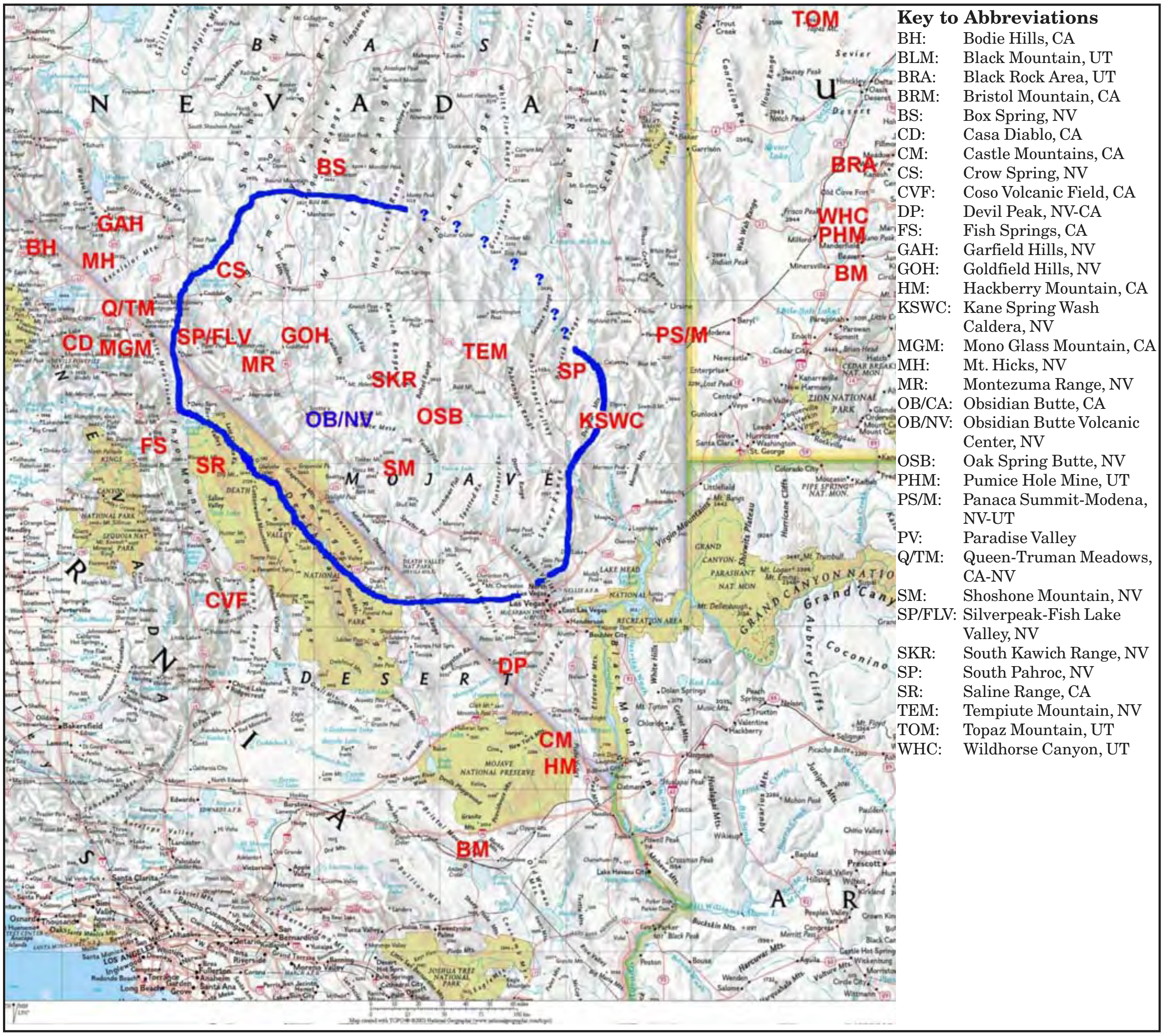


Figure 6.12. Boundaries of the Obsidian Butte Volcanic Center source conveyance range.

Obsidian Butte Volcanic Center source in the Eastern Sub-region sample but occurs in lower percentages in the Northern and Western Sub-region samples. Tempiute Mountain is completely absent in the Southern Sub-region sample. In the Northern and Western Sub-regions, Tempiute Mountain is the source of only 1 percent of later interval artifacts. Thus, although Tempiute Mountain obsidian was as significant as Obsidian Butte Volcanic Center obsidian, it was considerably less used in the Northern, Western, and Southern Sub-regions. Figure 6.14 shows the Tempiute Mountain source percentages of occurrence in the sub-region samples.

The Oak Spring Butte source was of roughly equal significance to the prehistoric Great Basin peoples of the region as the Tempiute Mountain source. Although only 3 percent of the pre-6,000 B.P. Central Sub-region artifacts was manufactured from Oak Springs Butte glass, the source was used to manufacture 13 percent of the later artifacts. Oak Spring Butte glass was as significant as Obsidian Butte obsidian in the Eastern Sub-region. The source was less used in the Northern Sub-region than Tempiute

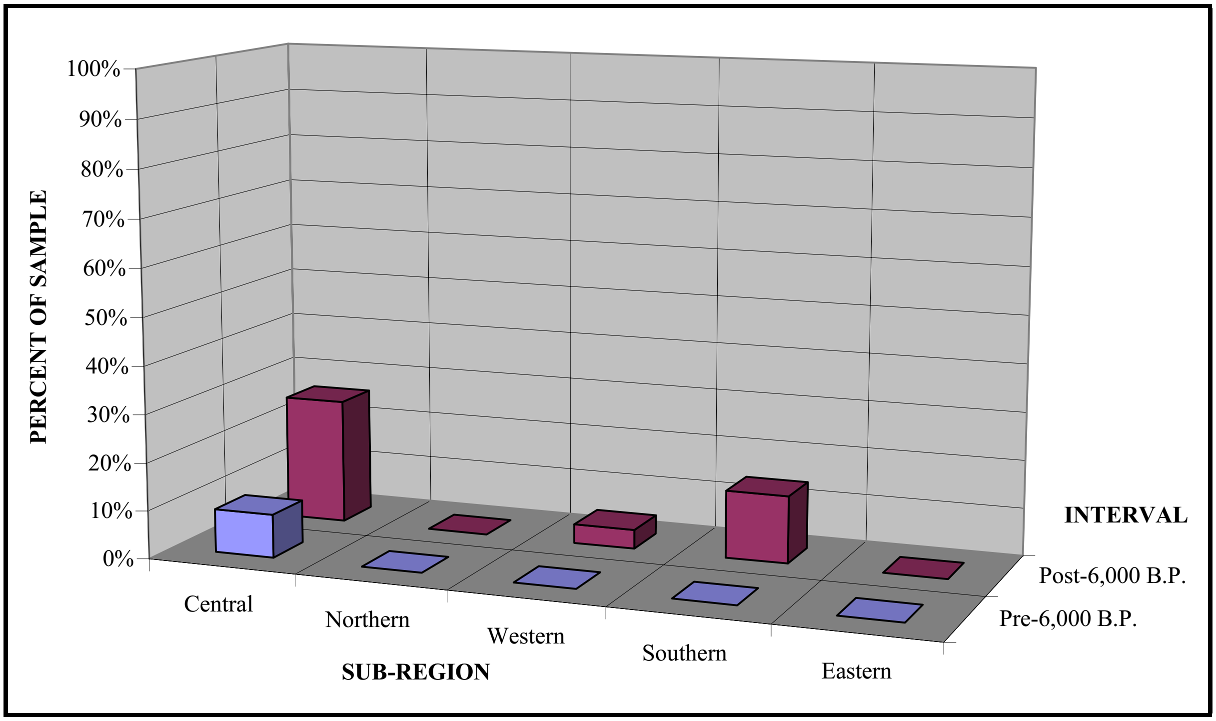


Figure 6.13. Shoshone Mountain Source occurrence percentages in the sub-region samples.

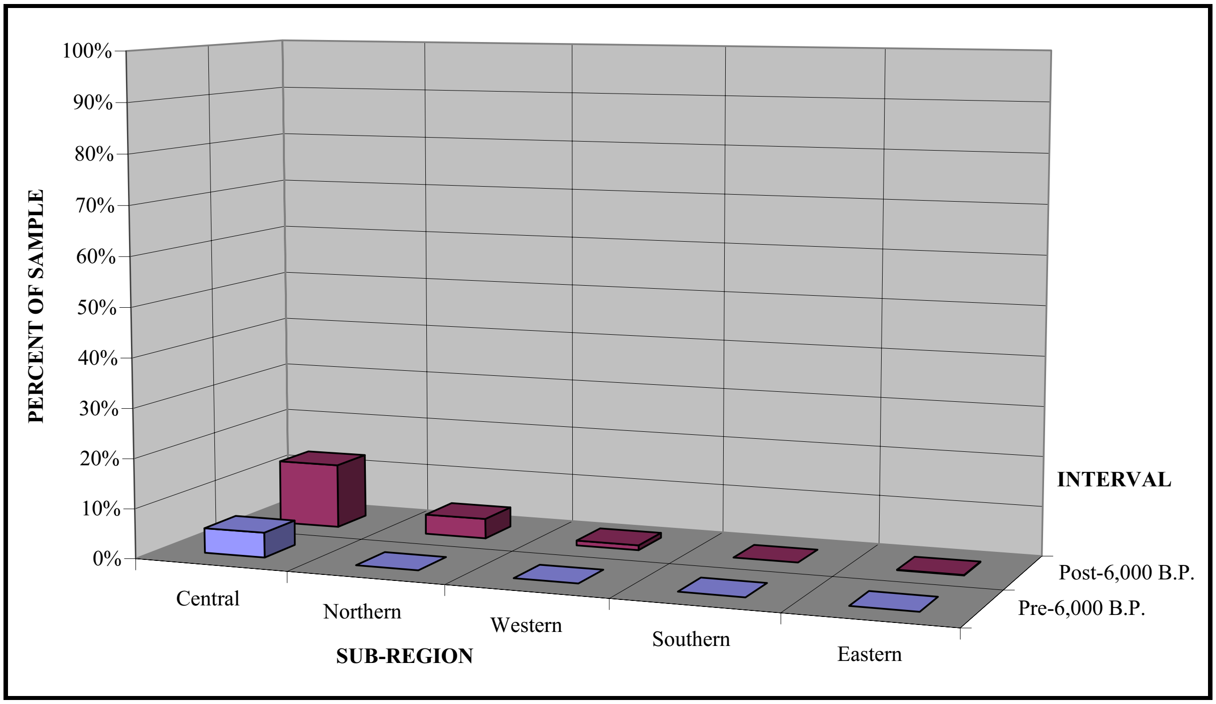


Figure 6.14. Tempaiute Mountain source occurrence percentages in the sub-region samples.

Mountain obsidian, occurring in only 1 percent of the sample.

In the Southern Sub-region sample, however, where Tempiute Mountain obsidian is absent, Oak Spring Butte glass was used to manufacture 4 percent of the sample. The occurrence patterns of the Tempiute Mountain and Oak Spring Butte sources appear to be a function of proximity. The Tempiute Mountain source is closer to the Northern Sub-region and, thus, was more frequently used by prehistoric peoples of that sub-region. Oak Spring Butte source is closer to the Southern Sub-region and, therefore, appears in that sample ,but the Tempiute source is absent. Figure 6.15 compares percentages of occurrence of Oak Spring Butte source in all sub-regions for the pre-6,000 B.P. and post-6,000 B.P. intervals.

It is apparent that prehistoric use of the South Kawich Range and Goldfield Hills sources for manufacturing projectile points through Great Basin time and space was insignificant. Only 1 percent of early points in the Central Sub-region sample were manufactured from Goldfield Hills obsidian, and only 2 percent of Central Sub-region later points were manufactured from South Kawich Range glass. The two sources do not appear in any other sub-region's sample. Compared to Obsidian Butte Volcanic Center source use and to most other Great Basin obsidian sources, prehistoric use of the South Kawich Range and Goldfield Hills sources for manufacturing projectile point was insignificant.

In summary, Obsidian Butte Volcanic Center was the most significant source in the 600 km north-south by 565 km east-west Great Basin-Mojave Desert macro-region from which the 1,644 obsidian artifacts were collected. Obsidian Butte glass was the most heavily used projectile point source through time in the Central Sub-region. Although Wildhorse Canyon obsidian was conveyed over greater distance to the west, Obsidian Butte Volcanic Center glass was conveyed in all directions over great distances and with greater frequency than any other source in the Great Basin-Mojave Desert region under study. Prehistoric peoples occupying both obsidian-rich and obsidian-poor areas up to 150 km away used the source to manufacture points in relatively significant amounts. Use of the Obsidian Butte Volcanic Center source was more frequent in obsidian-poor sub-regions.

Prehistoric peoples occupying the Great

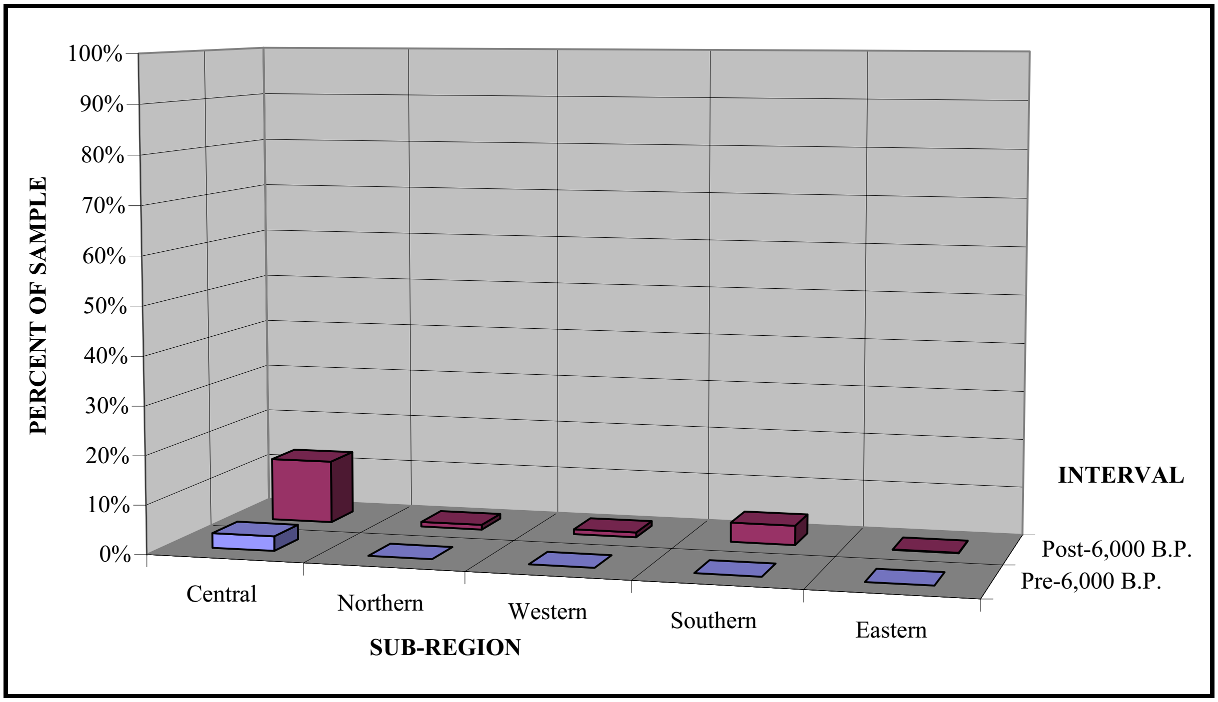


Figure 6.15. Oak Spring Butte source occurrence percentages in the sub-region samples.

Basin-Mojave Desert region used other study area obsidian sources to manufacture points but in lesser amounts than the Obsidian Butte Volcanic Center source. The Shoshone Mountain source was frequently used to manufacture later points in the Central Sub-region, but use of the source in other Great Basin sub-regions was minimal to nonexistent. The Tempiute Mountain and Oak Spring Butte sources were used even less. Use of the South Kawich Range and Goldfield Hills sources was negligible in the Central Sub-region and did not occur in any of the other sub-regions. These data emphasize that prehistoric peoples placed high value on obsidian toolstone from the Obsidian Butte Volcanic Center.

REFERENCES CITED

Arkush, B. S., and B. L. Pitblado
2000 Paleoarchaic Surface Assemblages in the Great Salt Lake Desert, Northwestern Utah. *Journal of California and Great Basin Anthropology* 22(1):12–42.

Bacon, C. R., R. Macdonald, R. L. Smith, and P. A. Baedecker
1981 Pleistocene High-silica Rhyolites of the Coso Volcanic Field, Inyo County, California. *Journal of Geophysical Research*, 86(B11):10223–1014.

Bailey, R. A., G. B. Dalrymple, and M. A. Lanphere
1976 Volcanism, Structure, and Geochcronology of the Long Valley Caldera, Mono County, California. *Journal of Geophysical Research* 81(B5):725–744.

Basgall, M. E.
1989 Obsidian Acquisition and Use in Prehistoric Central Eastern California: A Preliminary Assessment. In Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 111–126. *Contributions of the University of California Archaeological Research Facility* Number 48. Berkeley.

Basgall, M. E., and K. R. McGuire
1988 The Archaeology of CA-INY-30: Prehistoric Culture Change in the Southern Owens Valley, California. Far Western Anthropological Research Group. Report on file with the California Department of Transportation, Sacramento.

Bieling, D. G.
1992 Perspectives on Behavior Gained from Lithic Analysis and Archaeological Investigations near Bridgeport, Mono County, California. M.A. thesis, Sonoma State University.

Bouey, P. D., and M. E. Basgall
1984 Trans-Sierran Exchange in Prehistoric California: The Concept of Economic Articulation. In Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 135–172. *Contributions of the University of California Archaeological Research Facility* No. 45. Berkeley.

Buck, P. E., W. T. Hartwell, G. Haynes, and D. Rhode
1998 Archaeological Investigations at Two Early Holocene Sites Near Yucca Mountain, Nye County, Nevada. *Topics in Yucca Mountain Archaeology* Number 2.

Dames and Moore, Inc.
1994 Obsidian Studies. In Kern River Pipeline Cultural Resources Data Recovery Report: Utah, Volume 1, Research Context and Data Analysis, pp 7.1–7.64.

Davis, E. L.
1965 An Ethnography of the Kuzedika Paiute of Mono County, California. *University of Utah Anthropological Papers* 75:1–55.

Duffield, W. A., and C. R. Bacon
1981 Geologic Map of the Coso Volcanic Field and Adjacent Areas, Inyo County, California. *U.S. Geological Survey Miscellaneous Investigations Map* 1-1200.

Duffield, W. A., C. R. Bacon, and G. B. Dalrymple
1980 Late Cenozoic Volcanism, Geochronology, and Structure of the Coso Range, Inyo County, California. In Geothermal Investigations in the Coso Range, California. *Journal of Geophysical Research* 85(5):2381–2404.

Eerkens, J. W., and M. D. Glascock
2000 Northern Fish Lake Valley and the Volcanic Tablelands of Owens Valley: Two Minor Sources of Obsidian in the Western Great Basin. *Journal of California and Great Basin Anthropology* 22(2):331–342.

Eerkens, J. W., and J. S. Rosenthal
2004 Are Obsidian Subsources Meaningful Units of Analysis?: Temporal and Spatial Patterning of Subsources in the Coso Volcanic Field, Southern California. *Journal of Archaeological Science* 31:21–29.

Elston, R. G., and C. D. Zeier
1984 The Sugarloaf Obsidian Quarry. Naval Weapons Center Administrative Publication 313, China Lake, California.

Ericson, J. E.
1981 Exchange and Production Systems in California Prehistory: The Results of Hydration Dating and Chemical Characterization of Obsidian Sources. *British Archaeological Reports, International Series* 110. Oxford, England.

1982 Production for Obsidian Exchange in California. In *Contexts for Prehistoric Exchange*, edited by J. E. Ericson and T. K. Earle, pp. 129–148. Academic Press, New York.

Ericson, J. E., T. A. Hagan, and C. W. Chesterman
1976 Prehistoric Obsidian in California, II: Geologic and Geographic Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R. E. Taylor, pp. 218–239. Noyes Press, Park Ridge, New Jersey.

Ernst, P., L. Johnson, and S. Crowley
1975 BLM California Desert Project Archaeological Site Record for CA-INY-1975. On file at the Eastern Information Center, University of California-Riverside.

Farmer, M.
1937 An Obsidian Quarry Near Coso Hot Springs. *The Masterkey* 11:7–10.

Gilbert, C. M., M. N. Christensen, Y. Al-Rawi, and K. R. Lajoie
1968 Structural and Volcanic History of Mono Basin, California-Nevada. In Studies in Volcanology: A Memoir in Honor of Howel Williams, edited by R. R. Coates, R. L. Hay, and C. A. Anderson, pp. 275–329. *Geological Society of America Memoirs* 116.

Gilreath, A. J., and W. R. Hildebrandt
1997 Prehistoric Use of the Coso Volcanic Field. *Contributions of the University of California Archaeological Research Facility* 56. Berkeley.

Haarklau, L.
2001 *Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada.* Report No. NAFB 00-04. 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

Hall, M. C.
1983 Late Holocene Hunter-Gatherers and Volcanism in the Long Valley-Mono Basin Region: Prehistoric Culture Change in the Eastern Sierra Nevada. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

Harrington, M. R.
1951 A Colossal Quarry. *The Masterkey* 25(1):15–18.

Heizer, R. F., and A. E. Treganza
1944 Mines and Quarries of the Indians of California. *California Division of Mines and Geology Report* 40.

Hughes, R. E.
1983 X-ray Fluorescence Characterization of Obsidian. In The Archaeology of Monitor Valley: 2. Gatecliff Shelter, by D. H. Thomas, pp. 332–353. *Anthropological Papers of the American Museum of Natural History* 59(1), New York.

1985 Obsidian Source Use at Hidden Cave. In The Archaeology of Hidden Cave, Nevada, by D. H. Thomas, pp. 332–353. *Anthropological Papers of the American Museum of Natural History* Volume 61, Part 1. New York.

1988 The Coso Volcanic Field Re-examined: Implications for Obsidian Sourcing and Hydration Dating Research. *Geoarchaeology* 3(4):253–265.

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

1994b X-ray Fluorescence Analysis of Geologic Obsidian Samples and Artifacts from Kern River Gas Transmission Project, Utah. In Kern River Pipeline Cultural Resources Data Recovery Report: Utah. Volume I, Research Context and Data Analysis. Report submitted by Dames and Moore, Inc. to Kern River Gas Transmission Company, January 31, 1994.

Hughes, R. E., and J. A. Bennyhoff
1986 Early Trade. In *Handbook of North American Indians: Great Basin, Vol.* 11, edited by W. L. d'Azevedo, pp. 238–255. Smithsonian Institution Press. Washington, D. C.

Hughes, R. E., and R. L. Smith

1993 Archaeology, Geology, and Geochemistry in Obsidian Provenance Studies. In Effects of Scale on Archaeological and Geoscientific Perspectives, edited by J. K. Stein and A. R. Linse, pp. 79–91. *Geological Society of America Special Paper* 283.

Jackson, R. J.

1985 An Archaeological Survey of the Wet, Antelope, Railroad, and Ford Timber Sale Compartments in the Inyo National Forest. Report on file, USDA Forest Service, Inyo National Forest, Bishop, California.

Jackson, T. L.

1974 The Economics of Obsidian in Central California Prehistory: Applications of X-Ray Flourescence Spectography in Archaeology, M.A. thesis, San Francisco State University.

1984 A Reassessment of Obsidian Production Analyses for the Bodie Hills and Casa Diablo Quarry Areas. In Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 117–134. *Contributions to the University of California Archaeological Research Facility No.* 45. Berkeley.

Jackson, T. L., and J. E. Ericson

1994 Prehistoric Exchange Systems in California. In *Prehistoric Exchange Systems in North America*, edited by T. G. Baugh and J. E. Ericson, pp. 385–415. Plenum Press, New York.

Jack, R. N.

1976 Prehistoric Obsidian in California 1: Geochemical Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R. E. Taylor, pp. 183–217. Noyes Press. Park Ridge, New Jersey.

Jack, R. N., and I. S. E. Carmichael

1969 The Chemical Fingerprinting of Acid Volcanic Rocks. *California Division of Mines and Geology Special Report* 100: 17–32.

Johnson, L.

2003 Obsidian Studies in Death Valley National Park. Paper presented at the Nellis Air Force Base Native American Interaction Program Annual Meeting, Las Vegas, Nevada, May 8–9, 2003.

2002a Prehistoric Acquisition and Use of Obsidian in Death Valley National Park. Paper presented at the 6th Death Valley Conference on History and Prehistory, Furnace Creek, California, February 7–10, 2002.

2002b Imposter No More: Obsidian Studies in Death Valley National Park. Paper presented at the 28th Great Basin Anthropological Conference, Elko, Nevada, October 10–12, 2002.

Johnson, L., and D. L. Wagner

1998 Obsidian Quarries in the Saline Range, Inyo County, California. Poster presented at the 26th Great Basin Anthropological Conference, Bend, Oregon, October 8–10, 2002.

Johnson, L., D. L. Wagner, and C. E. Skinner

1999a Geochemistry of Archaeological Obsidian Sources in the Saline Range, Death Valley National Park, California. In Proceedings of the Conference on Status of Geologic Research and Mapping in Death Valley National Park, Las Vegas, Nevada, April 9–11. *U.S. Geological Survey Open-File Report* 99-153, pp. 118–120.

1999b An Update on Obsidian Sources in the Saline Range, Inyo County, California. *International Association for Obsidian Studies* Bulletin No. 23, pp. 8–10.

Kolvet, R. C., R. Deis, S. Stornetta, and M. K. Rusco

2000 A Stratified Archaeological Sample of Low Elevation Areas on Nellis Air Force Range, Nevada. 99 Civil Engineering Squadron/ Environmental Flight, Nellis Air Force Base, Nevada.

Lipman, P. W., P. D. Rowley, H. H. Mehnert. S. H. Evans Jr., W. P. Nash, and F. H. Brown

1978 Pleistocene Rhyolite of the Mineral Mountains, Utah-Geothermal and Archaeological Significance. *Journal of Research U.S. Geological Survey* 6(1):133–147.

Macdonald, R., R. L. Smith, and J. E. Thomas

1992 Chemistry of the Subalkalic Silicic Obsidians. *U.S. Geological Survey Professional Paper* 1523. United States Government Printing Office, Washington, D.C.

McCurry, M.
1988 Geology and Petrology of the Woods Mountains Volcanic Center, Southeastern California: Implications for the Genesis of Peralkaline Rhyolite Ash Flow Tuffs. *Journal of Geophysical Research* 93:14835–14855.

McCurry, M., D. R. Lux, and K. L. Mickus
1995 Neogene Structural Evolution of the Woods Mountains Volcanic Center, East Mojave National Scenic Area. *San Bernadino County Museum Association Quarterly* 42(3):75–80.

Meighan, C. W.
1955 Notes on the Archaeology of Mono County, California. *University of California Archaeological Survey Report No.* 28:6–28. Berkeley.

Moore, J.
1995 Great Basin Toolstone Sources, A Progress Report on the NDOT Obsidian XRF Sourcing Project:1994. Report prepared for the Nevada Department of Transportation, Carson City, Nevada.

1997 Great Basin Tool-Stone Sources, Revised Draft. The NDOT Obsidian and Tool-Stone Sourcing Project: 1999 Progress Report prepared for the Nevada Department of Transportation, Carson City, Nevada.

Moratto, M. J.
1972 A Study of Prehistory in the Southern Sierra Nevada Foothills. Unpublished Ph.D. dissertation, University of Oregon, Eugene.

Nelson, F. W. Jr.
1984 X-ray Fluorescence Analysis of Some Western North American Obsidians. In Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 27–62. *Contributions of the University of California Archaeological Research Facility* No. 45.

Nelson, F. W., and R. D. Holmes
1979 Trace Element Analysis of Obsidian Sources and Artifacts from Western Utah. *Antiquities Section Selected Papers* 6(15). Division of State History, Utah State Historical Society.

Norwood, R. H., C. S. Bull, and R. Quinn
1980 A Cultural Resource Overview of the Eureka, Saline, Panamint and Darwin Region, East Central California. Bureau of Land Management.

Norman, L. A. Jr., and R. M. Stewart
1951 Mines and Mineral Resources of Inyo County. *California Journal of Mines and Geology* 47(1):17–223.

Ramos, B. A.
2000 Prehistoric Obsidian Quarry Use and Technological Change in the Western Great Basin: Examining Lithic Procurement at the Truman/Queen Obsidian Source, California and Nevada. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Davis.

Reynolds, L. A.
1997 In the Dwelling Place of a Great Spirit: The Prehistory of the Pinyon-Juniper Woodland of the Inyo-White Mountain Range, Eastern California. Unpublished Ph.D. dissertation, Department of Anthropology, University of Nevada, Reno.

Richman, J., and M. E. Basgall
1998 Spatial and Temporal Variability in Obsidian Use within the western Great Basin: Results from the Analysis of 600 Artifacts from 94 Sites in Inyo and Mono Counties, California. Paper presented at the 26th Great Basin Anthropological Conference, October 8–10, 2002, in Bend, Oregon.

Robinson, P. T.
1972 Petrology of the Potassic Silver Peak Volcanic Center, Western Nevada. *Geological Society of America Bulletin* 83:1693–1708.

Robinson, P. T., E. H. McKee, and R. J. Moiola
1968 Cenozoic Volcanism and Sedimentation, Silver Peak Region, Western Nevada and Adjacent California. In Studies in Volcanology: A Memoir in Honor of Howel Williams, edited by R. R Coats, R. L. Hay, and C. A. Anderson, pp. 577–611. *Geological Society of America Memoir* 116.

Robinson, P. T., J. H. Stewart, R. J. Moiola, and J. P. Albers
1976 Geologic Map of the Rhyolite Ridge Quadrangle, Esmeralda County, Nevada. *U.S.G.S. Geologic Quadrangle Map* GQ-1325.

Rowley, P. D, F. W. Lytle, M. B. Lytle, and K. R. Stever
2002 Geology of the Modena Obsidian Source, Lincoln County, Nevada. Report on file at Bureau of Land Management, Ely Field Office.

Sample, L. L.
1950 *University of California Anthropological Reports* 8.

Sappington, R. L.
1981a A Progress Report on the Obsidian and Vitrophyre Sourcing Project. *Idaho Archaeologist* (4) 4:4–17.

1981b Additional Obsidian and Vitrophyre Source Descriptions from Idaho and Adjacent Areas. *Idaho Archaeologist* (5) 1:4–8.

Shackley, M.S.
1994 Intersource and Intrasource Geochemical Variability in Two New Archaeological Obsidian Sources in the Southern Great Basin: Bristol Mountains, California, and Devil Peak, Nevada. *Journal of California and Great Basin Anthropology* 16(1):118–129.
1995 Sources of Archaeological Obsidian in the Greater American Southwest: An Update and Quantitative Analysis. *American Antiquity* 60(3):531–551.

Singer, C. A., and J. E. Ericson
1977 Quarry Analysis at Bodie Hills, Mono County, California: A Case Study. In Exchange Systems in Prehistory, edited by T. K. Earle and J. E. Ericson, pp.171–188. Academic Press, New York.

Skinner, C. E., and J. J. Thatcher
2000 X-Ray Fluorescence Analysis and Obsidian Hydration Analysis of Artifact Obsidian from the Eureka Dunes Site, Death Valley National Park, Inyo County, California. Northwest Research Obsidian Studies Laboratory Report 2000-27 submitted to J. Burton, Western Archaeological and Conservation Center, Tucson, Arizona.

Steward, J. S.
1933 Ethnography of the Owens Valley Paiute. *University of California Publications in American Archaeology and Ethnology* 33(3):233–350.

Stewart, J. H., P. T. Robinson, J. P. Albers, and D. F. Crowder
1974 Geologic Map of the Piper Peak Quadrangle, Nevada-California. *USGS Geologic Quadrangle Map* GQ-1186.

Stevens, N.
2002 Prehistoric Use of the Alpine Sierra Nevada: Archaeological Investigations at Taboose Pass, Kings Canyon National Park, California. M.A. thesis, California State University, Sacramento.

Thomas, D. H.
1983 The Archaeology of Monitor Valley 2: Gatecliff Shelter. *Anthropological Papers of the American Museum of Natural History* 59(1), New York.

Umshler, D. B.
1975 Source of the Evan's Mound Obsidian. Unpublished M.S Thesis, New Mexico Institute of Mining and Technology, Socorro.

Wagner, D. L., and L. Johnson
2002 Geology of the Saline Range Obsidian Source: Implications for Sampling Strategies. Paper presented at the Annual Meeting of the Geological Society of America, October 27–30, 2002, Denver, Colorado.

Weight, H.
1950 "Volcanic Tears" on the Nevada Desert. *Desert Magazine* 13(11):14–18.

Wilke, P. J., and A. B. Schroth
1988 CA-SBr-5872: A Prehistoric Lithic Raw Material Prospect in the Castle Mountains, San Bernardino County, California. University of California, Riverside Archaeological Research Unit Project No. 931. Report on file at the Archaeological Information Center, San Bernardino County Museum, Redlands.

1989 Lithic Raw Material Prospects in the Mojave Desert, California. *Journal of California and Great Basin Anthropology* 11(2):146–174.

Wilkerson, C. M.
1985 Obsidian in the Black Rock Desert. *Utah Geological Survey Notes* 27(3):1351.

Wright, L. A., C. W. Chesterman, and L. A. Norman Jr.
1954 Occurrence and Use of Nonmetallic Commodities in Southern California. In Geology of Southern California, edited by R. H. Jahns, pp. 59–74. *California Division of Mines and Geology Bulletin* 170.

SUMMARY AND RECOMMENDATIONS

7

Keith Myhrer

SUMMARY

Air Force-sponsored studies must first address mission needs. On the Nevada Test and Training Range (NTTR), the dominating goal for archaeology projects is to increase the efficiency of the mission, which is fighter-pilot training. Ultimately, cultural resources management must address archaeology compliance issues and Native American consultation when targets are being constructed to facilitate training. Although only 5 percent of the NTTR surface is affected by targets, support facilities, and roads, the Air Force works to ensure cultural resources are identified, evaluated, avoided, or undergo mitigation such as data recovery. The 1999 obsidian sourcing project was designed as part of efforts to understand obsidian distribution on Pahute Mesa, Tolicha peak area of NTTR and to test a scientific question—that the Tolicha Peak area possessed many obsidian lithic scatter sites that lack diagnostics and presumably have limited data potential. The proposition argued that research should show similarity for this type-site, thus justifying a reduction in field recording and evaluating, increasing the efficiency of the mission. The research question was substantiated for obsidian lithic scatters that lack diagnostics for the Tolicha Peak area.

Encouraged by the success of the earlier project, in 2000, the Air Force sponsored a much larger study. A second goal for the Air Force cultural resources program is to enhance Native American ethnohistoric and archeological scientific research while addressing mission needs. Four research themes that included point typology and ethnohistoric investigations were proposed, and the results are summarized below.

Research Theme One: Defining the Obsidian Resource Base of the NTTR. The foundation of this research was the analysis of obsidian source materials and artifacts. Archeologists studied geologic maps to conduct aerial reconnaissance by helicopter for eight field days and ground reconnaissance for six field days to identify and collect raw source material from obsidian formations over a project area of 2 million acres that included more than 30 source and procurement localities. The locations of most of the procurement localities were previously unknown. Source materials and artifacts on loan from museums, federal agencies, and universities with collections from the Great Basin were subjected to EDXRF analysis. The data base provided sufficient informatiob to correlate artifacts with locations and to determine that Obsidian Butte, situated on the NTTR, was a significant source.

Research Theme Two: Evaluating Steward's 1930s Field Research. *If Steward's (1997 [1938], 1941) data are accurate, then the obsidian sources that the NTTR peoples used will be accurately predicted*. For many parts of the study area such as the Belted Range on NTTR, Steward's descriptions remain the single information source before archaeological compliance was instituted in the 1980s. The results of the ethnohistoric period obsidian procurement portion of this study positively correlated with Steward's ethnographic research of Basin-Plateau sociopolitical groups. In addition, the study results demonstrated a strong correlation between sources of obsidian artifacts from ethnohistoric period camp assemblages and food procurement areas. Obsidian procurement was deeply embedded in the subsistence systems of the ethnohistoric Great Basin peoples of this region.

Research Theme Three: Obsidian Point Typologies. *If environmental or cultural shifts occurred during the Holocene, then there should be corresponding diachronic changes in access to obsidian sources.* A total of 1,677 obsidian projectile points collected within distances of more than 300 km from NTTR were analyzed using the Thomas (1981) typology. The study did not reveal associations with individual point types and diachronic uses of obsidian sources through time. In contrast, the research indicated that among the post-Mazama types—such as the Elko, Gatecliff, Rosegate, and Desert series points—variability in point morphology increased through time and Great Basin hunters did not abandon use of the post-Mazama types. By 1,000 years ago, Great Basin people were using all of Thomas' (1981) Monitor Valley post-Mazama point types.

Research Theme Four: The Importance of Obsidian Butte and Other NTTR Sources. The Air Force views the mountain as important for strategic purposes. Native Americans see the formation as having important cultural values. The analysis of 1,644 tools was a test of its importance to regional aborigines to collect core material. Results indicated that Obsidian Butte was the most heavily used projectile point source in the Central Sub-region. Although Wildhorse Canyon obsidian was conveyed over greater distance to the west, Obsidian Butte Volcanic Center glass was conveyed in all directions over greater distances than any other source in the Great Basin-Mojave Desert region under study. Prehistoric peoples occupying both obsidian-rich and obsidian-poor areas up to 150 km distant used the source to manufacture points in relatively significant amounts. Use of the Obsidian Butte Volcanic Center source was more frequent in obsidian-poor sub-regions of the Great Basin-Mojave Desert region. These data emphasize that prehistoric peoples placed high value onthe Obsidian Butte Volcanic Center source.

RECOMMENDATIONS

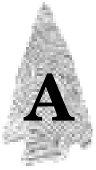
Why was Obsidian Butte one of the most significant obsidian sources in the region? Native Americans state that Obsidian Butte has cultural values for them. Does this mountain possess a different type or weight of value, or do most obsidian sources retain this description? If the butte has values considered more noteworthy in terms of settlement and land use decisions, why? Perhaps the obsidian is of higher quality or easier to access, or is the producing layer relatively thick? Or possibly the cultural values possess an ethereal quality that led users to walk into portions where the better material was prevalent.

Whether Native Americans first perceived cultural values that encouraged procurement of materials at Obsidian Butte over others or whether their view is because rock is of better quality and has a thicker formation, archaeology, geology, and cultural tradition are integral in a future study. A project would involve Native Americans through interviews and field trips to assist in refining research questions. A geologic contribution would define the morphology of the mountain to determine relative values of the rock for toolmaking compared to a sample of regional sources.

CONCLUSION

Although this Air Force-sponsored sourcing project for a 2-million acre region on the NTTR was expected to increase the database generously and address research questions, it is unusual in several aspects. Because of the variety of goals for the other obsidian sourcing studies in which project areas were often not exactly defined, it is difficult to rank by land size. But the NTTR study is arguably among the largest, if not the largest, in the world in terms of the size of the land base. The NTTR project also reflects analysis of the largest number of artifacts (1,644) and collections (34) from Great Basin and Eastern California archaeological sites for one project.

Rather than restricting research within the land owned by the federal funding institution, the analysis crossed several federal and state boundaries, treating archaeological data within a regional context. The size and scope of this project, and the autonomy to cross-institutional boundaries, was a result of the Air Combat Command, Air Force philosophy to conduct research with a holistic orientation.



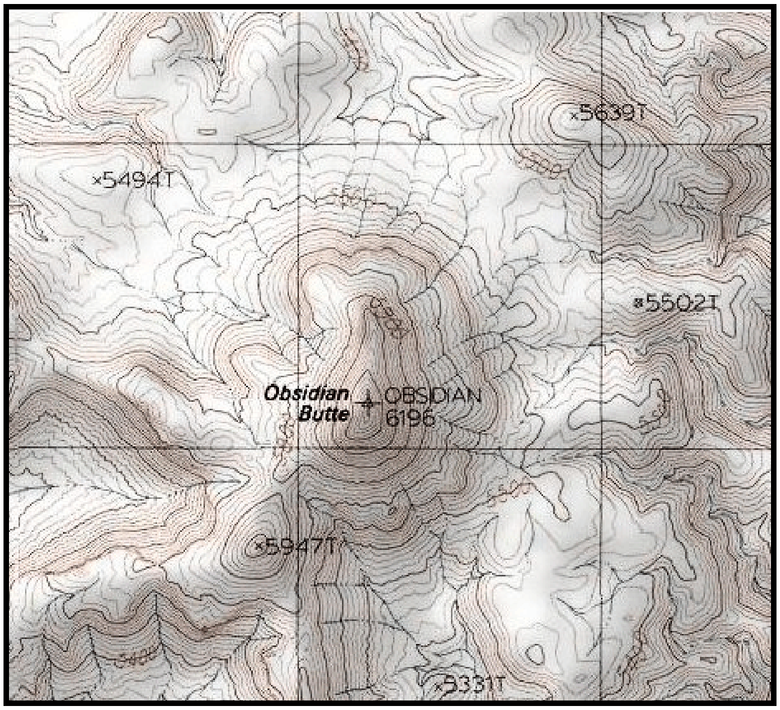
APPENDIX A: X-Ray Fluroescence Trace Element Provenance Analysis of Geologic Sources of Obsidian

Craig E. Skinner

and

Jennifer J. Thatcher

X-Ray Fluorescence Trace Element Provenance Analysis of Geologic Sources of Obsidian from the Nevada Test and Training Range and Surrounding Region, Nevada and California



2004

Craig E. Skinner
Jennifer J. Thatcher

Northwest Research Obsidian Studies Laboratory Report 2004-01

Contents

Appendices

Figures

Tables

Appendix A

X-Ray Fluorescence Trace Element Provenance Analysis of Geologic Sources of Obsidian from the Nevada Test and Training Range and Surrounding Region, Nevada and California

Craig E. Skinner
Jennifer J. Thatcher
Northwest Research Obsidian Studies Laboratory

Introduction

Four hundred and ninety-six geologic source specimens of obsidian collected at 67 specific localities in Nevada and California were submitted for energy dispersive X-ray fluorescence (EDXRF) trace element provenance analysis (see Figure A-1 for source collection locations). The samples were prepared and analyzed at Northwest Research Obsidian Studies Laboratory under the final accession number 2004-01.

The objectives of the investigation that is reported in this appendix were very straightforward:

1. To locate and sample sources of obsidian in Nevada and California that might be anticipated to be identified among geochemically characterized collections of artifacts from sites found within the Nevada Test and Training Range. The collection locales included sources located within the boundaries of the Nevada Test and Training Range and in the surrounding region in Nevada and eastern California.
2. To geochemically characterize (using nondestructive EDXRF methods) the obsidian source material.
3. To identify the different geochemical source groups found among the characterized samples.

In this section of the appendix, we summarize the results of the analysis and the analytical methods used for trace element analysis of the source specimens. The results of the X-ray fluorescence trace element analysis are presented in Appendix A-1. In Appendix A-2, we list the generalized locations of source specimen collection sites, provide a subjective assessment of the artifact quality of the glass, and designate whether or not the samples were collected at a primary *in situ* (directly at a primary source outcrop), primary (in good association with a primary outcrop), or secondary (transported and potentially mixed) context. Several of the collection localities (South Kawich Range, Delamar Mountains, Meadow Valley Range, and Resting Spring Range - see Appendix A-3) yielded obsidian or vitrophyre that was not of adequate quality for the likely manufacture of artifacts. In some locales, secondary deposits of obsidian of varying artifact quality from more that one geochemical source was found – these locales are designated as *mixed* in Table A-2. In Appendix A-3, we provide a tabulation of the visual qualities of each geochemical variety of glass collected at each sampling site. A list of alternate source names that have previously appeared in the published and gray literature is provided in Appendix A-4.

Analytical Methods: X-Ray Fluorescence Analysis

Introduction. Although a variety of physical, optical, petrographic, and chemical attributes are used to characterize volcanic glasses, the use of trace element abundances to "fingerprint" obsidian sources and artifacts has shown the greatest overall success. X-ray fluorescence analytical methods, with their ability to nondestructively and accurately measure trace element concentrations in obsidian, have been widely adopted for this purpose (Harbottle 1982; Rapp 1985; Williams-Thorpe 1995; Glascock et al. 1998; Herz and Garrison 1998; Lambert 1998).

Most geologic sources of obsidian are quite homogeneous in their trace element composition, yet demonstrate adequate intersource variability so that individual sources of glass can be distinguished. Because obsidian can be widely dispersed from its primary geologic source due to a variety of geologic and geomorphic processes, specimens of chemically identical glass are sometimes recovered from outcrops spread over large geographic areas (Hughes 1986; Hughes and Smith 1993). These secondary source boundaries are often not as well documented as primary sources but must be carefully considered in obsidian procurement studies (Shackley 1998, 2002; Church 2000). Hughes (1986, 1998a) points out that these chemically identical obsidian outcrops must be considered as a single chemical group or chemical type and his terminology is followed here.

Sample Preparation Methods. The obsidian specimens analyzed as part of this investigation were prepared in two ways. When the original nodule size and glass quality were adequate, a large flake of obsidian was cleaved from the original sample so that the analyzed surface was pristine and unweathered. For smaller samples and those of poor quality, the specimens were sawn in half with a lapidary saw and a freshly-sawn target surface was used as an X-ray target.

Analytical Methods. Analysis of the samples was completed using a Spectrace 5000 energy dispersive X-ray fluorescence spectrometer. The system is equipped with a Si(Li) detector with a resolution of 155 eV FHWM for 5.9 keV X-rays (at 1000 counts per second) in an area 30 mm^2. Signals from the spectrometer are amplified and filtered by a time variant pulse processor and sent to a 100 MHZ Wilkinson type analog-to-digital converter. The X-ray tube employed is a Bremsstrahlung type, with a rhodium target, and 5 mil Be window. The tube is driven by a 50 kV 1 mA high voltage power supply, providing a voltage range of 4 to 50 kV. The principles of X-ray fluorescence analytical methods are reviewed in detail by Norrish and Chappell (1967), Potts and Webb (1992), and Williams (1987). X-ray fluorescence analytical procedures used in the analysis of all obsidian samples were originally developed by M. Kathleen Davis (BioSystems Analysis and Northwest Research Obsidian Studies Laboratory).

For analysis of the elements zinc (Zn), lead (Pb), thorium (Th), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb), the X-ray tube is operated at 45 kV, 0.60 mA (pulsed), with a 0.127 mm Pd filter. Analytical lines used are Zn (K-alpha), Pb (L-alpha), Th (L-alpha), Rb (K-alpha), Sr (K-alpha), Y (K-alpha), Zr (K-alpha) and Nb (K-alpha). A collimator is installed and the samples are scanned for 200 seconds live-time in an air path.

Peak intensities for the above elements are calculated as ratios to the Compton scatter peak of rhodium, and converted to parts-per-million (ppm) by weight using linear regressions derived from the analysis of twenty rock standards from the U.S. Geological Survey, the Geologic Survey of Japan, and the National

Bureau of Standards. The analyte to Compton scatter peak ratio is employed to correct for variation in sample size, surface irregularities, and variation in the sample matrix.

For analysis of the elements titanium (Ti), manganese (Mn), and iron ($Fe_2O_3^T$), the X-ray tube is operated at 12 kV, 0.27 mA with a 0.127 mm aluminum filter. Samples are scanned for 200 seconds live-time in a vacuum path. Analytical lines used are Ti (K-alpha), Mn (K-alpha), and Fe (K-alpha).

Concentration values (parts per million for titanium and manganese, weight percent for iron) are calculated using linear regressions derived from the analysis of thirteen standards from the U.S. Geological Survey, the Geologic Survey of Japan and the National Bureau of Standards. However, these values are *not* corrected against the Compton scatter peak or other scatter regions, resulting in lower than normal trace element values for small samples that fall below the minimum size requirement. Iron/titanium (Fe/Ti) and iron/manganese (Fe/Mn) peak ratios are supplied for use as corrected values. In order to ensure comparability among samples of different sizes, source assignments in all reports are based upon these ratios, and not on the absolute concentration values.

For analysis of barium (Ba), the X-ray tube is operated at 50 kV, 0.25 mA with a 0.63 mm copper filter in the X-ray path. The analytical line used is Ba (K-alpha) and samples are scanned in an air path for 200 seconds live-time. Trace element intensities are calculated as ratios to the Bremsstrahlung region between 25.0 and 30.98 keV, and converted to parts-per-million by weight using a polynomial fit routine derived from the analysis of sixteen rock standards from the U.S. Geological Survey and the Geologic Survey of Japan. It should be noted that the Bremsstrahlung region corrects for sample mass only and does not account for matrix effects.

All samples are scanned as unmodified rock specimens. Reported errors represent counting and fitting error uncertainty only, and do not account for instrumental precision or effects related to the analysis of unmodified obsidian. When the latter effects are considered, relative analytical uncertainty is estimated to be between three and five percent.

In traditional X-ray fluorescence trace element studies, samples are powdered and pelletized before analysis (Norrish and Chappell 1967; Potts and Webb 1992). In theory, the irregular surfaces of most obsidian artifacts should induce measurement problems related to shifts in artifact-to-detector reflection geometry (Hughes 1986:35). Early experiments with intact obsidian flakes by Robert N. Jack, and later by Richard Hughes, however, indicate that analytical results from lenticular or biconvex obsidian surfaces are comparable to those from flat surfaces and pressed powder pellets, paving the way for the nondestructive analysis characterization of glass artifacts (Hughes 1986:35–37; Jack 1976). The minimum optimal sample size for analysis has been found to be approximately 10 mm in diameter and 1.5–2.0 mm thick. Later experimental studies conducted by Shackley and Hampel (1993) using samples with flat and slightly irregular surface geometries have corroborated Hughes' initial observations. In a similar experiment, Jackson and Hampel (1993) determined that for accurate results the minimum size of an artifact should be about 10 mm in diameter and 1.5 mm thick. Agreement between the U. S. Geological Survey standard RGM-1 (Glass Mountain obsidian) values and obsidian test samples was good at 1 mm thickness and improved markedly to a thickness of 3 mm. Details about the effects of sample size and surface geometry are discussed by Davis et al. (1998).

Appendix A: Results of X-Ray Fluorescence Trace Element Analysis of Obsidian Sources

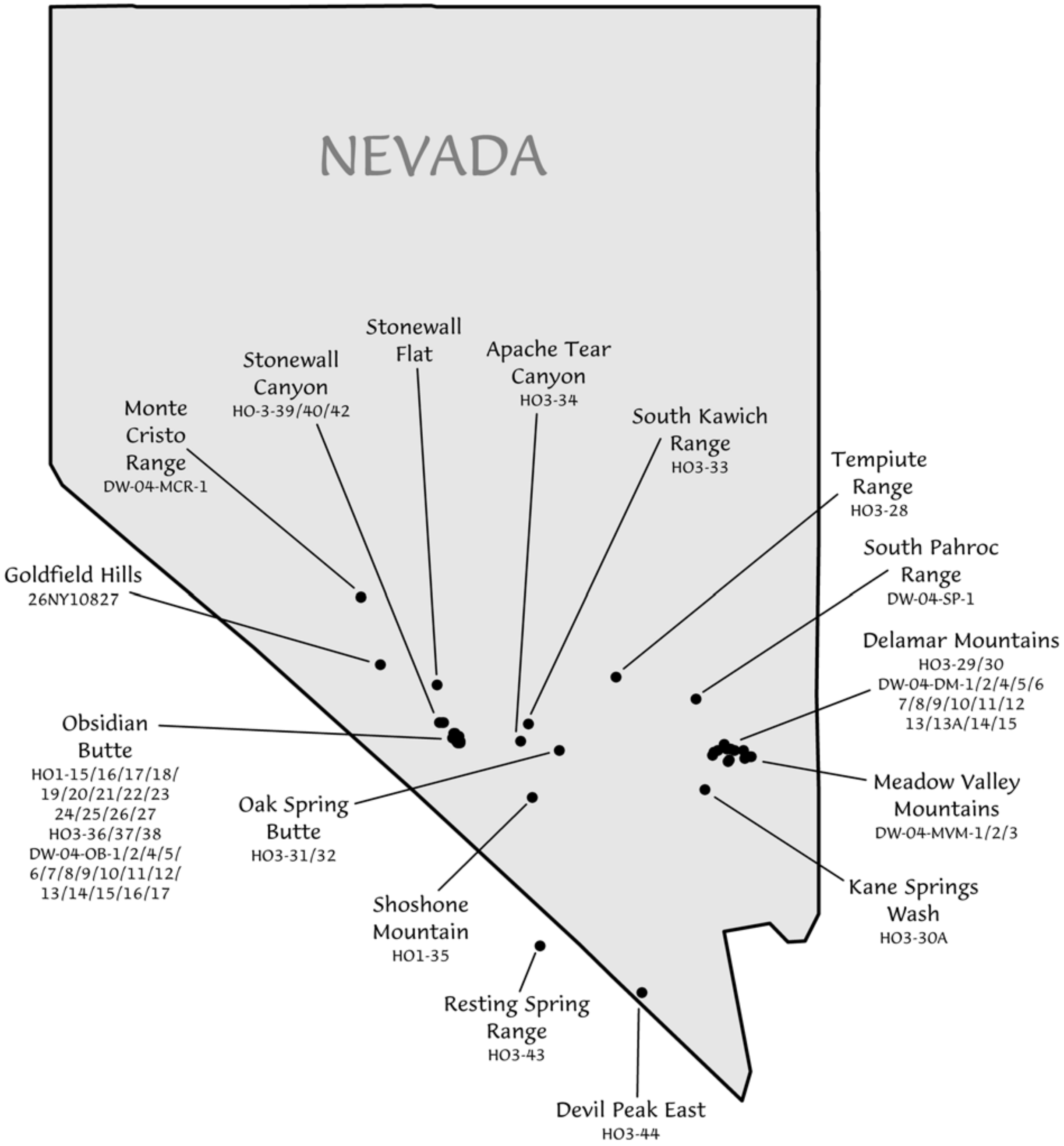


Figure A-1. Locations of the different obsidian sources and source areas from which samples were collected and analyzed in this investigation. While most of the obsidian is considered to be of artifact quality, some of the glass from the South Kawich Range, the Delamar Mountains, the Meadow Valley Mountains, and the Resting Spring range was deemed unsatisfactory for the manufacture of artifacts (see Appendix A-3 for details).

Diagnostic trace elements, as the term is used here, refer to trace element abundances that show low intrasource variation and uncertainty along with distinguishable intersource variability. In addition, this refers to elements measured by X-ray fluorescence analysis with high precision and low analytical uncertainty. In short, diagnostic elements are those that allow the clearest geochemical distinction between sources. Trace elements generally refer to those elements that occur in abundances of less than about 1000 ppm in a sample. For simplicity in this report, we use the term synonymously with major and minor elements such as iron, titanium, and manganese, which may be present in somewhat larger quantities.

Additional details about specific analytical methods and procedures used for the analysis of the elements reported in Table A-1 are available at the Northwest Research Obsidian Studies Laboratory World Wide Web site at *www.obsidianlab.com*. Descriptive information about the obsidian sources identified in the current investigation may be found elsewhere in this volume and at *www.sourcecatalog.com*.

Obsidian Source Collection Localities

Four-hundred and eighty-six specimens from 66 Nevada sample localities were selected for trace element analysis. An additional ten items from a single outcrop in the Resting Spring Range, eastern California, were also included in the material to be analyzed. The locations of the collection areas and the associated sample numbers are shown in Figure A-1 and are presented in more detail in Appendix A-2. All source samples were collected by Richard Hughes, Lynn Haarklau, Lynn Johnson, and David Wagner from 2001 through 2004. Some of the sampling locations and obsidian sources have been previously described by Haarklau and Hughes (2001) and the investigation that is reported here may be considered as a direct continuation of that earlier work.

Geologic specimens collected in the Obsidian Butte area, Nevada Test and Training Range, accounted for over 55 percent (N=268) of the samples analyzed in the current investigation. Outcrops in the ranges bordering Kane Springs Wash to the east of the Nevada Test and Training Range, the Delamar and Meadow Valley mountains, provided another 23 percent (N=113) of analyzed items. The remaining 115 specimens of source material collected for trace element studies came from the numerous other obsidian sources located in the region surrounding the primary study area at Obsidian Butte.

Results of Analysis

Twenty-two different geochemically-unique obsidian sources or types were identified among the 496 obsidian geologic source specimens that were analyzed and characterized by energy-dispersive X-ray fluorescence analysis. Analytical results are presented in Table A-1-1 in Appendix A-1 and are summarized in tables A-1 and A-2 and in figures A-2 and A-3.

Fourteen of the geochemical obsidian sources consisted of what was clearly high-quality glass suitable for the manufacture of artifacts. One of these chemical sources, South Kawich Range, was represented by two sampling localities, only one of which produced high-quality obsidian. Seven of the geochemical sources – the two Delamar Range, four Meadow Valley Mountains, and Resting Spring Range sources – yielded obsidian with hackly or irregular surfaces when flaked and were not of sufficient quality for the manufacture of artifacts (see Appendix A-3 for details).

Appendix A: Results of X-Ray Fluorescence Trace Element Analysis of Obsidian Sources

Table A-1. Obsidian source sample collection locales.

Collection Locale	**Identified Geochemical Source(s) ***	**Sample Number(s)**
Apache Tear Canyon, NV	South Kawich Range, NV	HO3-34
Delamar Mountains/Range, NV	*Delamar Range A, NV* *Delamar Range B, NV* Kane Springs Wash Caldera Variety 1, NV Kane Springs Wash Caldera Variety 2 (Kane Springs), NV	HO3-29, HO3-30, DW-04-DM-1, DW-04-DM-2, DW-04-DM-4, DW-04-DM-5, DW-04-DM-6, DW-04-DM-7, DW-04-DM-8, DW-04-DM-9, DW-04-DM-10, DW-04-DM-11, DW-04-DM-12, DW-04-DM-13, DW-04-DM-13A, DW-04-DM-14, DW-04-DM-15
Devil Peak East, NV	Devil Peak East, NV	HO3-44
Goldfield Hills, NV	Godlfield Hills, NV	26NY10827
Kane Springs Wash, NV	Kane Springs Wash Caldera Variety 1, NV	HO3-30A
Meadow Valley Mountains, NV	Kane Springs Wash Caldera Variety 1, NV *Meadow Valley Mountains A* *Meadow Valley Mountains B* *Meadow Valley Mountains C* *Meadow Valley Mountains D*	DW-04-MVM-1, DW-04-MVM-2, DW-04-MVM-3
Monte Cristo Range, NV	Crow Spring, NV	DW-04-MCR-1
Oak Spring Butte, NV	Oak Spring Butte, NV	HO3-31, HO3-32
Obsidian Butte, NV	Obsidian Butte, NV, Variety 1 Obsidian Butte, NV, Variety 2 (Airfield Canyon) Obsidian Butte, NV, Variety 3 (Obsidian Butte) Obsidian Butte, NV, Variety 4 (Obsidian Butte) Obsidian Butte, NV, Variety 5 (Unknown C)	HO1-15, HO1-16, HO1-17, HO1-18, HO1-19, HO1-20, HO1-21, HO1-22, HO1-23, HO1-24, HO1-25, HO1-26, HO1-27, HO3-36, HO3-37, HO3-38, DW-04-OB-1, DW-04-OB-2, DW-04-OB-4, DW-04-OB-5, DW-04-OB-6, DW-04-OB-7, DW-04-OB-8, DW-04-OB-9, DW-04-OB-10, DW-04-OB-11, DW-04-OB-12, DW-04-OB-13, DW-04-OB-14, DW-04-OB-15, DW-04-OB-16, DW-04-OB-17
Resting Spring Range, CA	*Resting Spring Range, CA*	HO3-43
Shoshone Mountain, NV	Shoshone Mountain, NV	HO1-35
South Kawich Range, NV	*South Kawich Range, NV*	HO3-33
South Pahroc Range, NV	South Pahroc, NV	DW-04-SP-1
Stonewall Canyon, NV	Obsidian Butte, NV, Variety 2 (Airfield Canyon) Obsidian Butte, NV, Variety 3 (Obsidian Butte) Obsidian Butte, NV, Variety 5 (Unknown C)	HO3-39, HO3-40, HO3-42
Stonewall Flat, NV	Godlfield Hills, NV	—
Tempiute Range, NV	Tempiute Mountain, NV	HO3-28

* Geochemical sources shown in italics are too poor for artifact manufacture.

Appendix A: Results of X-Ray Fluorescence Trace Element Analysis of Obsidian Sources

Table A-2. Results of trace element analysis of geologic obsidian source specimens. Table continued on following page.

Geochemical Source	Collection Locale (N = Analyzed Specimens)									
	HO1-15	HO1-16	HO1-17	HO1-18	HO1-19	HO1-20	HO1-21	HO1-22	HO1-23	HO1-24
Crow Spring	–	–	–	–	–	–	–	–	–	–
Delamar Range A	–	–	–	–	–	–	–	–	–	–
Delamar Range B	–	–	–	–	–	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–	–
Goldfield Hills	–	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	–	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains A	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains C	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	–	–	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 1	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	–	**10**	**10**	**–**	–	–	–	**10**	**–**
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	–	**3**	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	**10**	–	–	–	**11**	**10**	**10**	**10**	**–**	**2**
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	–	–	–	–	–	–	–	–
Resting Spring Range	–	–	–	–	–	–	–	–	–	–
Shoshone Mountain	–	–	–	–	–	–	–	–	–	–
South Kawich Range	–	–	–	–	–	–	–	–	–	–
South Pahroc	–	–	–	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	–	–	–	–	–	–	–
Total	**10**	**3**	**10**	**10**	**11**	**10**	**10**	**10**	**10**	**2**

Appendix A: Results of X-Ray Fluorescence Trace Element Analysis of Obsidian Sources

Table A-2. Results of trace element analysis of geologic obsidian source specimens.

Geochemical Source	**Collection Locale(N = Analyzed Specimens)**									
	HO1-25	**HO1-26**	**HO1-27**	**HO3-28**	**HO3-29**	**HO3-30**	**HO3-30A**	**HO3-31**	**HO3-32**	**HO3-33**
Crow Spring	–	–	–	–	–	–	–	–	–	–
Delamar Range A	–	–	–	–	**3**	–	–	–	–	–
Delamar Range B	–	–	–	–	**2**	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–	–
Goldfield Hills	–	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	–	–	–	–	–	**10**	**9**	–	–	–
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains A	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains C	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	–	–	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	**10**	**10**	–
Obsidian Butte, NV, Variety 1	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	**9**	**10**	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	**10**	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	–	–	–	–	–	–	–	–
Resting Spring Range	–	–	–	–	–	–	–	–	–	–
Shoshone Mountain	–	–	–	–	–	–	–	–	–	–
South Kawich Range	–	–	–	–	–	–	–	–	–	**8**
South Pahroc	–	–	–	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	**9**	–	–	–	–	–	–
Total	**10**	**9**	**10**	**9**	**5**	**10**	**9**	**10**	**10**	**8**

Table A-2 (continued). Results of trace element analysis of geologic obsidian source specimens. Table continued on following page.

	Collection Locale (N = Analyzed Specimens)									
Geochemical Source	**HO3-34**	**HO3-35**	**HO3-36**	**HO3-37**	**HO3-38**	**HO3-39**	**HO3-40**	**HO3-42**	**HO3-43**	**HO3-44**
Crow Spring	–	–	–	–	–	–	–	–	–	–
Delamar Range A	–	–	–	–	–	–	–	–	–	–
Delamar Range B	–	–	–	–	–	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–	**12**
Goldfield Hills	–	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	–	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains A	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains C	–	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	–	–	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 1	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	–	–	–	–	**1**	–	**1**	–	–
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	–	–	–	–	–	–	**2**	–	–	–
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	–	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	**10**	**11**	**10**	**9**	**3**	**4**	–	–
Resting Spring Range	–	–	–	–	–	–	–	–	**9**	–
Shoshone Mountain	–	**10**	–	–	–	–	–	–	–	–
South Kawich Range	**10**	–	–	–	–	–	–	–	–	–
South Pahroc	–	–	–	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	–	–	–	–	–	–	–
Total	**10**	**10**	**10**	**11**	**10**	**10**	**5**	**5**	**9**	**12**

Table A-2 (continued). Results of trace element analysis of geologic obsidian source specimens. Table continued on following page.

Geochemical Source	**Collection Locale (N = Analyzed Specimens)**								
	Stonewall Flat	**DW-04-OB-1**	**DW-04-OB-2**	**DW-04-OB-4**	**DW-04-DM-1**	**DW-04-DM-2**	**DW-04-OB-5**	**DW-04-OB-6**	**DW-04-OB-7**
Crow Spring	–	–	–	–	–	–	–	–	–
Delamar Range A	–	–	–	–	–	–	–	–	–
Delamar Range B	–	–	–	–	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–
Goldfield Hills	**3**	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	–	–	–	–	**15**	**15**	–	–	–
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains A	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains C	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	–	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 1	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	–	–	**15**	–	–	–	–	–
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	–	–	–	–	–	–	–	–	**5**
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	–	**8**	**7**	**–**	–	–	–	–	–
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	–	–	–	–	**5**	**5**	–
Resting Spring Range	–	–	–	–	–	–	–	–	–
Shoshone Mountain	–	–	–	–	–	–	–	–	–
South Kawich Range	–	–	–	–	–	–	–	–	–
South Pahroc	–	–	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	–	–	–	–	–	–
Total	**3**	**8**	**7**	**15**	**15**	**15**	**5**	**5**	**5**

Table A-2 (continued). Results of trace element analysis of geologic obsidian source specimens. Table continued on following page.

Geochemical Source	**Collection Locale (N = Analyzed Specimens)**								
	DW-04-OB-8	**DW-04-OB-9**	**DW-04-OB-10**	**DW-04-OB-11**	**DW-04-OB-12**	**DW-04-OB-13**	**DW-04-OB-14**	**DW-04-OB-15**	**DW-04-OB-16**
Crow Spring	–	–	–	–	–	–	–	–	–
Delamar Range A	–	–	–	–	–	–	–	–	–
Delamar Range B	–	–	–	–	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–
Goldfield Hills	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains A	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains C	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	–	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 1	–	–	**7**	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	**5**	–	**10**	**5**	–	–	–	**5**
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	**5**	–	–	–	–	**5**	**5**	**5**	–
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	–	–	–	–	–	–	–
Resting Spring Range	–	–	–	–	–	–	–	–	–
Shoshone Mountain	–	–	–	–	–	–	–	–	–
South Kawich Range	–	–	–	–	–	–	–	–	–
South Pahroc	–	–	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	–	–	–	–	–	–
Total	**5**	**5**	**7**	**10**	**5**	**5**	**5**	**5**	**5**

Table A-2 (continued). Results of trace element analysis of geologic obsidian source specimens. Table continued on following page.

Geochemical Source	**Collection Locale (N = Analyzed Specimens)**								
	DW-04-OB-17	**DW-04-SP-1**	**26NY10827**	**DW-04-MCR-1**	**DW-04-DM-4**	**DW-04-DM-5**	**DW-04-DM-6**	**DW-04-DM-7**	**DW-04-DM-8**
Crow Spring	–	–	–	**10**	–	–	–	–	–
Delamar Range A	–	–	–	–	–	–	–	**1**	–
Delamar Range B	–	–	–	–	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–
Goldfield Hills	–	–	**8**	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	–	–	–	–	**5**	**5**	**4**	**4**	**5**
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains A	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains C	–	–	–	–	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	–	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 1	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	**2**	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	**3**	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	–	–	–	–	–	–	–
Resting Spring Range	–	–	–	–	–	–	–	–	–
Shoshone Mountain	–	–	–	–	–	–	–	–	–
South Kawich Range	–	–	–	–	–	–	–	–	–
South Pahroc	–	**10**	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	–	–	–	–	–	–
Total	**5**	**10**	**8**	**10**	**5**	**5**	**4**	**5**	**5**

Table A-2 (continued). Results of trace element analysis of geologic obsidian source specimens. Table continued on following page.

Geochemical Source	**Collection Locale (N = Analyzed Specimens)**								
	DW-04-DM-9	**DW-04-DM-10**	**DW-04-DM-11**	**DW-04-MVM-1**	**DW-04-MVM-2**	**DW-04-MVM-3**	**DW-04-DM-12**	**DW-04-DM-13**	**DW-04-DM-13A**
Crow Spring	–	–	–	–	–	–	–	–	–
Delamar Range A	–	–	–	–	–	–	–	–	–
Delamar Range B	–	–	–	–	–	–	–	–	–
Devil Peak East	–	–	–	–	–	–	–	–	–
Goldfield Hills	–	–	–	–	–	–	–	–	–
Kane Springs Wash Caldera Variety 1	**5**	**5**	**1**	**2**	**1**	**2**	–	**1**	**2**
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	–	**4**	–	–	**1**	**5**	–	–
Meadow Valley Mountains A	–	–	–	**2**	–	–	–	–	–
Meadow Valley Mountains B	–	–	–	–	**1**	–	–	–	–
Meadow Valley Mountains C	–	–	–	**1**	–	–	–	–	–
Meadow Valley Mountains D	–	–	–	–	**1**	–	–	–	–
Oak Spring Butte	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 1	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	–	–	–	–	–	–	–	–	–
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	–	–	–	–	–	–	–
Resting Spring Range	–	–	–	–	–	–	–	–	–
Shoshone Mountain	–	–	–	–	–	–	–	–	–
South Kawich Range	–	–	–	–	–	–	–	–	–
South Pahroc	–	–	–	–	–	–	–	–	–
Tempiute Mountain	–	–	–	–	–	–	–	–	–
Total	**5**	**5**	**5**	**5**	**3**	**3**	**5**	**1**	**2**

Table A-2 (continued). Results of trace element analysis of obsidian source specimens

Geochemical Source	**Collection Locale (N=)**		**Total**
	DW-04-DM-14	**DW-04-DM-15**	
Crow Spring	–	–	**10**
Delamar Range A	–	–	**4**
Delamar Range B	–	–	**2**
Devil Peak East	–	–	**12**
Goldfield Hills	–	–	**11**
Kane Springs Wash Caldera Variety 1	**2**	–	**93**
Kane Springs Wash Caldera Variety 2 (Kane Springs)	–	**5**	**15**
Meadow Valley Mountains A	–	–	**2**
Meadow Valley Mountains B	–	–	**1**
Meadow Valley Mountains C	–	–	**1**
Meadow Valley Mountains D	–	–	**1**
Oak Spring Butte	–	–	**20**
Obsidian Butte, NV, Variety 1	–	–	**7**
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	–	–	**91**
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	–	–	**42**
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	–	–	**71**
Obsidian Butte, NV, Variety 5 (Unknown C)	–	–	**57**
Resting Spring Range	–	–	**9**
Shoshone Mountain	–	–	**10**
South Kawich Range	–	–	**18**
South Pahroc	–	–	**10**
Tempiute Mountain	–	–	**9**
Total	**2**	**5**	**496**

All of the 22 geochemical source types that were identified in this investigation were easily distinguishable from one another using different combinations of the elements rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), niobium (Nb), titanium (Ti), manganese (Mn), Iron (Fe^2O^3), and barium (Ba). A scatterplot of strontium plotted versus zirconium for all analyzed project source specimens demonstrates that this trace element pair alone sufficiently distinguishes many of the obsidian sources (see Figure A-2).

Obsidian Butte Sources. Characterized obsidian artifacts correlated with this source had been previously found at many sites in eastern California and western Nevada and the archaeological significance of the source was evident. We identified five geochemically-distinct obsidian source groups among the 248 specimens collected at primary source locations associated with Obsidian Butte. Although the different source groups at Obsidian Butte may be discriminated from one another using only their rubidium, strontium, zirconium, and barium composition, these source varieties are most clearly distinguished using the trace element pair of strontium and barium (see Figure A-3). The sources were named Variety 1 through Variety 5 in order of their increasing barium content. Twenty additional specimens collected from secondary deposits found approximately 15 kilometers northwest of Obsidian Butte at Stonewall Canyon were also correlated with three of the five Obsidian Butte sources.

The nomenclature of the different Obsidian Butte source varieties has a particularly complex history. Four of the five varieties have been known by a series of different names including Airfield Canyon, Obsidian Butte, Obsidian Butte varieties H-3 and H-5, Sarcobatus Flat A and B, and Unknown C (see Appendix A-4 for a list of alternate project source names). In previous provenance studies, the Obsidian Butte varieties 3 and 4 were interpreted to belong to a single chemical group. However, the large number of specimens analyzed in the current investigation made it possible for us to reliably separate these two different varieties from one another, primarily on the basis of their barium, strontium, and zirconium content. Variety 1 obsidian was previously identified as an unknown in earlier research reported by Haarklau and Hughes (2001:50; Locality H-99-4, catalog numbers 4-1a and 4-3a). Those specimens originated from a secondary mixed context at Obsidian Butte and we suspected that this unknown might be a minor Obsidian Butte source. Wagner, Johnson, and Haarklau successfully located and sampled the original source locality area and the subsequent trace element analysis of the specimens verified the existence of Variety 1. For many years, the Unknown C source has shown up in characterized collections of artifacts from eastern California and western Nevada sites. The identity of this unknown as one of the major Obsidian Butte source varieties (Variety 5) was also confirmed during the current investigation.

Delamar Mountains and Meadow Valley Mountains Sources. Artifact-quality obsidian has long been known from the secondary deposits located in Kane Springs Wash although the primary source of the obsidian had remained unknown. Previous geochemical studies of obsidian gathered at several locations along the wash revealed that two major geochemical varieties of glass were present in the secondary deposits along the drainage (Unpublished research by Northwest Research Obsidian Studies Laboratory). Based on the association of the two obsidian sources with the Kane Springs Wash Caldera and volcanic center (Novak 1984), the sources were termed as the Kane Springs Wash Caldera Variety 1 and Variety 2 (the latter being equivalent to the well-known Kane Springs source).

During the later phase of this current investigation, several reconnaissance and collection trips (each followed by trace element analysis of the samples) were made by Johnson, Wagner, and Haarklau to the ranges and potential source areas bordering the wash – the Delamar Mountains on the west and the Meadow Valley Mountains on the east. During the course of this ancillary investigation, we analyzed 113 specimens from 20 different collection sites. Several specimens of non-artifact quality glass from the Delamar and Meadow Valley mountains were also included in the analyzed sample. The geochemical source group names that were applied to these items (Delamar Range A and B and Meadow Valley Mountains A, B, C, and D) likely represent the overall range of chemical variability for the sources rather than unique geochemical types.

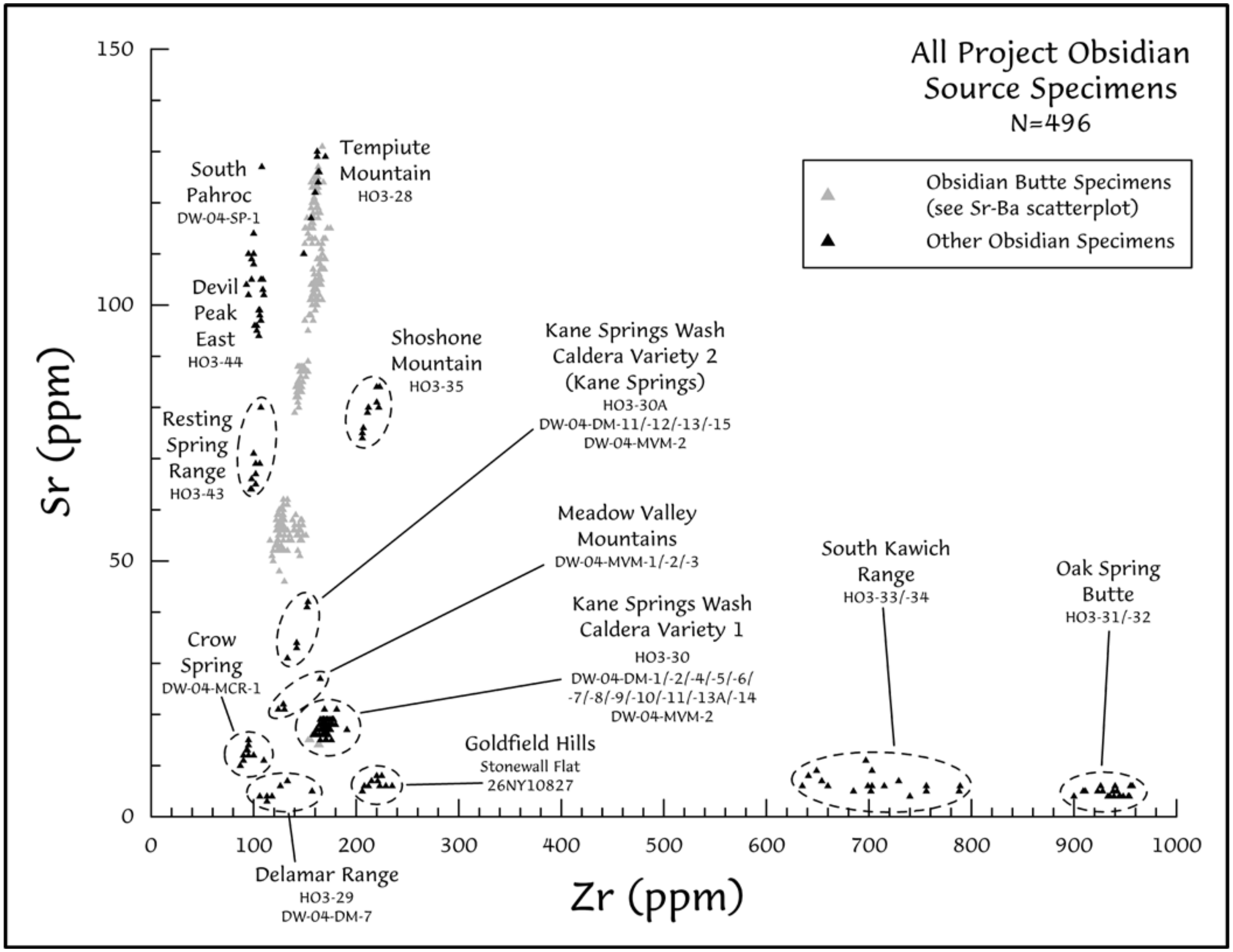


Figure A-2. Scatterplot of strontium (Sr) plotted versus zirconium (Zr) for all characterized obsidian specimens. See Figure A-3 for a detailed breakdown of the Obsidian Butte geochemical source groups.

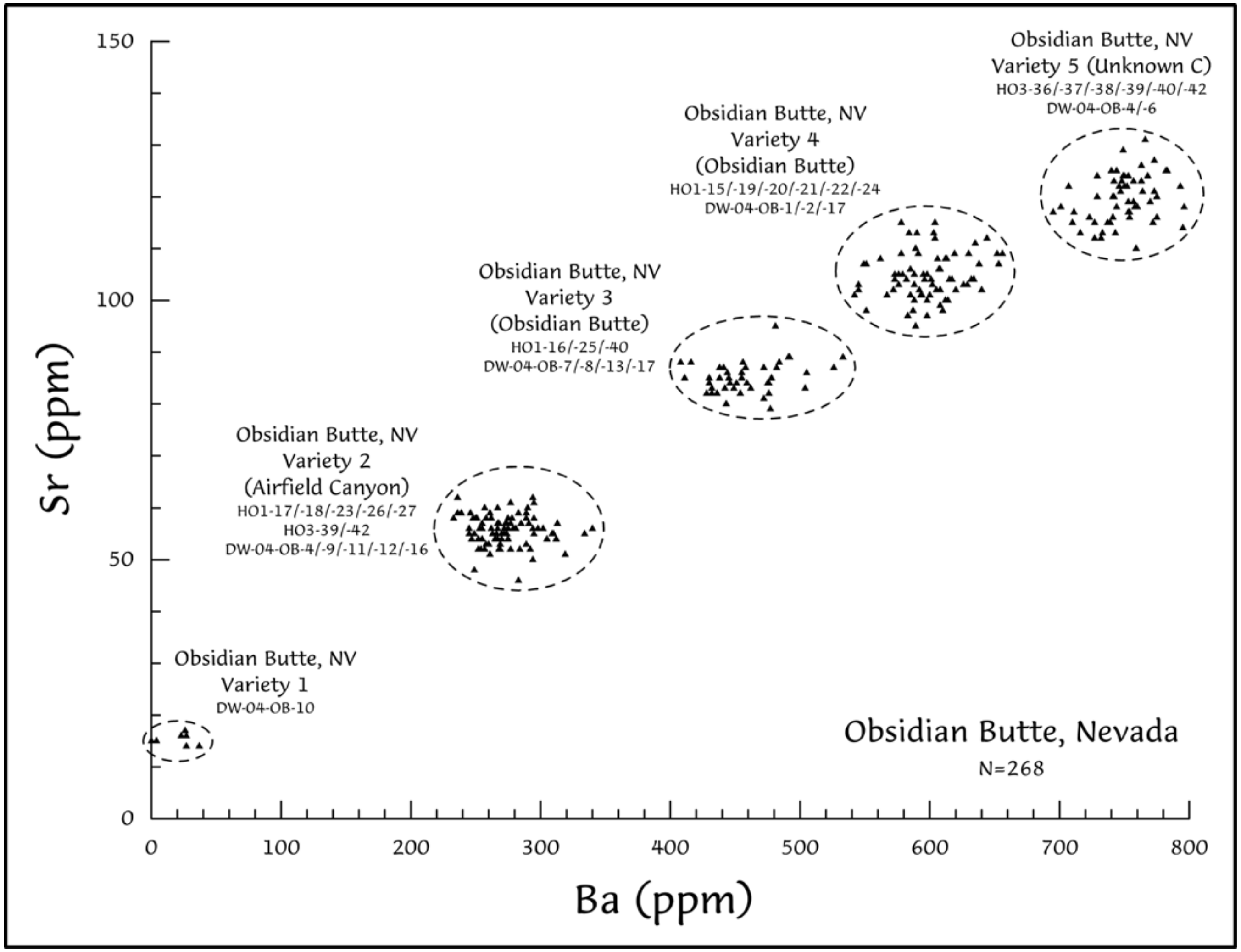


Figure A-3. Scatterplot of strontium (Sr) plotted versus barium (Ba) for all specimens collected from localities at Obsidian Butte, Nevada Test and Training Range, Nevada.

The results of the combined field and laboratory work indicated that secondary outcrops of artifact-quality obsidian from the two main sources were available at many locations in the Delamar Mountains. As the field work associated with this project was coming to a close, several primary outcrops of obsidian were finally located in the immediate vicinity of Kane Springs (within the boundaries of Novak's Kane Springs Wash Caldera). Analysis of the samples established that they correlated with the Kane Springs Wash Caldera Variety 2 (Kane Springs) source, effectively solving the mystery of the origin of this very archaeologically-significant source. The primary source of the second Kane Springs Wash Caldera Variety 1 obsidian remains unknown but is almost certainly located elsewhere in the Delamar Mountains.

Other Sources. The remaining nine chemical sources that were examined as part of this study are all geochemically-distinctive and easily separable from one another (Figure A-2). One of these sources, Goldfield Hills, was first located near the northern boundary of the Nevada Test and Training Range at Stonewall Flat. Occasional secondary nodules of obsidian can be found on the playa and earlier trace element studies by Hughes (1998b) pointed out that they were a distinct and new source that he called *Stonewall Flat*. These analyzed nodules were found near what appeared to be to geographic limits of a primary source located elsewhere, possibly in the vicinity of the Goldfield Hills situated to the northwest of Stonewall Flat. Analysis of a 7.5 cm-diameter tested nodule of raw material from 26NY1446 in the Goldfield Hills further fueled our speculation that the primary source was located in this area and we renamed the source as *Goldfield Hills*. Later analysis of small glass nodules (all correlated with the Goldfield Hills source) from 26NY10827 located northwest of the Goldfield Hills and north from the Montezuma Range provides further evidence that this obsidian source is located somewhere in the vicinity of the Goldfield Hills.

Summary and Conclusions

Nondestructive EDXRF trace element analysis of 496 obsidian source specimens from 67 collection localities from the region within and surrounding the Nevada Test and Training Range resulted in the identification of 22 geochemically distinct sources of natural glass. Fifteen of these chemical sources proved to be of high-quality obsidian suitable for the manufacture of prehistoric artifacts. The trace elements determined in this investigation were more than adequate for distinguishing among all of the different sources of glass. The data presented here will provide a valuable reference database of sources for future artifact obsidian characterization studies at the Nevada Test and Training Range.

Recommendations for Further Source Research

Although the obsidian source and trace element investigation reported in this appendix will contribute to future research concerning the understanding of obsidian source use and prehistoric procurement behavior at the Nevada Test and Training Range, it is evident that further obsidian source investigations are warranted. The results of provenance studies of artifacts reported elsewhere in this volume (see Appendix D) demonstrate that numerous nonlocal obsidian sources are found among characterized artifact collections from Nevada Test and Training Range archaeological sites.

The principal research objective that should guide future area obsidian source studies at the Nevada Test and Training Range must be *to identify and geochemically characterize the natural sources and source boundaries of obsidian located in and adjacent to the range.* In order to identify the sources of obsidian artifacts, it is plain that we must first have found their geologic sources, a methodological step in artifact provenance studies that is often neglected in the rush for archaeological results.

With this primary goal in mind, future obsidian source-related research issues related to Nevada Test and Training Range archaeological objectives should encompass:

1. *Further geochemical studies of selected sources that were examined in the current investigation.* Our initial trace element analysis of several of the sources evaluated in this appendix suggest that further geochemical studies are warranted. Several of the local sources examined here – the Goldfield Hills, Oak Spring Butte, Shoshone Mountain, and particularly the South Kawich source, were under-represented in the sample. Additional analyzed samples would be helpful in better understanding the range of variability of trace element composition of these sources.

2. *Mapping of obsidian source boundaries.* A variety of natural transport processes may distribute obsidian at considerable distances from primary source areas and systematic studies of the primary and secondary distribution boundaries of these sources are needed in order to take full advantage of artifact characterization information. We recommend additional collection and analysis of samples, particularly those originating from Obsidian Butte, from secondary contexts with the specific objective of site boundary determination guiding the effort.

3. *Geochemical and geoarchaeological studies of additional obsidian sources that are likely to be found at Nevada Test and Training Range archaeological sites.* Some of these sources have been reported by Ericson et al. (1976), Ericson (1981), Moore (1997) and others but remain wholly or largely uninvestigated and we recommend that further source studies be undertaken. These might include but should not be limited to the following obsidian sources or source areas located in eastern California and southern Nevada:
    - Bagdad (Bristol Mountains), California (Shackley 1994)
    - Bodie Hills, California (Moore 1997)
    - Box Spring, Nevada (Thomas 1983)
    - Casa Diablo (Bailey et al. 1976; Bailey 1989; Hughes 1994)
    - Castle Mountains, Nevada (Hewett 1956; Wilke and Schroth 1989; Torres 1998, Christensen et al. 2001)
    - Coso Volcanic Field, California (Bacon et al. 1980, 1981; Hughes 1988; Gilreath and Hildebrandt 1997; Eerkens and Rosenthal 2004)
    - Devil Peak West, Nevada (Shackley 1994)
    - Fish Springsm California (Ericson et al. 1976: Ericson 1981; Bettinger et al. 1984; Hughes and Bettinger 1984; Bettinger 1989)
    - Garfield Hills, Nevada (Moore 1997)
    - Hackberry Mountains, California (Hewett 1956)
    - Monitor Valley unknown sources, Nevada (Thomas 1983)
    - Montezuma Range, Nevada (Benson and Hughes 1998)
    - Mono Craters, California (Bailey et al. 1976; Sieh and Bursik 1986; Bailey 1989; Hughes 1989)
    - Mono Glass Mountain, California (Noble et al. 1972; Hughes 1989)
    - Mt. Hicks, Nevada (Ericson et al. 1976; Ericson 1981)
    - Queen, California-Nevada (Ericson et al. 1976; Ericson 1981)
    - Silverpeak and Fish Lake Valley, Nevada (Eerkens et al. 2001)
    - Saline Range, California (Johnson et al. 1999; Burton et al. 2000)

A comprehensive knowledge of the chemical composition and geoarchaeological characteristics of the local and nonlocal prehistoric obsidian sources that were used at the Nevada Test and Training Range will provide future researchers with the accurate tools and information needed to address issues of prehistoric procurement and source use, territoriality and land use, and longer-distance interaction and procurement of raw materials.

References Cited

Bacon, Charles R., Wendell A. Duffield, and Kazuaki Nakamura
1980 Distribution of Quaternary Rhyolite Domes of the Coso Range, California: Implications for Extent of the Geothermal Anomaly. *Journal of Geophysical Research* 85:2,425–2,433.

Bacon, Charles R., Ray MacDonald, Robert L. Smith, and Philip A. Baedecker
1981 Pleistocene High-Silica Rhyolites of the Coso Volcanic Field, Inyo County, California. *Journal of Geophysical Research* 86:10,223–10,241.

Bailey, Roy A.
1989 *Geologic Map of the Long Valley Caldera, Mono-Inyo Craters Volcanic Chain, and Vicinity, Eastern California.* U.S. Geological Survey Miscellaneous Investigations Series Map I-1993, scale 1:62,500.

Bailey, Roy A., G. B. Dalrymple, and L. A. Lanphere
1976 Volcanism, Structure, and Geochronology of the Long Valley Caldera, Mono County, California. *Journal of Geophysical Research* 81:725–744.

Benson, Arlene and Richard E. Hughes
1998 Sources of Obsidian Collected from the Humboldt-Toiyabe National Forest, Nye County, Nevada. Paper presented at the Twenty-Sixth Great Basin Anthropological Conference, October 8-10, 1998, Bend, Oregon.

Bettinger, Robert L.
1989 Establishing an Hydration Rate for Fish Springs Obsidian. In *Current Directions in California Obsidian Studies*, edited by Richard E. Hughes, pp. 59–68. Contributions of the University of California Archaeological Research Facility No. 48, Berkeley, California.

Bettinger, Robert L., Michael G. Delacorte, and Robert L. Jackson
1984 Visual Sourcing of Central Eastern California Obsidians. In *Obsidian Studies in the Great Basin*, edited by Richard E. Hughes, pp. 63–78. Contributions of the University of California Archaeological Research Facility, Berkeley, California.

Burton, Jeffrey F., William W. Bloomer, and Lynn Johnson
2000 *Stoneworking in Eureka Valley: Archaeological Investigations at the Eureka Dunes Site (CA-INY-2489), Death Valley National Park, California*. Western Archaeological and Conservation Center Publications in Anthropology 78, National Park Service, Tucson, Arizona.

Christensen, Don D. , Jerry Dickey, and David Lee
2001 The Granite Mountains Archaeological Survey: Prehistoric Land Use in the East Mojave Desert, California. *Pacific Coast Archaeological Society Quarterly* 37(2):1–78.

Church, Tim
2000 Distribution and Sources of Obsidian in the Rio Grande Gravels of New Mexico. *Geoarchaeology* 15:649–678.

Davis, M. Kathleen, Thomas L. Jackson, M. Steven Shackley, Timothy Teague, and Joachim H. Hampel
1998 Factors Affecting the X-Ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian. In *Archaeological Obsidian Studies: Method and Theory*, edited by M. Steven Shackley, pp. 159–180. Advances in Archaeological and Museum Science Series. Plenum Publishing Co., New York, New York.

Eerkens, Jelmer W. and Michael D. Glascock
2001 Northern Fish Lake Valley and the Volcanic Tablelands of Owens Valley: Two Minor Sources of Obsidian in the Western Great Basin. *Journal of California and Great Basin Anthropology* 22:331–342.

Eerkens, Jelmer W. and Jeffrey S. Rosenthal
2004 Are Obsidian Subsources Meaningful Units of Analysis?: Temporal and Spatial Patterning of Subsources in the Coso Volcanic Field, Southeastern California. *Journal of Archaeological Science* 31:21–29.

Ericson, Jonathon E.
1981 *Exchange and Production Systems in Californian Prehistory: The Results of Hydration Dating and Chemical Characterization of Obsidian Sources*. BAR International Series 110, Oxford, England.

Ericson, Jonathon E., Timothy A. Hagan, and Charles W. Chesterman
1976 Prehistoric Obsidian in California II: Geologic and Geographic Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R. E. Taylor, pp. 218–239. Noyes Press, Park Ridge, New Jersey.

Gilreath, Amy J. and William R. Hildebrandt
1997 *Prehistoric Use of the Coso Volcanic Field*. Contributions of the University of California Archaeological Research Facility No. 56, Berkeley, California.

Glascock, Michael D., Geoffrey E. Brasswell, and Robert H. Cobean
1998 A Systematic Approach to Obsidian Source Characterization. In *Archaeological Obsidian Studies: Method and Theory*, edited by M. Steven Shackley, pp. 15–65. Advances in Archaeological and Museum Science Series. Plenum Publishing Co., New York, New York.

Goldberg, Susan K., Elizabeth J. Skinner, and Jeffrey F. Burton
1990 *Archaeological Excavations at Sites CA-MNO-574, -577, -578, and -833: Stoneworking in Mono County, California*. Report prepared for the California Department of Transportation, Bishop, California, by INFOTEC Research, Inc., Sonora, California.

Haarklau, Lynn with a contribution from Richard E. Hughes
2001 *Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada*. Report prepared by Prewitt & Associates, Inc., Austin, Texas, for Nellis Air Force Base, Nevada.

Harbottle, Garman
1982 Chemical Characterization in Archaeology. In *Contexts for Prehistoric Exchange*, edited by Jonathon E. Ericson and Timothy K. Earle, pp. 13–51. Academic Press, New York, New York.

Herz, Norman and Ervan G. Garrison
1998 *Geological Methods for Archaeology*. Oxford University Press, New York, New York.

Hewett, D. F.
1956 *Geology and Mineral Resources of the Ivanpah Quadrangle, California and Nevada*. U. S. Geological Survey Professional Paper 275.

Hughes, Richard E.
1986 *Diachronic Variability in Obsidian Procurement Patterns in Northeastern California and Southcentral Oregon*. University of California Publications in Anthropology 17, Berkeley, California.

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

1989 A New Look at Mono Basin Obsidians. In *Current Directions in California Obsidian Studies*, edited by Richard E. Hughes, pp. 1–12.. Contributions of the University of California Arch. Research Facility No. 48, Berkeley, California.

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

1998a On Reliability, Validity, and Scale on Obsidian Sourcing Research. *In Unit Issues in Archaeology: Measuring Time, Space, and Material*, edited by Ann F. Ramenofsky and Anastasia Steffen, pp. 103–114. University of Utah Press, Salt Lake City, Utah.

1998b Unpublished letter report dated November 30, 1998, by Geochemical Research Laboratory. Prepared for Nellis Air Force Base, Nevada.

Hughes, Richard E. and R. L. Bettinger
1984 Obsidian and Prehistoric Sociocultural Systems in California. In *Exploring the Limits: Frontiers and Boundaries in Prehistory*, edited by S. P. DeAtley and F. Findlow, BAR International Series 223: Oxford, England, pp. 153–172.

Hughes, Richard E. and Robert L. Smith
1993 Archaeology, Geology, and Geochemistry in Obsidian Provenance Studies, in *Effects of Scale on Archaeological and Geoscientific Perspectives*, edited by J. K. Stein and A. R. Linse, pp. 79–91. Geological Society of America Special Paper 283, Boulder, Colorado.

Jack, Robert N.
1976 Prehistoric Obsidian in California I: Geochemical Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R. E. Taylor, pp. 183–217. Noyes Press, Park Ridge, New Jersey.

Jackson, Thomas L. and Joachim Hampel
1993 Size Effects in the Energy-Dispersive X-ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian (Abstract). *International Association for Obsidian Studies Bulletin* 9:8.

Johnson, Lynn, David L. Wagner, and Craig E. Skinner
1999 Geochemistry of Archaeological Obsidian Sources in the Saline Range, Death Valley National Park, California. In *Proceedings of Conference on Status of Geologic Research and Mapping in Death Valley National Park, Las Vegas, Nevada, April 4-11, 1999.* U.S. Geological Survey Open-File Report 99-153, pp.118–120.

Lambert, Joseph B.
1998 *Traces of the Past: Unraveling the Secrets of Archaeology Through Chemistry*. Perseus Books, Reading, Massachusetts.

Moore, Joe
1997 *Great Basin Tool-Stone Sources (Revised Draft).* Report prepared by the Nevada Department of Transportation, Carson City, Nevada.

Noble, Donald C., Marjorie K. Korringa, Carl E. Hedge, and George O. Riddle
1972 Highly Differentiated Subalkaline Rhyolite from Glass Mountain, Mono County, California. *Geological Society of America Bulletin* 83:1,179–1,184.

Norrish, K. and B. W. Chappell
1967 X-Ray Fluorescence Spectrography. In *Physical Methods in Determinative Mineralogy*, edited by J. Zussman, pp. 161–214. Academic Press, New York, New York.

Novak, Steven W.
1984 Eruptive History of Kane Springs Wash Volcanic Center, Nevada. *Journal of Geophysical Research* 89:8,603–8,615.

Potts, Philip J. and Peter C. Webb
1992 X-Ray Fluorescence Spectrometry. *Journal of Geochemical Exploration* 44:251–296.

Rapp, George, Jr.
1985 The Provenience of Artifactual Raw Materials. In *Archaeological Geology*, edited by George Rapp, Jr. and John A. Gifford, pp. 353–375. Yale University Press, New Haven, Connecticut.

Shackley, M. Steven
1994 Intersource and Intrasource Geochemical Variability in Two Newly Discovered Archaeological Obsidian Sources in the Southern Great Basin: Bristol Mountains, California and Devil Peak, Nevada. *Journal of California and Great Basin Anthropology* 16:118–129.

1998 Intrasource Chemical Variability and Secondary Depositional Processes: Lessons from the American Southwest. In *Archaeological Obsidian Studies: Method and Theory*, edited by M. Steven Shackley, pp. 83–102. Advances in Archaeological and Museum Science Series. Plenum Publishing Co., New York, New York.

2002 More than Exchange: Pre-Ceramic through Ceramic Period Obsidian Studies in the Greater North American Southwest. In *Geochemical Evidence for Long-Distance Exchange*, edited by Michael D. Glascock, pp. 89–87. Bergin and Garvey, Westport, Connecticut.

Shackley, M. Steven and Joachim Hampel
1993 Surface Effects in the Energy-Dispersive X-ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian (Abstract). *International Association for Obsidian Studies Bulletin* 9:10.

Sieh, Kerry and M. Bursik
1986 Most Recent Eruption of the Mono Craters, Eastern Central California. *Journal of Geophysical Research* 91:12,539–12,571.

Thomas, D. H.
1983 The Archaeology of Monitor Valley: 2. Gatecliff Shelter. *Anthropological Papers of the American Museum of Natural History* 59.

Torres, John
1998 Juan Obsidian Clast Source. *Lithic Technology* 23:85–89.

Wilke, Philip J. and Adella B. Schroth
1989 Lithic Raw Material Prospects in the Mojave Desert, California. *Journal of California and Great Basin Anthropology* 11:146–174.

Williams, K. L.
1987 *An Introduction to X-Ray Spectrometry: X-Ray Fluorescence and Electron Microprobe Analysis.* Allen & Unwin, Boston, Massachusetts.

Williams-Thorpe, O.
1995 Obsidian in the Mediterranean and the Near East: A Provenancing Success Story. *Archaeometry* 37:217–248.

Appendix A-1

Results of X-Ray Fluorescence Analysis

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	1	HO1-15-1	33	23	167	105	24	163	21	838	341	598	1.20	30.1	48.0	Obsidian Butte, NV, Variety 4
HO1-15			± 8	5	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	2	HO1-15-2	35	25	173	104	23	164	22	851	324	617	1.15	30.5	45.6	Obsidian Butte, NV, Variety 4
HO1-15			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	3	HO1-15-3	35	18	150	95	25	153	19	766	471	589	1.08	19.7	47.5	Obsidian Butte, NV, Variety 4
HO1-15			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	4	HO1-15-4	44	20	171	107	23	158	23	595	226	549	0.80	31.4	45.7	Obsidian Butte, NV, Variety 4
HO1-15			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	5	HO1-15-5	36	25	160	103	22	159	22	738	341	626	1.15	29.1	52.4	Obsidian Butte, NV, Variety 4
HO1-15			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	6	HO1-15-6	49	27	160	97	25	158	20	656	282	598	1.00	31.0	51.4	Obsidian Butte, NV, Variety 4
HO1-15			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	7	HO1-15-7	41	25	173	108	24	164	24	815	463	612	1.19	21.9	48.8	Obsidian Butte, NV, Variety 4
HO1-15			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	8	HO1-15-8	39	24	167	104	25	166	22	881	343	615	1.19	29.9	45.7	Obsidian Butte, NV, Variety 4
HO1-15			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	9	HO1-15-9	29	21	169	108	23	164	22	765	307	606	1.08	30.3	47.5	Obsidian Butte, NV, Variety 4
HO1-15			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	10	HO1-15-10	54	24	168	112	25	163	23	795	367	604	1.15	26.9	48.6	Obsidian Butte, NV, Variety 4
HO1-15			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	11	HO1-16-1	30	28	169	82	28	144	20	716	376	436	1.08	24.7	50.6	Obsidian Butte, NV, Variety 3
HO1-16			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	12	HO1-16-2	35	25	169	80	26	144	24	658	320	443	1.12	30.0	56.7	Obsidian Butte, NV, Variety 3
HO1-16			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	13	HO1-16-3	48	27	177	84	26	144	25	577	292	430	0.95	28.2	55.0	Obsidian Butte, NV, Variety 3
HO1-16			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	14	HO1-17-1	34	29	183	61	22	133	22	753	477	277	0.97	17.6	43.7	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	15	HO1-17-2	38	26	168	59	23	141	21	963	458	283	0.94	17.9	33.6	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	90	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	16	HO1-17-3	35	23	153	52	19	123	22	1182	298	257	0.83	24.6	24.5	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	90	27	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	17	HO1-17-4	34	30	159	58	23	130	21	644	340	275	0.94	24.0	49.2	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	18	HO1-17-5	41	30	166	56	21	128	20	701	354	262	0.95	23.4	46.0	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	19	HO1-17-6	38	31	164	54	22	123	23	563	367	255	0.76	18.5	46.3	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	20	HO1-17-7	47	22	164	57	22	127	19	786	352	277	1.00	24.6	43.1	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	21	HO1-17-8	30	25	164	56	21	133	21	701	359	275	1.08	26.1	51.9	Obsidian Butte, NV, Variety 2
HO1-17			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	22	HO1-17-9	44	26	160	55	20	125	22	673	448	266	1.03	19.9	51.5	Obsidian Butte, NV, Variety 2
HO1-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	23	HO1-17-10	29	28	154	53	20	121	18	747	400	258	0.95	20.6	43.2	Obsidian Butte, NV, Variety 2
HO1-17			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	24	HO1-18-1	44	24	177	57	27	124	26	636	344	285	1.13	28.3	59.4	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	25	HO1-18-2	34	15	159	52	24	119	23	482	301	268	0.91	26.6	63.2	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	26	HO1-18-3	31	21	187	56	26	126	25	512	291	255	0.84	25.5	55.4	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	27	HO1-18-4	35	23	184	62	26	129	24	669	349	294	1.14	28.2	57.0	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	28	HO1-18-5	30	28	170	56	28	122	23	572	314	262	1.02	28.1	59.5	Obsidian Butte, NV, Variety 2
HO1-18			± 8	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	29	HO1-18-6	37	22	182	58	27	128	24	478	313	251	0.84	23.6	58.6	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	30	HO1-18-7	36	20	178	57	28	124	28	577	380	274	1.05	23.8	60.6	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	31	HO1-18-8	49	25	198	62	27	133	27	485	284	236	0.82	25.5	56.8	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	32	HO1-18-9	39	24	173	58	27	122	23	519	280	233	0.86	27.2	56.0	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2} O$^{3\ T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	33	HO1-18-10	42	29	181	59	26	129	23	405	383	239	0.75	17.3	61.9	Obsidian Butte, NV, Variety 2
HO1-18			± 7	4	4	9	3	7	1	88	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	34	HO1-19-1	45	30	185	115	26	175	24	905	315	604	1.14	31.3	42.8	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	35	HO1-19-2	40	23	174	109	26	169	26	922	398	630	1.26	27.1	46.1	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	36	HO1-19-3	37	25	171	109	24	164	24	881	351	656	1.29	31.3	49.1	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	37	HO1-19-4	41	22	172	102	24	160	22	869	414	608	1.25	25.8	48.3	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	38	HO1-19-5	36	26	166	104	22	159	23	710	283	632	1.04	32.0	49.5	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	39	HO1-19-6	57	24	161	100	25	160	21	743	301	612	1.07	30.9	48.6	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	40	HO1-19-7	42	29	167	109	25	170	23	758	362	619	1.07	25.5	47.6	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	41	HO1-19-8	27	24	168	106	24	163	22	729	455	607	1.02	19.5	47.4	Obsidian Butte, NV, Variety 4
HO1-19			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	42	HO1-19-9	49	24	156	98	24	156	23	699	291	610	1.03	30.7	49.6	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	43	HO1-19-10	33	22	165	106	24	164	23	867	325	608	1.16	30.7	45.2	Obsidian Butte, NV, Variety 4
HO1-19			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	44	HO1-19-11	43	22	160	104	21	157	21	878	465	634	1.24	22.7	47.4	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	45	HO1-20-1	45	18	161	105	27	163	22	827	448	573	1.13	21.6	46.1	Obsidian Butte, NV, Variety 4
HO1-19			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	46	HO1-20-2	35	25	163	103	27	161	22	802	307	545	1.08	30.3	45.3	Obsidian Butte, NV, Variety 4
HO1-20			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	47	HO1-20-3	39	30	178	110	28	167	23	951	348	589	1.25	30.8	44.4	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	48	HO1-20-4	44	22	162	104	25	158	22	701	340	582	1.00	25.6	48.2	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	49	HO1-20-5	42	18	162	100	24	162	23	811	308	614	1.10	30.9	45.9	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	50	HO1-20-6	36	22	160	100	21	157	21	745	382	588	1.25	28.0	56.2	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	51	HO1-20-7	36	24	166	104	24	161	19	787	336	573	1.20	30.7	51.3	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	52	HO1-20-8	46	23	171	101	23	160	23	794	380	593	1.15	26.1	48.9	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	53	HO1-20-9	47	24	168	101	21	162	20	758	313	594	1.16	31.9	51.4	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	54	HO1-20-10	44	21	164	102	26	159	21	884	334	640	1.19	30.5	45.3	Obsidian Butte, NV, Variety 4
HO1-20			± 7	4	4	9	3	7	1	90	28	33	0.11			(Obsidian Butte)
Obsidian Butte:	55	HO1-21-1	43	23	162	103	23	162	21	803	431	629	1.16	23.0	48.5	Obsidian Butte, NV, Variety 4
HO1-21			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	56	HO1-21-2	49	22	163	100	24	157	23	839	424	598	1.25	25.1	49.9	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	57	HO1-21-3	42	25	160	102	25	158	24	874	330	605	1.16	30.2	44.7	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	58	HO1-21-4	37	21	166	103	24	161	23	893	347	602	1.24	30.5	46.5	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	59	HO1-21-5	42	26	173	111	25	166	24	778	338	635	1.14	28.9	49.2	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	60	HO1-21-6	43	28	187	115	26	172	23	719	374	578	0.92	21.5	43.6	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	61	HO1-21-7	33	28	174	107	24	169	23	874	332	653	1.28	33.1	49.3	Obsidian Butte, NV, Variety 4
HO1-21			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	62	HO1-21-8	49	21	163	99	23	160	20	783	329	608	1.20	31.3	51.3	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	63	HO1-21-9	30	21	161	104	22	156	22	778	315	596	1.19	32.4	51.2	Obsidian Butte, NV, Variety 4
HO1-21			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	64	HO1-21-10	42	24	172	109	25	164	23	889	447	652	1.24	23.7	46.9	Obsidian Butte, NV, Variety 4
HO1-21			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	65	HO1-22-1	30	21	147	98	25	154	19	838	284	587	1.12	34.2	45.2	Obsidian Butte, NV, Variety 4
HO1-22			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	66	HO1-22-2	47	22	159	102	23	157	20	764	287	545	1.06	31.9	46.7	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	67	HO1-22-3	36	26	160	105	22	166	22	781	392	588	1.14	25.0	49.1	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	68	HO1-22-4	45	28	165	108	23	165	23	752	404	613	1.08	23.0	48.3	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	69	HO1-22-5	38	25	164	104	23	159	22	899	359	632	1.28	30.4	47.7	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	70	HO1-22-6	31	24	163	105	25	164	21	871	352	576	1.20	29.2	46.4	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	71	HO1-22-7	43	22	175	108	26	164	22	789	304	562	1.09	31.0	46.6	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	90	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	72	HO1-22-8	37	26	170	103	25	158	23	830	332	576	1.18	30.6	47.9	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	73	HO1-22-9	19	20	153	97	23	150	24	832	306	583	1.14	32.0	46.2	Obsidian Butte, NV, Variety 4
HO1-22			±10	5	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	74	HO1-22-10	36	28	170	109	24	162	23	872	396	591	1.18	25.4	45.4	Obsidian Butte, NV, Variety 4
HO1-22			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	75	HO1-23-1	26	22	159	52	20	133	23	674	368	269	0.91	21.6	45.9	Obsidian Butte, NV, Variety 2
HO1-23			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	76	HO1-23-2	37	28	159	57	21	129	21	733	371	267	0.98	23.0	45.5	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	77	HO1-23-3	25	27	158	56	18	126	23	645	320	279	0.87	23.8	45.7	Obsidian Butte, NV, Variety 2
HO1-23			± 8	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	78	HO1-23-4	44	30	166	57	21	127	21	674	379	268	0.95	21.8	47.7	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	79	HO1-23-5	39	26	166	57	24	129	20	680	324	273	0.91	24.4	45.2	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	80	HO1-23-6	42	25	164	55	20	135	21	700	376	274	0.93	21.6	45.2	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	81	HO1-23-7	39	28	168	57	23	129	21	533	279	267	0.71	22.7	45.6	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	82	HO1-23-8	29	23	160	56	19	131	20	662	403	302	0.83	18.1	42.8	Obsidian Butte, NV, Variety 2
HO1-23			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	83	HO1-23-9	39	30	192	58	23	138	21	759	333	248	0.93	24.3	41.6	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	84	HO1-23-10	37	25	165	56	24	129	20	621	314	245	0.85	23.7	46.3	Obsidian Butte, NV, Variety 2
HO1-23			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	85	HO1-24-1	34	22	154	98	20	155	22	604	316	551	0.87	24.0	48.6	Obsidian Butte, NV, Variety 4
HO1-24			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	86	HO1-24-2	36	23	170	109	23	166	24	864	444	578	1.18	22.8	46.1	Obsidian Butte, NV, Variety 4
HO1-24			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	87	HO1-25-1	36	25	171	84	25	141	23	785	348	475	1.22	30.1	52.2	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	88	HO1-25-2	40	22	172	88	24	143	23	657	305	416	1.09	31.0	55.7	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	89	HO1-25-3	40	21	178	88	22	147	25	740	347	484	1.14	28.3	51.7	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	90	HO1-25-4	47	26	165	86	28	146	26	707	408	505	1.08	22.7	51.3	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	91	HO1-25-5	35	25	168	85	27	143	21	627	310	411	1.08	30.1	57.4	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	92	HO1-25-6	48	26	172	88	25	145	21	689	329	456	1.07	28.2	52.2	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	93	HO1-25-7	38	19	167	84	26	146	20	708	338	446	1.18	29.9	55.5	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	94	HO1-25-8	41	23	176	86	25	146	23	659	350	444	1.02	25.1	51.9	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	95	HO1-25-9	35	22	168	84	24	143	23	689	325	476	1.13	30.0	55.1	Obsidian Butte, NV, Variety 3
HO1-25			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	96	HO1-25-10	36	28	173	86	24	151	23	724	315	455	1.10	30.1	51.1	Obsidian Butte, NV, Variety 3
HO1-25			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	97	HO1-26-1	28	31	158	55	19	151	22	748	425	295	0.86	17.8	39.5	Obsidian Butte, NV, Variety 2
HO1-26			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	98	HO1-26-2	27	26	156	55	20	142	22	793	405	334	1.02	21.7	43.5	Obsidian Butte, NV, Variety 2
HO1-26			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	99	HO1-26-3	28	29	156	56	20	146	23	779	336	340	0.88	23.0	38.8	Obsidian Butte, NV, Variety 2
HO1-26			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	100	HO1-26-4	30	28	153	54	23	137	21	837	402	305	1.07	23.0	43.3	Obsidian Butte, NV, Variety 2
HO1-26			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	101	HO1-26-5	41	29	157	54	23	145	23	716	325	312	0.86	23.4	41.2	Obsidian Butte, NV, Variety 2
HO1-26			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	102	HO1-26-6	26	23	158	57	20	148	21	803	346	313	0.95	23.9	40.4	Obsidian Butte, NV, Variety 2
HO1-26			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	103	HO1-26-7	32	27	155	57	22	140	23	795	333	291	0.95	24.8	40.6	Obsidian Butte, NV, Variety 2
HO1-26			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	104	HO1-26-8	40	29	160	55	23	148	20	695	355	309	0.80	19.9	39.6	Obsidian Butte, NV, Variety 2
HO1-26			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	105	HO1-26-9	41	27	149	56	21	139	22	785	381	298	0.92	21.1	40.2	Obsidian Butte, NV, Variety 2
HO1-26			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	106	HO1-27-1	53	23	160	54	21	147	25	765	375	305	1.04	23.9	45.9	Obsidian Butte, NV, Variety 2
HO1-27			± 8	5	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	107	HO1-27-2	44	26	158	55	23	144	21	819	366	295	0.98	23.4	40.9	Obsidian Butte, NV, Variety 2
HO1-27			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	108	HO1-27-3	31	35	154	58	19	147	23	858	415	289	0.97	20.3	38.7	Obsidian Butte, NV, Variety 2
HO1-27			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	109	HO1-27-4	49	29	158	52	21	143	23	786	345	292	0.91	23.0	39.5	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	110	HO1-27-5	40	27	158	51	20	145	24	822	396	319	0.98	21.4	40.5	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	111	HO1-27-6	40	26	160	56	22	140	24	864	376	281	1.04	23.8	40.7	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	112	HO1-27-7	33	26	159	57	20	144	23	799	456	313	0.91	17.3	38.9	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

Site	Specimen No.	Catalog No.	Trace Element Concentrations											Ratios		Geochemical Source
			Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Fe:Ti	
Obsidian Butte:	113	HO1-27-8	32	24	160	56	22	144	24	890	365	294	1.02	24.2	39.1	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	114	HO1-27-9	44	33	166	58	21	146	21	721	322	295	0.82	22.6	39.2	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	115	HO1-27-10	34	30	160	55	21	142	22	816	444	310	0.96	18.8	40.1	Obsidian Butte, NV, Variety 2
HO1-27			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Tempiute Range:	116	HO3-28-1	73	24	192	122	32	160	27	521	457	551	1.32	24.5	82.6	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	89	28	32	0.11			
Tempiute Range:	118	HO3-28-3	72	28	214	129	33	170	30	496	427	565	1.25	24.9	82.1	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	89	28	32	0.11			
Tempiute Range:	119	HO3-28-4	63	28	202	130	33	162	30	576	541	583	1.38	21.6	78.7	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	89	28	32	0.11			
Tempiute Range:	120	HO3-28-5	64	27	198	126	34	164	26	487	475	534	1.18	21.2	79.3	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	89	28	32	0.11			
Tempiute Range:	121	HO3-28-6	66	32	183	117	32	156	25	582	474	577	1.40	25.1	79.0	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	89	28	32	0.11			
Tempiute Range:	122	HO3-28-7	75	21	205	129	32	162	29	1039	401	583	1.14	24.4	37.3	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	90	28	32	0.11			
Tempiute Range:	123	HO3-28-8	46	22	182	110	30	149	27	1173	383	546	1.15	25.7	33.3	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	90	28	32	0.11			
Tempiute Range:	124	HO3-28-9	70	20	202	126	34	163	26	890	528	565	1.29	20.7	48.6	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	90	28	32	0.11			
Tempiute Range:	125	HO3-28-10	72	26	202	124	30	163	30	524	501	530	1.26	21.4	78.7	Tempiute Mountain, NV
HO3-28			± 7	4	4	9	3	7	1	89	28	32	0.11			
Delamar Range:	126	HO3-29-1	97	49	514	5	123	157	89	145	261	0	0.91	30.6	182.1	Delamar Range B, NV
HO3-29			± 7	4	5	9	3	7	2	87	27	31	0.11			
Delamar Range:	127	HO3-29-2	85	50	515	7	117	133	78	331	248	45	1.05	36.6	101.3	Delamar Range B, NV
HO3-29			± 7	4	5	9	3	7	2	88	27	33	0.11			
Delamar Range:	128	HO3-29-3	54	35	320	4	74	113	52	170	267	0	0.91	29.8	159.8	Delamar Range A, NV
HO3-29			± 7	4	4	9	3	7	1	87	27	31	0.11			
Delamar Range:	129	HO3-29-4	57	37	318	4	77	106	54	209	241	14	0.94	34.2	138.2	Delamar Range A, NV
HO3-29			± 7	4	4	9	3	7	1	87	27	31	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Delamar Range:	130	HO3-29-5	54	32	310	3	78	113	53	164	200	9	0.89	39.3	160.8	Delamar Range A, NV
HO3-29			± 7	4	4	10	3	7	1	87	27	31	0.11			
Delamar Range:	131	HO3-30-1	44	29	181	18	47	166	35	1118	177	66	1.25	61.1	37.8	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	90	27	32	0.11			Variety 1, NV
Delamar Range:	132	HO3-30-2	54	30	178	17	49	169	34	891	160	82	1.13	61.6	42.8	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Range:	133	HO3-30-3	42	24	184	17	50	167	34	873	162	56	1.10	59.3	42.5	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Range:	134	HO3-30-4	54	17	189	17	48	172	37	923	199	48	1.08	47.2	39.7	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Range:	135	HO3-30-5	45	26	182	17	50	169	32	1100	230	67	1.08	40.8	33.5	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Range:	136	HO3-30-6	54	23	183	19	46	174	31	1231	175	45	1.18	58.8	32.7	Kane Springs Wash Caldera
HO3-30			± 8	5	4	9	3	7	1	90	27	33	0.11			Variety 1, NV
Delamar Range:	137	HO3-30-7	47	24	193	17	49	175	38	957	170	68	1.08	55.6	38.3	Kane Springs Wash Caldera
HO3-30			± 8	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Range:	138	HO3-30-8	51	23	188	17	50	171	36	999	341	60	1.15	28.9	39.0	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	28	33	0.11			Variety 1, NV
Delamar Range:	139	HO3-30-9	54	24	189	18	51	173	35	1029	163	56	1.08	58.3	35.9	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Range:	140	HO3-30-10	51	21	182	17	47	165	34	1130	193	40	1.09	49.1	32.8	Kane Springs Wash Caldera
HO3-30			± 7	4	4	9	3	7	1	89	27	35	0.11			Variety 1, NV
Kane Springs Wash:	141	HO3-30A-1	38	27	182	17	51	171	36	1008	181	41	1.14	54.9	38.4	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	27	34	0.11			Variety 1, NV
Kane Springs Wash:	142	HO3-30A-2	42	23	188	18	49	167	34	1037	244	51	1.22	43.1	39.8	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Kane Springs Wash:	143	HO3-30A-3	49	19	182	18	50	164	35	961	147	49	1.03	62.0	36.7	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Kane Springs Wash:	144	HO3-30A-4	44	21	184	18	45	170	31	991	162	39	1.14	61.5	38.9	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	27	34	0.11			Variety 1, NV
Kane Springs Wash:	145	HO3-30A-5	51	25	181	18	46	169	37	1073	340	65	1.02	26.0	32.6	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	28	33	0.11			Variety 1, NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Kane Springs Wash:	146	HO3-30A-6	40	28	186	19	47	172	35	1023	223	73	1.21	47.0	40.0	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Kane Springs Wash:	147	HO3-30A-7	49	20	187	18	51	170	34	910	175	60	1.14	57.0	42.4	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Kane Springs Wash:	149	HO3-30A-9	68	24	176	17	46	168	34	1167	213	50	1.09	44.5	32.0	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	90	27	33	0.11			Variety 1, NV
Kane Springs Wash:	150	HO3-30A-10	41	21	174	16	48	158	32	1198	215	60	1.04	42.2	29.7	Kane Springs Wash Caldera
H03-30A			± 7	4	4	9	3	7	1	90	27	33	0.11			Variety 1, NV
Oak Spring Butte:	151	HO3-31-1	197	30	190	4	81	948	67	1268	1137	0	3.84	27.6	99.1	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	90	29	31	0.11			
Oak Spring Butte:	152	HO3-31-2	195	26	179	5	82	923	68	1764	1054	0	3.66	28.3	68.4	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	153	HO3-31-3	172	31	179	4	76	900	67	1777	1050	0	3.68	28.7	68.4	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	154	HO3-31-4	186	29	182	5	83	942	70	1581	1143	0	3.69	26.4	76.9	Oak Spring Butte, NV
HO3-31			± 9	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	155	HO3-31-5	203	39	193	6	84	957	69	1375	1173	0	3.78	26.3	90.2	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	156	HO3-31-6	199	27	186	4	81	939	64	1604	1107	0	3.73	27.5	76.4	Oak Spring Butte, NV
HO3-31			± 8	4	4	10	3	8	2	91	29	31	0.11			
Oak Spring Butte:	157	HO3-31-7	195	29	190	6	87	955	66	1293	1097	0	3.82	28.4	96.6	Oak Spring Butte, NV
HO3-31			± 9	5	4	9	3	8	2	90	29	31	0.11			
Oak Spring Butte:	158	HO3-31-8	219	29	185	4	84	944	68	1288	1270	0	4.05	26.0	102.9	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	159	HO3-31-9	184	32	185	4	81	945	72	1284	1220	0	3.94	26.3	100.5	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	90	29	31	0.11			
Oak Spring Butte:	160	HO3-31-10	186	34	181	4	81	933	69	1644	1046	0	3.64	28.5	73.0	Oak Spring Butte, NV
HO3-31			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	161	HO3-32-1	204	30	182	5	84	928	67	1616	1083	0	3.86	29.1	78.7	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	162	HO3-32-2	199	36	183	5	82	938	68	1423	980	0	3.46	28.9	79.9	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Oak Spring Butte:	163	HO3-32-3	209	31	188	4	84	954	68	1505	1113	0	3.79	27.8	82.8	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	164	HO3-32-4	203	32	190	4	79	935	67	1568	1054	0	3.55	27.6	74.6	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	165	HO3-32-5	189	32	179	6	84	926	65	1562	1092	0	3.61	27.0	76.0	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	166	HO3-32-6	179	31	178	5	83	909	71	1659	973	0	3.33	28.0	66.3	Oak Spring Butte, NV
HO3-32			± 9	5	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	167	HO3-32-7	194	35	191	4	84	953	72	1441	1071	0	3.59	27.4	81.9	Oak Spring Butte, NV
HO3-32			± 9	4	4	10	3	8	2	91	29	31	0.11			
Oak Spring Butte:	168	HO3-32-8	196	33	188	6	82	940	69	1391	1132	0	3.10	22.5	73.5	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			
Oak Spring Butte:	169	HO3-32-9	211	31	184	4	86	944	67	1366	857	0	2.87	27.6	69.4	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	90	28	31	0.11			
Oak Spring Butte:	170	HO3-32-10	193	31	174	5	80	911	69	1662	1074	0	3.54	27.0	70.3	Oak Spring Butte, NV
HO3-32			± 8	4	4	9	3	8	2	91	29	31	0.11			
South Kawich	171	HO3-33-1	126	28	182	6	63	699	53	1121	551	0	2.07	31.2	61.1	South Kawich Range, NV
Range: HO3-33			± 7	4	4	9	3	7	1	90	28	31	0.11			
South Kawich	172	HO3-33-2	142	28	184	8	64	641	54	1000	543	0	1.77	27.2	58.6	South Kawich Range, NV
Range: HO3-33			± 7	4	4	9	3	7	1	89	28	31	0.11			
South Kawich	174	HO3-33-4	118	39	178	6	60	635	52	1004	533	0	1.96	30.8	64.7	South Kawich Range, NV
Range: HO3-33			± 7	4	4	9	3	7	1	90	28	31	0.11			
South Kawich	175	HO3-33-5	136	38	179	9	64	649	53	1152	729	0	1.98	22.6	57.1	South Kawich Range, NV
Range: HO3-33			± 7	4	4	9	3	7	1	90	28	31	0.11			
South Kawich	176	HO3-33-6	111	38	187	11	65	697	53	1078	654	0	2.21	28.0	67.6	South Kawich Range, NV
Range: HO3-33			± 8	4	4	9	3	7	1	90	28	31	0.11			
South Kawich	177	HO3-33-7	119	31	181	9	65	703	56	1017	576	0	2.12	30.7	69.0	South Kawich Range, NV
Range: HO3-33			± 8	4	4	9	3	7	2	90	28	31	0.11			
South Kawich	178	HO3-33-8	124	24	174	6	61	660	54	944	477	0	1.71	30.1	60.1	South Kawich Range, NV
Range: HO3-33			± 7	4	4	9	3	7	2	89	28	31	0.11			
South Kawich	179	HO3-33-9	130	34	188	7	61	654	55	1271	643	0	2.14	27.7	56.0	South Kawich Range, NV
Range: HO3-33			± 7	4	4	9	3	7	1	90	28	31	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Apache Tear	180	HO3-34-1	141	31	183	5	65	702	57	1275	527	0	1.82	28.9	47.6	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	181	HO3-34-2	140	27	193	5	69	788	59	1273	572	0	2.25	32.7	58.6	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	182	HO3-34-3	129	31	188	6	68	756	56	1276	560	0	2.16	32.1	56.3	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	183	HO3-34-4	140	31	191	5	65	685	59	1158	408	0	1.50	31.0	43.4	South Kawich Range, NV
Canyon: HO3-34			± 8	5	4	9	3	7	2	90	28	31	0.11			
Apache Tear	184	HO3-34-5	116	35	195	6	66	703	55	1136	709	0	2.34	27.4	68.2	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	185	HO3-34-6	148	34	195	5	67	756	57	1063	708	0	2.18	25.5	67.7	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	186	HO3-34-7	159	33	220	6	72	789	63	917	394	0	1.57	33.7	57.1	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	8	2	89	28	31	0.11			
Apache Tear	187	HO3-34-8	158	28	189	4	69	740	58	1080	543	0	1.79	27.6	55.2	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	188	HO3-34-9	130	30	189	7	64	729	60	1114	560	0	1.85	27.7	55.4	South Kawich Range, NV
Canyon: HO3-34			± 7	4	4	9	3	7	2	90	28	31	0.11			
Apache Tear	189	HO3-34-10	138	32	185	6	66	715	59	1279	729	0	2.16	24.6	56.1	South Kawich Range, NV
Canyon: HO3-34			± 8	4	4	9	3	7	2	90	28	31	0.11			
Shoshone Mt.:	190	HO3-35-1	40	30	193	74	29	206	26	1107	243	588	1.11	39.5	34.1	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	90	27	32	0.11			
Shoshone Mt.:	191	HO3-35-2	45	23	198	75	28	206	26	1337	306	616	1.35	37.6	34.2	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	91	27	32	0.11			
Shoshone Mt.:	192	HO3-35-3	38	25	187	76	27	207	28	1073	237	578	1.08	39.5	34.3	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	90	27	32	0.11			
Shoshone Mt.:	193	HO3-35-4	48	29	204	79	25	211	26	1271	265	601	1.27	41.2	34.0	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	91	27	32	0.11			
Shoshone Mt.:	194	HO3-35-5	47	27	215	80	26	222	28	1384	330	616	1.25	32.5	30.8	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	91	28	32	0.11			
Shoshone Mt.:	195	HO3-35-6	32	25	208	81	27	220	30	1209	351	577	1.12	27.4	31.6	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	90	28	32	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Shoshone Mt.:	196	HO3-35-7	32	27	217	84	27	223	28	1225	288	604	1.20	35.7	33.2	Shoshone Mountain, NV
HO3-35			± 8	4	4	9	3	7	1	91	27	32	0.11			
Shoshone Mt.:	197	HO3-35-8	46	30	200	80	28	212	26	1375	284	616	1.32	39.9	32.6	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	91	28	32	0.11			
Shoshone Mt.:	198	HO3-35-9	39	21	216	84	25	220	29	1378	466	625	1.23	22.6	30.5	Shoshone Mountain, NV
HO3-35			± 7	4	4	9	3	7	1	91	28	32	0.11			
Shoshone Mt.:	199	HO3-35-10	26	29	189	74	25	206	22	1136	243	622	1.13	40.4	34.0	Shoshone Mountain, NV
HO3-35			± 8	4	4	9	3	7	1	90	27	32	0.11			
Obsidian Butte:	200	HO3-36-1	36	25	149	117	19	159	22	781	380	711	1.03	23.4	44.6	Obsidian Butte, NV, Variety 5
HO3-36			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	201	HO3-36-2	37	26	150	118	19	162	18	883	335	760	1.13	29.1	43.4	Obsidian Butte, NV, Variety 5
HO3-36			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	202	HO3-36-3	26	23	144	114	18	153	21	1204	436	795	0.98	19.5	28.1	Obsidian Butte, NV, Variety 5
HO3-36			± 8	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	203	HO3-36-4	31	19	147	113	20	154	19	791	310	716	0.96	27.0	41.3	Obsidian Butte, NV, Variety 5
HO3-36			± 8	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	204	HO3-36-5	27	23	150	118	21	158	17	870	327	796	1.09	28.9	42.5	Obsidian Butte, NV, Variety 5
HO3-36			± 8	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	205	HO3-36-6	26	25	136	115	20	155	18	934	388	772	1.15	25.3	41.5	Obsidian Butte, NV, Variety 5
HO3-36			± 9	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	206	HO3-36-7	26	29	149	120	19	160	19	782	358	775	1.10	26.4	47.3	Obsidian Butte, NV, Variety 5
HO3-36			± 8	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	207	HO3-36-8	48	17	141	116	21	158	20	1058	261	754	0.87	29.2	28.3	Obsidian Butte, NV, Variety 5
HO3-36			± 7	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	208	HO3-36-9	51	21	158	127	20	163	20	932	342	773	1.16	29.2	42.1	Obsidian Butte, NV, Variety 5
HO3-36			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	209	HO3-36-10	39	27	155	124	21	161	19	758	441	729	0.98	19.2	43.6	Obsidian Butte, NV, Variety 5
HO3-36			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	210	HO3-37-1	48	23	142	112	20	157	20	804	410	732	1.00	21.0	42.1	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	211	HO3-37-2	25	22	152	115	18	158	19	1306	301	739	1.01	29.3	26.8	Obsidian Butte, NV, Variety 5
HO3-37			± 8	4	4	9	3	7	1	91	27	32	0.11			(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2} O$^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	212	HO3-37-3	35	25	146	115	20	151	18	1242	273	710	0.95	30.4	26.4	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	213	HO3-37-4	42	21	137	110	18	148	17	1366	250	759	0.80	28.3	20.5	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	214	HO3-37-5	36	23	147	119	19	156	19	1233	434	770	1.04	20.6	28.9	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	91	28	32	0.11			(Unknown C)
Obsidian Butte:	215	HO3-37-6	59	28	148	116	20	156	18	1214	360	741	1.04	25.1	29.4	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	216	HO3-37-7	33	26	148	116	21	156	19	1281	321	723	1.07	28.7	28.5	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	91	28	32	0.11			(Unknown C)
Obsidian Butte:	217	HO3-37-8	30	22	145	117	19	152	19	1305	270	754	0.92	29.7	24.4	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	218	HO3-37-9	38	26	145	113	21	157	18	1331	376	733	1.01	23.3	26.2	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	91	28	32	0.11			(Unknown C)
Obsidian Butte:	219	HO3-37-10	37	28	150	115	19	154	20	1343	454	727	1.06	20.2	27.2	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	91	28	32	0.11			(Unknown C)
Obsidian Butte:	220	HO3-37-11	40	21	142	115	20	150	18	1401	310	737	1.07	29.8	26.2	Obsidian Butte, NV, Variety 5
HO3-37			± 7	4	4	9	3	7	1	91	28	32	0.11			(Unknown C)
Obsidian Butte:	221	HO3-38-1	34	26	144	113	21	160	16	870	326	743	1.04	27.7	40.7	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	222	HO3-38-2	44	28	149	125	20	163	21	955	349	782	1.24	30.4	43.8	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	223	HO3-38-3	40	24	152	122	21	163	20	1063	375	793	1.27	29.0	40.5	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	224	HO3-38-4	42	27	156	122	20	160	17	718	377	707	0.88	20.5	41.9	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	89	28	32	0.11			(Unknown C)
Obsidian Butte:	225	HO3-38-5	32	28	157	125	18	159	19	1001	409	744	1.14	23.9	38.5	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	226	HO3-38-6	48	25	150	123	23	160	19	924	331	748	1.15	29.9	42.2	Obsidian Butte, NV, Variety 5
HO3-38			± 8	5	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	227	HO3-38-7	39	27	154	122	23	162	21	933	332	746	1.12	29.1	40.6	Obsidian Butte, NV, Variety 5
HO3-38			± 8	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	228	HO3-38-8	42	32	150	119	23	163	19	917	451	753	1.03	19.8	38.4	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	229	HO3-38-9	26	31	148	118	22	158	21	962	337	744	1.14	29.2	40.3	Obsidian Butte, NV, Variety 5
HO3-38			± 8	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	230	HO3-38-10	47	28	145	119	20	161	22	899	363	757	1.06	25.2	40.0	Obsidian Butte, NV, Variety 5
HO3-38			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	231	HO3-39-1	34	20	149	118	19	165	19	900	337	758	1.19	30.4	44.7	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	232	HO3-39-2	45	23	154	123	21	157	20	958	393	763	1.17	25.4	41.2	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	233	HO3-39-3	30	25	152	120	18	161	20	821	324	729	1.09	29.1	44.8	Obsidian Butte, NV, Variety 5
HO3-39			± 8	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Stonewall Canyon:	234	HO3-39-4	37	26	153	125	19	160	17	888	330	783	1.11	29.1	42.4	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	235	HO3-39-5	38	25	152	121	21	159	20	774	439	764	0.99	19.6	43.5	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	236	HO3-39-6	48	28	180	60	25	129	27	602	425	290	0.98	20.0	54.6	Obsidian Butte, NV, Variety 2
HO3-39			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Stonewall Canyon:	237	HO3-39-7	40	25	156	121	18	159	21	887	318	773	1.13	30.7	43.2	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	238	HO3-39-8	54	25	147	120	18	159	19	922	328	741	1.20	31.4	44.0	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	239	HO3-39-9	51	27	155	124	20	159	20	920	408	768	1.20	25.2	44.1	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	240	HO3-39-10	34	27	154	123	22	163	18	860	358	742	1.15	27.6	45.1	Obsidian Butte, NV, Variety 5
HO3-39			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	241	HO3-40-1	45	23	169	87	29	148	26	677	321	441	1.10	29.5	54.3	Obsidian Butte, NV, Variety 3
HO3-40			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Stonewall Canyon:	242	HO3-40-2	35	26	147	123	20	157	19	980	488	757	1.17	20.4	40.3	Obsidian Butte, NV, Variety 5
HO3-40			± 8	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Stonewall Canyon:	243	HO3-40-3	51	31	151	122	20	159	20	925	351	750	1.23	29.9	44.8	Obsidian Butte, NV, Variety 5
HO3-40			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Stonewall Canyon: HO3-40	244	HO3-40-4	30	23	169	82	21	141	22	635	312	432	1.07	29.7	56.4	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
			± 8	4	4	9	3	7	1	89	28	32	0.11			
Stonewall Canyon: HO3-40	245	HO3-40-5	39	24	149	121	20	159	19	921	363	747	1.17	27.8	43.0	Obsidian Butte, NV, Variety 5 (Unknown C)
			± 7	4	4	9	3	7	1	90	28	32	0.11			
Stonewall Canyon: HO3-42	246	HO3-42-1	33	24	149	124	20	156	18	849	319	749	1.16	31.3	46.1	Obsidian Butte, NV, Variety 5 (Unknown C)
			± 7	4	4	9	3	7	1	90	28	32	0.11			
Stonewall Canyon: HO3-42	247	HO3-42-2	29	26	147	117	18	158	18	852	303	753	1.08	30.7	42.8	Obsidian Butte, NV, Variety 5 (Unknown C)
			± 8	4	4	9	3	7	1	90	27	32	0.11			
Stonewall Canyon: HO3-42	248	HO3-42-3	45	22	151	120	20	157	17	913	334	742	1.11	28.6	41.3	Obsidian Butte, NV, Variety 5 (Unknown C)
			± 7	4	4	9	3	7	1	90	27	32	0.11			
Stonewall Canyon: HO3-42	249	HO3-42-4	27	19	173	58	28	126	24	498	299	258	0.94	27.4	62.7	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
			± 8	4	4	9	3	7	1	88	27	32	0.11			
Stonewall Canyon: HO3-42	250	HO3-42-5	35	17	136	116	21	157	19	733	271	775	0.96	30.9	44.4	Obsidian Butte, NV, Variety 5 (Unknown C)
			± 8	4	4	9	3	7	1	89	27	32	0.11			
Resting Spring Range: HO3-43	251	HO3-43-1	34	28	147	69	19	106	16	668	552	417	0.86	13.5	43.6	Resting Spring Range, CA
			± 7	4	4	9	3	7	1	89	28	32	0.11			
Resting Spring Range: HO3-43	252	HO3-43-2	44	29	147	69	19	102	15	684	372	428	0.91	21.4	45.3	Resting Spring Range, CA
			± 7	4	4	9	3	7	1	89	28	32	0.11			
Resting Spring Range: HO3-43	253	HO3-43-3	28	28	155	65	18	102	16	587	320	439	0.74	20.5	43.1	Resting Spring Range, CA
			± 7	4	4	9	3	7	1	89	27	32	0.11			
Resting Spring Range: HO3-43	255	HO3-43-5	26	31	149	66	19	98	18	634	329	433	0.84	22.5	45.2	Resting Spring Range, CA
			± 8	4	4	9	3	7	1	89	27	32	0.11			
Resting Spring Range: HO3-43	256	HO3-43-6	25	24	147	80	19	107	18	515	295	454	0.74	22.2	48.6	Resting Spring Range, CA
			± 8	4	4	9	3	7	1	89	27	32	0.11			
Resting Spring Range: HO3-43	257	HO3-43-7	30	27	140	64	18	97	17	766	440	423	0.68	13.9	31.2	Resting Spring Range, CA
			± 7	4	4	9	3	7	1	89	28	32	0.11			
Resting Spring Range: HO3-43	258	HO3-43-8	31	29	161	67	19	102	18	601	310	417	0.77	22.0	43.7	Resting Spring Range, CA
			± 7	4	4	9	3	7	1	89	27	32	0.11			
Resting Spring Range: HO3-43	259	HO3-43-9	27	29	145	64	19	98	16	631	445	433	0.81	16.1	44.0	Resting Spring Range, CA
			± 8	4	4	9	3	7	1	89	28	32	0.11			
Resting Spring Range: HO3-43	260	HO3-43-10	38	28	159	71	19	100	18	602	409	424	0.69	15.0	39.4	Resting Spring Range, CA
			± 7	4	4	9	3	7	1	89	28	32	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2} O$^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Devil Peak East	261	HO3-44-1	44	40	186	103	31	109	24	447	419	247	0.58	12.6	45.1	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	88	28	32	0.11			
Devil Peak East	262	HO3-44-2	63	38	188	105	28	107	26	567	668	213	0.75	9.9	45.4	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	89	28	32	0.11			
Devil Peak East	263	HO3-44-3	41	42	195	99	31	105	27	444	461	274	0.57	11.3	44.5	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	88	28	32	0.11			
Devil Peak East	264	HO3-44-4	43	37	191	96	27	101	26	584	640	240	0.80	11.0	46.6	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	89	28	32	0.11			
Devil Peak East	265	HO3-44-5	52	31	198	105	32	109	25	521	710	250	0.73	9.1	47.8	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	89	28	32	0.11			
Devil Peak East	266	HO3-44-6	47	37	184	94	27	105	23	432	457	262	0.65	12.8	51.2	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	88	28	32	0.11			
Devil Peak East	267	HO3-44-7	38	42	193	99	29	106	25	552	557	230	0.79	12.4	48.4	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	89	28	32	0.11			
Devil Peak East	268	HO3-44-8	36	34	182	97	29	107	24	599	541	262	0.76	12.4	43.5	Devil Peak East, NV
HO3-44			± 8	4	4	9	3	7	1	88	28	32	0.11			
Devil Peak East	269	HO3-44-9	45	40	186	96	32	103	23	561	595	260	0.80	11.8	48.5	Devil Peak East, NV
HO3-44			± 8	4	4	9	3	7	1	89	28	32	0.11			
Devil Peak East	270	HO3-44-10	30	37	175	95	29	103	21	521	483	232	0.67	12.4	44.1	Devil Peak East, NV
HO3-44			± 8	4	4	9	3	7	1	88	28	32	0.11			
Devil Peak East	271	HO3-44-11	48	34	194	98	29	106	23	621	510	239	0.72	12.5	39.7	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	89	28	32	0.11			
Devil Peak East	272	HO3-44-12	51	39	193	102	31	110	24	585	667	256	0.71	9.5	42.0	Devil Peak East, NV
HO3-44			± 7	4	4	9	3	7	1	89	28	32	0.11			
Stonewall Flat	273	1	55	35	273	7	46	221	64	445	852	0	1.31	13.0	95.1	Goldfield Hills, NV
			± 8	4	4	9	3	7	1	88	28	31	0.11			
Stonewall Flat	274	2	61	28	269	5	45	206	62	299	526	0	0.97	15.9	103.4	Goldfield Hills, NV
			± 8	4	4	9	3	7	2	88	28	31	0.11			
Stonewall Flat	275	3	75	33	302	8	50	225	64	352	523	0	0.94	15.5	86.5	Goldfield Hills, NV
			± 7	4	4	9	3	7	1	88	28	31	0.11			
Obsidian Butte:	276	DW-04-OB-1a	33	28	182	113	24	170	25	663	278	603	0.93	29.1	47.4	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	277	DW-04-OB-1b	28	20	165	104	24	163	22	805	306	601	1.14	32.1	47.6	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	278	DW-04-OB-1c	44	24	166	112	27	167	25	889	396	644	1.25	26.9	47.2	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	279	DW-04-OB-1d	51	28	161	102	25	159	23	670	308	572	1.00	28.3	50.4	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	280	DW-04-OB-1e	33	23	154	102	24	157	25	715	294	592	1.00	29.7	47.4	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	281	DW-04-OB-1f	29	21	155	106	23	159	23	760	342	585	1.04	26.4	46.4	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	282	DW-04-OB-1g	35	19	153	101	23	155	23	796	294	585	1.09	32.1	46.4	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	283	DW-04-OB-1h	41	24	178	113	21	168	22	719	271	584	1.01	32.5	47.5	Obsidian Butte, NV, Variety 4
DW-04-OB-1			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	284	DW-04-OB-2a	48	19	165	105	24	160	23	824	358	595	1.23	29.5	50.3	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	285	DW-04-OB-2b	35	22	159	101	23	167	25	854	372	600	1.13	26.0	44.6	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	286	DW-04-OB-2c	34	23	177	113	23	168	21	685	282	590	0.96	29.7	47.4	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	287	DW-04-OB-2d	42	21	162	105	26	166	23	703	256	579	0.96	32.6	46.0	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	288	DW-04-OB-2e	48	27	163	107	26	167	24	814	373	638	1.23	28.3	50.8	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	289	DW-04-OB-2f	40	27	151	101	22	157	23	706	464	542	0.94	17.7	45.3	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	290	DW-04-OB-2g	44	21	165	107	21	165	23	614	279	551	0.92	28.8	50.5	Obsidian Butte, NV, Variety 4
DW-04-OB-2			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	291	DW-04-OB-4a	33	21	177	57	28	123	25	427	262	273	0.77	26.2	60.4	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	292	DW-04-OB-4b	40	26	182	58	25	126	25	445	292	262	0.75	22.9	56.8	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	293	DW-04-OB-4c	18	28	178	60	28	127	24	566	316	257	0.99	27.1	58.3	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 9	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	294	DW-04-OB-4d	40	24	177	56	25	122	24	358	269	245	0.66	22.2	61.9	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	295	DW-04-OB-4e	32	24	178	60	26	125	27	508	368	267	0.94	22.2	61.5	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	296	DW-04-OB-4f	43	25	193	61	29	129	25	593	310	295	0.95	26.8	54.0	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	297	DW-04-OB-4g	32	24	179	58	28	126	27	533	355	250	0.89	21.9	56.2	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	298	DW-04-OB-4h	31	27	183	56	30	126	25	589	339	253	1.04	26.7	59.2	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	299	DW-04-OB-4i	25	23	178	58	29	128	25	639	382	278	1.08	24.3	56.3	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	300	DW-04-OB-4j	38	24	176	59	25	125	26	533	307	246	0.93	26.4	58.2	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	301	DW-04-OB-4k	23	23	176	55	27	126	26	585	339	270	1.08	27.5	61.5	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 9	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	302	DW-04-OB-4l	27	27	178	59	27	123	24	523	380	236	0.84	19.3	53.9	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 8	4	4	9	3	7	1	88	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	303	DW-04-OB-4m	37	22	177	57	27	125	24	566	325	255	0.91	24.5	54.3	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 8	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	304	DW-04-OB-4n	35	25	177	55	29	124	23	496	291	272	0.89	26.8	60.0	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 8	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	305	DW-04-OB-4o	36	24	157	54	28	116	26	549	312	270	0.99	27.5	59.9	Obsidian Butte, NV, Variety 2
DW-04-OB-4			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Delamar Mountains:	306	DW-04-DM-1a	49	22	185	19	48	168	35	651	164	62	1.17	62.3	59.7	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	307	DW-04-DM-1b	39	26	183	16	47	167	34	627	178	57	1.28	62.2	67.4	Kane Springs Wash Caldera
DW-04-DM-1			± 8	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	308	DW-04-DM-1c	42	21	166	17	43	165	33	547	171	72	1.07	54.6	64.6	Kane Springs Wash Caldera
DW-04-DM-1			± 8	4	4	9	3	7	1	88	27	32	0.11			Variety 1, NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2O^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Delamar Mountains:	309	DW-04-DM-1d	48	23	186	18	48	168	35	703	203	48	1.30	55.2	61.6	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	310	DW-04-DM-1e	55	24	184	17	49	170	33	695	180	48	1.30	62.4	62.1	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	311	DW-04-DM-1f	42	25	185	18	52	175	36	677	268	57	1.31	42.0	64.3	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	28	32	0.11			Variety 1, NV
Delamar Mountains:	312	DW-04-DM-1g	60	25	184	17	51	191	33	679	191	49	1.33	60.3	65.0	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	313	DW-04-DM-1h	37	26	186	19	47	176	37	667	176	62	1.30	63.9	64.6	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	314	DW-04-DM-1i	35	26	182	17	50	169	36	689	194	31	1.33	59.3	64.2	Kane Springs Wash Caldera
DW-04-DM-1			± 8	4	4	9	3	7	1	89	27	37	0.11			Variety 1, NV
Delamar Mountains:	315	DW-04-DM-1j	45	15	182	17	49	167	36	632	229	60	1.15	43.7	60.8	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	316	DW-04-DM-1k	52	29	186	16	53	168	36	653	172	71	1.32	66.5	66.9	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	317	DW-04-DM-1l	59	28	186	17	44	170	36	646	178	46	1.24	60.1	63.5	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	318	DW-04-DM-1m	49	29	189	16	49	171	38	621	201	39	1.19	51.4	63.6	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	34	0.11			Variety 1, NV
Delamar Mountains:	319	DW-04-DM-1n	59	19	188	17	48	167	35	666	265	65	1.25	40.6	62.6	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	320	DW-04-DM-1o	47	23	184	16	49	167	36	686	183	41	1.20	57.3	58.5	Kane Springs Wash Caldera
DW-04-DM-1			± 7	4	4	9	3	7	1	89	27	34	0.11			Variety 1, NV
Delamar Mountains:	321	DW-04-DM-2a	43	19	185	17	49	175	35	583	205	53	1.27	53.2	71.7	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	322	DW-04-DM-2b	43	29	188	19	47	174	37	630	284	65	1.24	37.5	65.3	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	323	DW-04-DM-2c	65	26	182	19	49	169	40	560	167	49	1.11	58.1	65.5	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	324	DW-04-DM-2d	40	25	199	19	52	174	37	545	282	38	1.02	31.3	62.1	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	88	27	34	0.11			Variety 1, NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2} O$^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Delamar Mountains:	325	DW-04-DM-2e	47	22	181	17	44	161	34	1168	327	85	0.98	26.0	28.8	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	90	28	32	0.11			Variety 1, NV
Delamar Mountains:	326	DW-04-DM-2f	38	24	189	18	50	171	36	632	179	42	1.20	58.3	63.1	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	327	DW-04-DM-2g	43	25	191	19	52	178	36	677	302	62	1.27	36.2	62.5	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	28	32	0.11			Variety 1, NV
Delamar Mountains:	328	DW-04-DM-2h	69	19	189	17	52	170	34	589	180	68	1.16	56.3	65.5	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	329	DW-04-DM-2i	43	26	187	17	48	168	33	649	247	54	1.26	43.9	64.3	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	330	DW-04-DM-2j	37	23	182	17	50	169	34	1069	178	56	1.15	56.3	36.6	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	90	27	33	0.11			Variety 1, NV
Delamar Mountains:	331	DW-04-DM-2k	47	23	186	17	51	170	34	626	193	53	1.24	55.7	65.6	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	332	DW-04-DM-2l	40	26	189	15	50	171	37	636	227	51	1.27	48.2	66.2	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	333	DW-04-DM-2m	38	27	185	16	51	172	34	603	309	36	1.16	32.4	64.0	Kane Springs Wash Caldera
DW-04-DM-2			± 8	4	4	9	3	7	1	89	27	35	0.11			Variety 1, NV
Delamar Mountains:	334	DW-04-DM-2n	44	19	184	19	51	168	35	671	195	58	1.29	57.1	63.6	Kane Springs Wash Caldera
DW-04-DM-2			± 8	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	335	DW-04-DM-2o	49	25	188	17	50	173	35	689	205	64	1.33	55.8	64.0	Kane Springs Wash Caldera
DW-04-DM-2			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Obsidian Butte:	336	DW-04-OB-5a	19	16	151	118	22	158	17	781	302	701	1.08	31.1	46.9	Obsidian Butte, NV, Variety 5
DW-04-OB-5			±10	5	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	337	DW-04-OB-5b	47	31	163	131	19	167	21	898	510	766	1.13	19.0	42.6	Obsidian Butte, NV, Variety 5
DW-04-OB-5			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	338	DW-04-OB-5c	39	26	154	125	19	163	18	893	324	740	1.10	29.3	41.7	Obsidian Butte, NV, Variety 5
DW-04-OB-5			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	339	DW-04-OB-5d	39	26	151	124	22	159	18	920	354	753	1.17	28.4	42.9	Obsidian Butte, NV, Variety 5
DW-04-OB-5			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	340	DW-04-OB-5e	41	23	150	117	22	163	18	715	294	695	0.90	26.7	42.7	Obsidian Butte, NV, Variety 5
DW-04-OB-5			± 7	4	4	9	3	7	1	89	27	32	0.11			(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	341	DW-04-OB-6a	48	28	162	129	18	162	18	803	313	749	0.98	27.1	41.4	Obsidian Butte, NV, Variety 5
DW-04-OB-6			± 7	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	342	DW-04-OB-6a	46	24	134	112	21	150	18	671	303	727	0.82	23.9	41.9	Obsidian Butte, NV, Variety 5
DW-04-OB-6			± 7	4	4	9	3	7	1	89	27	32	0.11			(Unknown C)
Obsidian Butte:	343	DW-04-OB-6c	34	27	152	126	22	162	21	843	454	763	1.03	19.6	41.5	Obsidian Butte, NV, Variety 5
DW-04-OB-6			± 8	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	344	DW-04-OB-6d	41	22	161	124	20	168	21	842	305	750	1.04	29.5	41.8	Obsidian Butte, NV, Variety 5
DW-04-OB-6			± 7	4	4	9	3	7	1	90	27	32	0.11			(Unknown C)
Obsidian Butte:	345	DW-04-OB-6e	45	25	150	122	20	161	22	911	336	752	1.17	29.8	43.3	Obsidian Butte, NV, Variety 5
DW-04-OB-6			± 7	4	4	9	3	7	1	90	28	32	0.11			(Unknown C)
Obsidian Butte:	346	DW-04-OB-7a	51	21	170	83	25	146	25	643	421	462	0.99	20.4	51.9	Obsidian Butte, NV, Variety 3
DW-04-OB-7			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	347	DW-04-OB-7b	52	25	172	85	26	148	20	718	318	478	1.05	28.5	49.1	Obsidian Butte, NV, Variety 3
DW-04-OB-7			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	348	DW-04-OB-7c	36	25	167	83	23	142	21	708	363	432	1.03	24.6	49.1	Obsidian Butte, NV, Variety 3
DW-04-OB-7			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	349	DW-04-OB-7d	36	24	181	87	27	151	24	674	338	458	1.05	27.0	52.5	Obsidian Butte, NV, Variety 3
DW-04-OB-7			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	350	DW-04-OB-7e	31	27	167	82	26	143	23	672	409	476	1.11	23.4	55.4	Obsidian Butte, NV, Variety 3
DW-04-OB-7			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	351	DW-04-OB-8a	35	22	158	83	29	145	22	741	481	504	1.19	21.2	53.9	Obsidian Butte, NV, Variety 3
DW-04-OB-8			± 8	5	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	352	DW-04-OB-8b	29	22	164	89	24	153	24	665	291	491	1.01	30.1	50.9	Obsidian Butte, NV, Variety 3
DW-04-OB-8			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	353	DW-04-OB-8c	46	31	175	95	29	153	24	551	245	481	0.90	32.3	55.0	Obsidian Butte, NV, Variety 3
DW-04-OB-8			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	354	DW-04-OB-8d	38	23	162	87	25	153	25	729	426	526	1.15	23.1	52.8	Obsidian Butte, NV, Variety 3
DW-04-OB-8			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	355	DW-04-OB-8e	30	23	169	87	24	150	23	747	323	482	1.10	29.5	49.6	Obsidian Butte, NV, Variety 3
DW-04-OB-8			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	356	DW-04-OB-9a	33	27	157	55	22	135	21	582	293	249	0.88	26.3	51.0	Obsidian Butte, NV, Variety 2
DW-04-OB-9			± 8	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	357	DW-04-OB-9b	27	29	159	54	21	134	21	752	348	275	0.96	24.0	43.4	Obsidian Butte, NV, Variety 2
DW-04-OB-9			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	358	DW-04-OB-9c	36	21	165	53	20	127	20	791	364	269	0.88	21.1	38.0	Obsidian Butte, NV, Variety 2
DW-04-OB-9			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	359	DW-04-OB-9d	33	28	163	56	23	124	22	689	319	272	0.87	24.0	43.2	Obsidian Butte, NV, Variety 2
DW-04-OB-9			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	360	DW-04-OB-9e	43	32	162	52	22	128	22	763	433	284	0.98	19.6	43.5	Obsidian Butte, NV, Variety 2
DW-04-OB-9			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	361	DW-04-OB-10a	30	27	149	15	26	153	27	249	226	4	0.51	21.0	67.9	Obsidian Butte, NV, Variety 1
DW-04-OB-10			± 9	4	4	9	3	7	1	88	27	31	0.11			
Obsidian Butte:	362	DW-04-OB-10b	51	29	165	14	27	165	26	546	413	27	1.00	20.9	60.9	Obsidian Butte, NV, Variety 1
DW-04-OB-10			± 7	4	4	9	3	7	1	88	28	47	0.11			
Obsidian Butte:	363	DW-04-OB-10c	44	25	156	17	26	170	27	NM	NM	26	NM	20.2	68.2	Obsidian Butte, NV, Variety 1
DW-04-OB-10			± 8	4	4	9	3	7	1	NM	NM	63	NM			
Obsidian Butte:	364	DW-04-OB-10d	51	22	167	15	26	156	29	NM	NM	0	NM	20.3	79.4	Obsidian Butte, NV, Variety 1
DW-04-OB-10			± 7	4	4	9	3	7	1	NM	NM	31	NM			
Obsidian Butte:	365	DW-04-OB-10e	36	22	158	16	24	157	30	398	363	23	0.83	20.0	68.9	Obsidian Butte, NV, Variety 1
DW-04-OB-10			± 8	4	4	9	3	7	1	88	28	31	0.11			
Obsidian Butte:	366	DW-04-OB-10f	53	29	182	16	23	161	31	NM	NM	27	NM	21.1	74.3	Obsidian Butte, NV, Variety 1
DW-04-OB-10			±13	7	5	9	3	7	2	NM	NM	67	NM			
Obsidian Butte:	367	DW-04-OB-10g	52	26	171	14	29	162	29	NM	NM	37	NM	19.2	63.9	Obsidian Butte, NV, Variety 1
DW-04-OB-10			± 8	5	4	9	3	7	1	NM	NM	38	NM			
Obsidian Butte:	368	DW-04-OB-11a	38	26	159	54	23	129	23	674	343	252	0.96	24.3	48.2	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	369	DW-04-OB-11b	40	23	163	53	19	124	16	708	338	260	0.93	24.1	44.8	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	370	DW-04-OB-11c	28	20	161	55	21	130	20	730	428	263	0.98	19.8	45.5	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	371	DW-04-OB-11d	45	25	152	46	23	130	21	659	298	283	0.88	25.8	45.3	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 7	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	372	DW-04-OB-11e	35	24	151	52	19	124	22	692	390	277	0.96	21.4	46.9	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	373	DW-04-OB-11f	40	26	168	54	21	129	21	675	320	247	0.87	24.0	44.1	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	374	DW-04-OB-11g	29	27	150	53	21	122	21	726	366	289	1.00	23.8	46.7	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	375	DW-04-OB-11h	41	27	166	56	20	127	20	774	358	275	1.01	24.5	44.3	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	376	DW-04-OB-11i	25	22	145	52	18	126	20	637	370	254	0.86	20.4	45.9	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	377	DW-04-OB-11j	32	25	142	48	20	125	23	636	323	249	0.89	24.1	47.4	Obsidian Butte, NV, Variety 2
DW-04-OB-11			± 8	4	4	9	3	7	1	89	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	378	DW-04-OB-12a	34	25	142	51	22	118	20	505	282	261	0.68	21.5	45.8	Obsidian Butte, NV, Variety 2
DW-04-OB-12			± 8	4	4	9	3	7	1	88	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	379	DW-04-OB-12b	28	24	144	50	21	119	19	786	396	294	1.04	22.7	44.8	Obsidian Butte, NV, Variety 2
DW-04-OB-12			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	380	DW-04-OB-12c	31	24	158	59	19	128	22	755	422	289	1.05	21.4	46.8	Obsidian Butte, NV, Variety 2
DW-04-OB-12			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	381	DW-04-OB-12d	31	25	164	55	22	126	21	611	488	245	0.79	14.2	43.9	Obsidian Butte, NV, Variety 2
DW-04-OB-12			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	382	DW-04-OB-12e	48	27	167	59	21	123	22	684	341	261	0.94	23.9	46.4	Obsidian Butte, NV, Variety 2
DW-04-OB-12			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	383	DW-04-OB-13a	36	21	175	84	25	147	23	587	347	459	0.97	24.3	55.5	Obsidian Butte, NV, Variety 3
DW-04-OB-13			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	384	DW-04-OB-13b	43	22	170	83	27	144	26	619	358	442	1.05	25.3	56.6	Obsidian Butte, NV, Variety 3
DW-04-OB-13			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	385	DW-04-OB-13c	30	19	175	83	25	147	23	704	323	449	1.14	30.3	54.1	Obsidian Butte, NV, Variety 3
DW-04-OB-13			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	386	DW-04-OB-13d	35	25	178	87	25	145	27	641	288	438	0.93	28.3	49.1	Obsidian Butte, NV, Variety 3
DW-04-OB-13			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	387	DW-04-OB-13e	35	24	164	82	23	141	25	587	378	428	1.02	23.2	57.8	Obsidian Butte, NV, Variety 3
DW-04-OB-13			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	388	DW-04-OB-14a	31	27	177	87	24	146	25	665	436	472	1.08	21.3	54.3	Obsidian Butte, NV, Variety 3
DW-04-OB-14			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3^T}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	389	DW-04-OB-14b	25	24	172	85	25	144	22	693	346	445	1.14	28.3	55.0	Obsidian Butte, NV, Variety 3
DW-04-OB-14			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	390	DW-04-OB-14c	40	19	172	84	29	143	23	671	315	451	1.04	28.8	52.3	Obsidian Butte, NV, Variety 3
DW-04-OB-14			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	391	DW-04-OB-14d	36	31	168	85	27	145	24	634	302	438	0.98	28.2	51.7	Obsidian Butte, NV, Variety 3
DW-04-OB-14			± 7	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	392	DW-04-OB-14e	30	28	159	79	27	140	25	564	251	477	0.88	30.9	52.6	Obsidian Butte, NV, Variety 3
DW-04-OB-14			± 8	4	4	9	3	7	1	89	27	32	0.11			(Obsidian Butte)
Obsidian Butte:	393	DW-04-OB-15a	37	27	171	85	24	145	23	734	336	455	1.17	29.8	53.3	Obsidian Butte, NV, Variety 3
DW-04-OB-15			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	394	DW-04-OB-15b	56	24	162	82	25	142	21	614	389	454	1.00	22.2	54.5	Obsidian Butte, NV, Variety 3
DW-04-OB-15			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	395	DW-04-OB-15c	40	22	168	81	27	143	23	683	393	472	1.20	26.1	58.5	Obsidian Butte, NV, Variety 3
DW-04-OB-15			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	396	DW-04-OB-15d	43	22	181	88	25	149	25	707	325	408	1.11	29.4	52.5	Obsidian Butte, NV, Variety 3
DW-04-OB-15			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	397	DW-04-OB-15e	43	17	169	85	23	144	24	593	416	430	0.93	19.4	52.6	Obsidian Butte, NV, Variety 3
DW-04-OB-15			± 8	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	398	DW-04-OB-16a	32	28	154	54	20	123	18	753	459	265	0.99	18.7	44.6	Obsidian Butte, NV, Variety 2
DW-04-OB-16			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	399	DW-04-OB-16b	23	24	162	56	23	125	18	635	463	267	0.85	16.1	45.7	Obsidian Butte, NV, Variety 2
DW-04-OB-16			± 8	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	400	DW-04-OB-16c	36	24	162	54	22	124	19	689	402	267	0.96	20.7	47.2	Obsidian Butte, NV, Variety 2
DW-04-OB-16			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	401	DW-04-OB-16d	36	24	155	52	17	124	19	1008	312	269	0.84	23.8	29.0	Obsidian Butte, NV, Variety 2
DW-04-OB-16			± 8	4	4	9	3	7	1	90	27	32	0.11			(Airfield Canyon)
Obsidian Butte:	402	DW-04-OB-16e	48	20	160	52	21	130	19	701	385	252	1.05	23.5	50.3	Obsidian Butte, NV, Variety 2
DW-04-OB-16			± 7	4	4	9	3	7	1	89	28	32	0.11			(Airfield Canyon)
Obsidian Butte:	403	DW-04-OB-17a	39	25	164	89	24	153	22	705	341	492	1.08	27.4	51.7	Obsidian Butte, NV, Variety 3
DW-04-OB-17			± 7	4	4	9	3	7	1	89	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	404	DW-04-OB-17b	34	29	165	89	25	153	20	788	371	533	1.18	27.2	50.1	Obsidian Butte, NV, Variety 3
DW-04-OB-17			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\text{T}}$	Fe:Mn	Fe:Ti	Geochemical Source
Obsidian Butte:	405	DW-04-OB-17c	45	25	165	102	26	164	23	856	319	620	1.18	31.7	46.3	Obsidian Butte, NV, Variety 4
DW-04-OB-17			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	406	DW-04-OB-17d	37	27	165	103	26	161	21	799	327	588	1.15	30.3	48.5	Obsidian Butte, NV, Variety 4
DW-04-OB-17			± 8	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
Obsidian Butte:	407	DW-04-OB-17e	36	25	169	101	24	163	22	752	331	567	1.10	28.7	49.3	Obsidian Butte, NV, Variety 4
DW-04-OB-17			± 7	4	4	9	3	7	1	90	28	32	0.11			(Obsidian Butte)
South Pahroc Range:	408	DW-04-SP-1a	45	30	192	114	27	100	26	1007	498	506	0.71	12.6	24.8	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	90	28	32	0.11			
South Pahroc Range:	409	DW-04-SP-1b	35	30	195	110	32	100	25	560	423	491	0.62	13.2	38.6	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	89	28	32	0.11			
South Pahroc Range:	410	DW-04-SP-1c	28	23	180	104	28	93	23	1085	518	476	0.71	12.1	23.0	South Pahroc, NV
DW-04-SP-1			± 8	4	4	9	3	7	1	90	28	32	0.11			
South Pahroc Range:	411	DW-04-SP-1d	51	29	197	114	26	100	23	1425	408	497	0.67	14.6	16.7	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	91	28	32	0.11			
South Pahroc Range:	412	DW-04-SP-1e	40	30	187	109	28	98	25	597	554	478	0.77	12.2	43.8	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	89	28	32	0.11			
South Pahroc Range:	413	DW-04-SP-1f	53	39	218	127	33	108	28	645	469	464	0.72	13.6	38.3	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	89	28	32	0.11			
South Pahroc Range:	414	DW-04-SP-1g	33	25	186	108	28	100	22	695	533	515	0.87	14.3	42.9	South Pahroc, NV
DW-04-SP-1			± 8	4	4	9	3	7	1	89	28	32	0.11			
South Pahroc Range:	415	DW-04-SP-1h	41	22	182	105	30	98	21	1038	459	484	0.67	13.1	23.0	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	90	28	32	0.11			
South Pahroc Range:	416	DW-04-SP-1i	44	27	183	110	28	95	23	1059	449	484	0.72	14.2	23.8	South Pahroc, NV
DW-04-SP-1			± 7	4	4	9	3	7	1	90	28	32	0.11			
South Pahroc Range:	417	DW-04-SP-1j	36	26	175	102	27	95	23	1050	458	485	0.64	12.6	21.8	South Pahroc, NV
DW-04-SP-1			± 8	4	4	9	3	7	1	90	28	32	0.11			
Goldfield Hills:	418	26-NY-10827a	59	27	271	8	49	220	61	450	758	0	1.32	14.8	95.3	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	88	28	31	0.11			
Goldfield Hills:	419	26-NY-10827b	69	23	258	6	47	212	62	949	728	0	1.21	14.1	42.9	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	89	28	31	0.11			
Goldfield Hills:	420	26-NY-10827c	66	23	287	6	47	223	68	404	690	0	1.18	14.6	94.5	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	88	28	31	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Goldfield Hills:	421	26-NY-10827d	79	24	297	6	50	235	66	446	761	0	1.32	14.7	95.6	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	88	28	31	0.11			
Goldfield Hills:	422	26-NY-10827e	65	28	266	7	42	215	64	874	735	0	1.20	13.9	46.2	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	89	28	31	0.11			
Goldfield Hills:	423	26-NY-10827f	68	26	263	6	46	208	60	826	729	0	1.15	13.4	46.8	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	89	28	31	0.11			
Goldfield Hills:	424	26-NY-10827g	62	27	270	6	48	229	63	734	715	0	1.09	13.1	50.0	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	89	28	31	0.11			
Goldfield Hills:	425	26-NY-10827h	66	28	267	7	50	221	61	904	745	0	1.21	13.8	45.2	Goldfield Hills, NV
26NY10827			± 7	4	4	9	3	7	1	89	28	31	0.11			
Monte Cristo Range:	426	DW-04-MCR-1a	29	19	203	11	22	110	30	1338	335	17	0.58	15.7	15.7	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	90	28	31	0.11			
Monte Cristo Range:	427	DW-04-MCR-1b	28	21	210	13	22	94	31	779	443	0	0.57	11.8	26.2	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	89	28	31	0.11			
Monte Cristo Range:	428	DW-04-MCR-1c	23	22	205	11	24	90	35	564	381	0	0.65	15.4	40.1	Crow Spring, CA
DW-04-MCR-1			± 8	4	4	9	3	7	1	88	28	31	0.11			
Monte Cristo Range:	429	DW-04-MCR-1d	28	25	207	12	22	90	30	537	403	7	0.67	14.8	42.8	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	88	28	31	0.11			
Monte Cristo Range:	430	DW-04-MCR-1e	16	21	184	10	24	87	27	900	285	0	0.39	13.2	16.4	Crow Spring, CA
DW-04-MCR-1			±10	4	4	9	3	7	1	89	27	31	0.11			
Monte Cristo Range:	431	DW-04-MCR-1f	18	20	201	12	23	95	31	999	383	0	0.65	15.2	23.0	Crow Spring, CA
DW-04-MCR-1			± 9	4	4	9	3	7	1	89	28	31	0.11			
Monte Cristo Range:	432	DW-04-MCR-1g	33	20	202	13	20	93	33	879	364	0	0.45	11.7	19.0	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	89	27	31	0.11			
Monte Cristo Range:	433	DW-04-MCR-1h	32	18	204	14	23	95	29	528	395	13	0.64	14.5	41.8	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	88	28	31	0.11			
Monte Cristo Range:	434	DW-04-MCR-1i	24	28	231	12	25	100	32	1062	375	24	0.56	13.7	19.1	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	89	28	178	0.11			
Monte Cristo Range:	435	DW-04-MCR-1j	32	21	214	15	26	95	35	409	309	20	0.52	15.6	44.3	Crow Spring, CA
DW-04-MCR-1			± 7	4	4	9	3	7	1	88	27	31	0.11			
Delamar Mountains:	436	DW-04-DM-4a	41	23	189	16	53	170	34	524	152	68	1.11	64.3	70.1	Kane Springs Wash Caldera
DW-04-DM-4			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Delamar Mountains:	437	DW-04-DM-4b	34	23	178	15	47	170	33	1057	259	45	1.19	39.7	38.2	Kane Springs Wash Caldera
DW-04-DM-4			± 8	4	4	9	3	7	1	89	28	33	0.11			Variety 1, CA
Delamar Mountains:	438	DW-04-DM-4c	57	20	172	17	50	165	35	964	246	63	0.97	34.6	34.6	Kane Springs Wash Caldera
DW-04-DM-4			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, CA
Delamar Mountains:	439	DW-04-DM-4d	54	21	185	18	51	180	34	885	259	43	1.09	36.6	41.9	Kane Springs Wash Caldera
DW-04-DM-4			± 7	4	4	9	3	7	1	89	27	34	0.11			Variety 1, CA
Delamar Mountains:	440	DW-04-DM-4e	56	24	162	16	44	160	34	565	192	33	1.07	48.7	62.9	Kane Springs Wash Caldera
DW-04-DM-4			± 7	4	4	9	3	7	1	88	27	37	0.11			Variety 1, CA
Delamar Mountains:	441	DW-04-DM-5a	42	21	171	16	46	161	31	923	308	26	0.95	26.9	35.3	Kane Springs Wash Caldera
DW-04-DM-5			± 8	4	4	9	3	7	1	89	27	63	0.11			Variety 1, CA
Delamar Mountains:	442	DW-04-DM-5b	47	28	190	18	51	168	34	1035	184	47	1.26	59.3	41.1	Kane Springs Wash Caldera
DW-04-DM-5			± 7	4	4	9	3	7	1	90	27	33	0.11			Variety 1, CA
Delamar Mountains:	443	DW-04-DM-5c	45	22	187	18	51	177	32	578	166	53	1.12	59.4	64.6	Kane Springs Wash Caldera
DW-04-DM-5			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, CA
Delamar Mountains:	444	DW-04-DM-5d	44	24	186	18	49	167	32	734	175	53	1.28	63.5	58.3	Kane Springs Wash Caldera
DW-04-DM-5			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, CA
Delamar Mountains:	445	DW-04-DM-5e	60	25	194	19	52	177	39	566	179	65	1.15	55.9	67.0	Kane Springs Wash Caldera
DW-04-DM-5			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, CA
Delamar Mountains:	446	DW-04-DM-6a	51	25	177	16	51	164	33	1044	161	59	1.11	60.7	36.3	Kane Springs Wash Caldera
DW-04-DM-6			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, CA
Delamar Mountains:	447	DW-04-DM-6b	42	27	178	16	48	169	36	1146	161	43	1.12	60.7	33.3	Kane Springs Wash Caldera
DW-04-DM-6			± 8	4	4	9	3	7	1	90	27	34	0.11			Variety 1, CA
Delamar Mountains:	448	DW-04-DM-6c	53	20	177	15	47	165	34	1230	142	43	1.05	65.4	29.3	Kane Springs Wash Caldera
DW-04-DM-6			± 7	4	4	9	3	7	1	90	27	34	0.11			Variety 1, CA
Delamar Mountains:	449	DW-04-DM-6d	52	20	182	16	50	172	35	1356	143	79	1.02	62.8	25.8	Kane Springs Wash Caldera
DW-04-DM-6			± 7	4	4	9	3	7	1	90	27	32	0.11			Variety 1, CA
Delamar Mountains:	450	DW-04-DM-7a	34	22	181	17	46	169	36	1019	172	53	1.23	62.1	40.8	Kane Springs Wash Caldera
DW-04-DM-7			± 8	4	4	9	3	7	1	89	27	33	0.11			Variety 1, CA
Delamar Mountains:	451	DW-04-DM-7b	44	17	183	21	49	169	35	807	203	63	1.15	49.0	47.9	Kane Springs Wash Caldera
DW-04-DM-7			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, CA
Delamar Mountains:	452	DW-04-DM-7c	49	33	316	6	83	126	59	694	281	0	1.02	31.6	49.6	Delamar Range A, NV
DW-04-DM-7			± 7	4	4	9	3	7	2	89	27	31	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Delamar Mountains:	453	DW-04-DM-7d	45	23	185	16	50	170	35	1012	253	54	1.19	40.5	39.8	Kane Springs Wash Caldera
DW-04-DM-7			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	454	DW-04-DM-7e	46	23	186	17	52	175	34	1045	173	79	1.20	60.5	39.0	Kane Springs Wash Caldera
DW-04-DM-7			± 7	4	4	9	3	7	1	90	27	32	0.11			Variety 1, NV
Delamar Mountains:	455	DW-04-DM-8a	39	25	197	15	49	176	34	953	280	54	1.21	37.2	42.9	Kane Springs Wash Caldera
DW-04-DM-8			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	456	DW-04-DM-8b	43	23	184	19	48	169	36	965	174	63	1.11	55.9	39.2	Kane Springs Wash Caldera
DW-04-DM-8			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	457	DW-04-DM-8c	46	23	177	16	46	164	35	839	263	41	1.05	34.7	42.5	Kane Springs Wash Caldera
DW-04-DM-8			± 8	4	4	9	3	7	1	89	27	34	0.11			Variety 1, NV
Delamar Mountains:	458	DW-04-DM-8d	41	26	179	19	49	167	35	577	183	57	1.23	58.5	70.6	Kane Springs Wash Caldera
DW-04-DM-8			± 8	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	459	DW-04-DM-8e	36	21	179	17	45	162	32	1155	164	70	1.03	55.4	30.7	Kane Springs Wash Caldera
DW-04-DM-8			± 7	4	4	9	3	7	1	90	27	32	0.11			Variety 1, NV
Delamar Mountains:	460	DW-04-DM-9a	49	24	187	19	47	165	33	1109	198	55	1.07	47.1	33.0	Kane Springs Wash Caldera
DW-04-DM-9			± 7	4	4	9	3	7	1	90	27	33	0.11			Variety 1, NV
Delamar Mountains:	461	DW-04-DM-9b	45	29	194	19	50	172	35	987	163	69	1.07	57.6	36.8	Kane Springs Wash Caldera
DW-04-DM-9			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	462	DW-04-DM-9c	45	25	180	18	48	168	33	992	219	53	0.93	37.2	32.1	Kane Springs Wash Caldera
DW-04-DM-9			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	463	DW-04-DM-9d	41	25	192	17	53	174	35	693	195	63	1.31	58.0	62.6	Kane Springs Wash Caldera
DW-04-DM-9			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	464	DW-04-DM-9e	42	26	179	16	50	169	32	1175	228	45	1.19	45.3	34.5	Kane Springs Wash Caldera
DW-04-DM-9			± 7	4	4	9	3	7	1	90	27	33	0.11			Variety 1, NV
Delamar Mountains:	465	DW-04-DM-10a	44	19	184	17	49	169	33	486	147	32	0.93	56.3	63.9	Kane Springs Wash Caldera
DW-04-DM-10			± 7	4	4	9	3	7	1	88	27	38	0.11			Variety 1, NV
Delamar Mountains:	466	DW-04-DM-10b	56	21	186	17	49	174	37	641	191	67	1.26	56.8	65.0	Kane Springs Wash Caldera
DW-04-DM-10			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	467	DW-04-DM-10c	51	25	193	19	48	176	37	670	303	49	1.21	34.4	60.2	Kane Springs Wash Caldera
DW-04-DM-10			± 7	4	4	9	3	7	1	89	28	33	0.11			Variety 1, NV
Delamar Mountains:	468	DW-04-DM-10d	44	18	187	17	49	167	35	1103	278	61	1.13	35.2	35.0	Kane Springs Wash Caldera
DW-04-DM-10			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
Delamar Mountains:	469	DW-04-DM-10e	49	25	181	17	47	169	37	936	280	82	1.12	34.6	40.6	Kane Springs Wash Caldera
DW-04-DM-10			± 7	4	4	9	3	7	1	89	28	32	0.11			Variety 1, NV
Delamar Mountains:	470	DW-04-DM-11a	28	22	207	34	36	142	26	643	302	187	1.16	33.2	60.2	Kane Springs Wash Caldera
DW-04-DM-11			± 8	4	4	9	3	7	1	89	28	32	0.11			Variety 2 (Kane Springs)
Delamar Mountains:	471	DW-04-DM-11b	26	19	205	33	40	142	25	876	303	179	0.83	24.0	32.6	Kane Springs Wash Caldera
DW-04-DM-11			± 8	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	472	DW-04-DM-11c	45	27	195	42	36	153	28	1051	223	237	1.21	47.1	39.1	Kane Springs Wash Caldera
DW-04-DM-11			± 7	4	4	9	3	7	1	90	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	473	DW-04-DM-11d	43	26	183	31	33	133	25	570	212	201	1.04	42.9	61.0	Kane Springs Wash Caldera
DW-04-DM-11			± 8	4	4	9	3	7	1	88	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	474	DW-04-DM-11e	42	24	188	18	47	175	37	623	177	59	1.16	57.0	61.7	Kane Springs Wash Caldera
DW-04-DM-11			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Meadow Valley Mts:	475	DW-04-MVM-1a	29	22	187	22	32	129	22	483	208	53	1.11	46.4	75.7	Meadow Valley Mountains A,
DW-04-MVM-1			± 8	4	4	9	3	7	1	88	27	33	0.11			NV
Meadow Valley Mts:	476	DW-04-MVM-1b	33	18	185	21	32	130	21	919	193	79	1.04	47.1	38.5	Meadow Valley Mountains A,
DW-04-MVM-1			± 7	4	4	9	3	7	1	89	27	32	0.11			NV
Meadow Valley Mts:	477	DW-04-MVM-1c	47	25	281	21	63	124	47	890	190	18	0.94	43.7	36.3	Meadow Valley Mountains C,
DW-04-MVM-1			± 7	4	4	9	3	7	1	89	27	31	0.11			NV
Meadow Valley Mts:	478	DW-04-MVM-1d	45	27	182	16	48	173	37	NM	NM	NM	NM	62.5	68.3	Kane Springs Wash Caldera
DW-04-MVM-1			± 7	4	4	9	3	7	1	NM	NM	NM	NM			Variety 1, NV
Meadow Valley Mts:	479	DW-04-MVM-1e	64	27	205	21	52	181	35	NM	NM	NM	NM	58.1	68.6	Kane Springs Wash Caldera
DW-04-MVM-1			± 7	4	4	9	3	7	1	NM	NM	NM	NM			Variety 1, NV
Meadow Valley Mts:	480	DW-04-MVM-2a	55	26	187	19	53	171	38	863	152	57	1.01	58.7	39.8	Kane Springs Wash Caldera
DW-04-MVM-2			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Meadow Valley Mts:	481	DW-04-MVM-2b	59	22	193	27	49	165	35	901	209	36	1.27	52.5	47.6	Meadow Valley Mountains B,
DW-04-MVM-2			± 7	4	4	9	3	7	1	89	27	34	0.11			NV
Meadow Valley Mts:	482	DW-04-MVM-2c	62	33	418	4	83	118	56	691	240	0	0.95	34.8	46.7	Meadow Valley Mountains D,
DW-04-MVM-2			± 7	4	4	9	3	7	1	88	27	31	0.11			NV
Meadow Valley Mts:	483	DW-04-MVM-3a	38	23	186	16	49	167	36	993	216	63	1.08	43.7	37.1	Kane Springs Wash Caldera
DW-04-MVM-3			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Meadow Valley Mts:	484	DW-04-MVM-3b	44	26	184	16	49	172	33	1040	154	8	1.08	61.8	35.4	Kane Springs Wash Caldera
DW-04-MVM-3			± 7	4	4	9	3	7	1	89	27	31	0.11			Variety 1, NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1-1. Results of XRF Studies: Nevada Test and Training Range Region Obsidian Sources, Nevada and California

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2 O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
Meadow Valley Mts:	485	DW-04-MVM-3c	37	18	196	41	37	152	28	962	252	243	1.12	38.4	39.5	Kane Springs Wash Caldera
DW-04-MVM-3			± 8	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	486	DW-04-DM-12a	43	22	212	34	35	142	26	686	248	183	1.27	43.9	61.3	Kane Springs Wash Caldera
DW-04-DM-12			± 8	5	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	487	DW-04-DM-12b	20	26	215	34	37	143	30	678	233	185	1.24	46.0	61.0	Kane Springs Wash Caldera
DW-04-DM-12			±10	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	488	DW-04-DM-12c	29	20	194	32	39	138	27	566	314	192	1.00	27.6	59.0	Kane Springs Wash Caldera
DW-04-DM-12			± 8	4	4	9	3	7	1	88	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	489	DW-04-DM-12d	43	18	228	38	39	148	30	665	227	174	1.19	45.4	59.8	Kane Springs Wash Caldera
DW-04-DM-12			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	490	DW-04-DM-12e	31	23	208	35	40	145	26	748	248	203	1.27	44.1	56.8	Kane Springs Wash Caldera
DW-04-DM-12			± 8	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	491	DW-04-DM-13a	54	26	175	17	48	168	33	568	272	36	1.22	38.5	70.7	Kane Springs Wash Caldera
DW-04-DM-13			± 8	4	4	9	3	7	1	89	28	35	0.11			Variety 1, NV
Delamar Mountains:	492	DW-04-DM-13Aa	39	29	183	16	51	175	38	621	177	47	1.20	58.9	64.0	Kane Springs Wash Caldera
DW-04-DM-13A			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	493	DW-04-DM-13Ab	57	27	183	19	51	172	37	604	184	45	1.20	56.5	65.9	Kane Springs Wash Caldera
DW-04-DM-13A			± 7	4	4	9	3	7	1	89	27	33	0.11			Variety 1, NV
Delamar Mountains:	494	DW-04-DM-14a	48	25	192	16	51	176	35	650	195	62	1.28	56.4	65.1	Kane Springs Wash Caldera
DW-04-DM-14			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 1, NV
Delamar Mountains:	495	DW-04-DM-14b	49	27	197	17	50	175	36	705	218	36	1.26	49.8	59.5	Kane Springs Wash Caldera
DW-04-DM-14			± 7	4	4	9	3	7	1	89	27	35	0.11			Variety 1, NV
Delamar Mountains:	496	DW-04-DM-15a	50	26	220	44	39	150	27	607	241	218	1.06	38.3	58.5	Kane Springs Wash Caldera
DW-04-DM-15			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	497	DW-04-DM-15b	31	27	207	44	40	157	25	698	188	239	1.11	51.4	53.3	Kane Springs Wash Caldera
DW-04-DM-15			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	498	DW-04-DM-15c	30	26	197	41	37	156	28	494	174	224	0.89	45.1	60.1	Kane Springs Wash Caldera
DW-04-DM-15			± 8	4	4	9	3	7	1	88	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	499	DW-04-DM-15d	30	23	194	41	34	152	25	626	190	247	1.03	47.2	54.9	Kane Springs Wash Caldera
DW-04-DM-15			± 8	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV
Delamar Mountains:	500	DW-04-DM-15e	44	25	209	44	37	158	26	772	211	265	1.22	50.2	53.1	Kane Springs Wash Caldera
DW-04-DM-15			± 7	4	4	9	3	7	1	89	27	32	0.11			Variety 2 (Kane Springs), NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Appendix A-2

Obsidian Source Sampling Locations

APPENDIX A-2

Obsidian Source Sampling Locations

Table A-2-1. Locations of obsidian source specimens selected for trace element analysis. Table is continued on next page.

Sample No.	Source Area	Longitude	Latitude	Elevation (ft)	USGS Map 7.5	Primary/Secondary	Artifact Quality?
HO1-15	Obsidian Butte (NV)			5560	Tolicha Peak SW	Primary	Yes
HO1-16	Obsidian Butte (NV)			5520	Tolicha Peak	Primary	Yes
HO1-17	Obsidian Butte (NV)			5680	Tolicha Peak	Primary	Yes
HO1-18	Obsidian Butte (NV)			5257	Tolicha Peak	Primary	Yes
HO1-19	Obsidian Butte (NV)			5544	Tolicha Peak	Primary	Yes
HO1-20	Obsidian Butte (NV)			5440	Tolicha Peak	Primary	Yes
HO1-21	Obsidian Butte (NV)			5231	Tolicha Peak	Primary	Yes
HO1-22	Obsidian Butte (NV)			5198	Tolicha Peak	Primary	Yes
HO1-23	Obsidian Butte (NV)			5588	Tolicha Peak	Primary	Yes
HO1-24	Obsidian Butte (NV)			5046	Tolicha Peak	Primary	Yes
HO1-25	Obsidian Butte (NV)			5036	Tolicha Peak	Primary	Yes
HO1-26	Obsidian Butte (NV)			5296	Tolicha Peak SW	Primary	Yes
HO1-27	Obsidian Butte (NV)			5606	Tolicha Peak SW	Primary	Yes
HO3-28	Tempiute Range (NV)			5404	Tempiute Mt. North	Primary	Yes

Table A-2-1 (continued). Locations of obsidian source specimens selected for trace element analysis. Table is continued on next page.

Sample No.	Source Area	Longitude	Latitude	Elevation (ft)	USGS Map 7.5	Primary/Secondary	Artifact Quality?
HO3-29	Delamar Range (NV)			5692	South of Gregerson Basin	Primary	No
HO3-30	Delamar Range (NV)			4997	South of Delamar Lake	Secondary	Yes
HO3-30A	Kane Springs Wash (NV)			2723	Wildcat Wash NW	Secondary	Yes
HO3-31	Oak Spring Butte (NV)			6383	Oak Spring	Primary	Yes
HO3-32	Oak Spring Butte (NV)			6461	Oak Spring	Primary	Yes
HO3-33	Kawich Range (NV)			6172	Apache Tear Canyon	Primary	No
HO3-34	Kawich Range (NV)			5637	Apache Tear Canyon	Secondary	Yes
HO3-35	Shoshone Mountain (CA)			6660	Topopah Spring	Primary	Yes
HO3-36	Obsidian Butte (NV)			5641	Tolicha Peak SW	Primary	Yes
HO3-37	Obsidian Butte (NV)			5613	Tolicha Peak SW	Primary	Yes
HO3-38	Obsidian Butte (NV)			5801	Tolicha Peak SW	Primary	Yes
HO3-39	Stonewall Canyon (NV)			4632	Tolicha Peak NW	Secondary	Yes
HO3-40	Stonewall Canyon (NV)			4732	Tolicha Peak NW	Secondary	Yes
HO3-42	Stonewall Canyon (NV)			4870	Tolicha Peak NW	Secondary	Yes
HO3-43	Resting Spring Range (CA)			2338	Resting Spring	Primary	No
HO3-44	Devil Peak East (NV)			3397	State Line Pass	Primary	Yes

Table A-2-1 (continued). Locations of obsidian source specimens selected for trace element analysis. Table is continued on next page.

Sample No.	**Source Area**	**Longitude**	**Latitude**	**Elevation (ft)**	**USGS Map 7.5**	**Primary/Secondary**	**Artifact Quality?**
—	Stonewall Flat (NV)			4775	East of Goldfield	Secondary	Yes
DW-04-OB-1	Obsidian Butte (NV)			5440	Tolicha Peak	Primary *in situ*	Yes
DW-04-OB-2	Obsidian Butte (NV)			5440	Tolicha Peak	Primary *in situ*	Yes
DW-04-OB-4	Obsidian Butte (NV)			5235	Tolicha Peak	Primary *in situ*	Yes
DW-04-DM-1	Delamar Mountains (NV)			5100	South of Gregerson Basin	Secondary	Yes
DW-04-DM-2	Delamar Mountains (NV)			5370	South of Gregerson Basin	Secondary	Yes
DW-04-OB-5	Obsidian Butte (NV)			5500	Tolicha Peak SW	Primary *in situ*	Yes
DW-04-OB-6	Obsidian Butte (NV)			5760	Tolicha Peak SW	Primary *in situ*	Yes
DW-04-OB-7	Obsidian Butte (NV)			5060	Tolicha Peak	Primary *in situ*	Yes
DW-04-OB-8	Obsidian Butte (NV)			5550	Tolicha Peak	Primary *in situ*	Yes
DW-04-OB-9	Obsidian Butte (NV)			5600	Tolicha Peak	Primary *in situ*	Yes
DW-04-OB-10	Obsidian Butte (NV)			5890	Tolicha Peak	Primary *in situ*	Marginal
DW-04-OB-11	Obsidian Butte (NV)			5510	Tolicha Peak	Primary	Yes
DW-04-OB-12	Obsidian Butte (NV)			5510	Tolicha Peak	Primary	Yes
DW-04-OB-13	Obsidian Butte (NV)			5530	Tolicha Peak	Secondary	Yes
DW-04-OB-14	Obsidian Butte (NV)			5100	Tolicha Peak	Primary *in situ*	Yes

Appendix A: Results of X-Ray Fluorescence Trace Element Analysis of Obsidian Sources

Table A-2-1 (continued). Locations of obsidian source specimens selected for trace element analysis. Table is continued on next page.

Sample No.	Source Area	Longitude	Latitude	Elevation (ft)	USGS Map 7.5	Primary/Secondary	Artifact Quality?
DW-04-OB-15	Obsidian Butte (NV)			5100	Tolicha Peak	Primary *in situ*	Yes
DW-04-OB-16	Obsidian Butte (NV)			5600	Tolicha Peak	Primary	Yes
DW-04-OB-17	Obsidian Butte (NV)			5360	Tolicha Peak	Secondary	Yes
DW-04-SP-1	South Pahroc Range (NV)			5135	Hiko SE	Primary	Yes
26NY10827	Goldfield Hills (NV)			5485	Paymaster Ridge	Secondary	Yes
DW-04-MCR-1	Monte Cristo Range (NV)			5600	Crow Springs	Primary	Yes
DW-04-DM-4	Delamar Mountains (NV)			6400	Gregerson Basin	Secondary	Yes
DW-04-DM-5	Delamar Mountains (NV)			6400	Gregerson Basin	Secondary	Yes
DW-04-DM-6	Delamar Mountains (NV)			5441	Gregerson Basin	Secondary	Yes
DW-04-DM-7	Delamar Mountains (NV)			3760	South of Gregerson Basin	–	Mixed
DW-04-DM-8	Delamar Mountains (NV)			3675	Vigo NW	Secondary	Yes
DW-04-DM-9	Delamar Mountains (NV)			5200	Elgin SW	Secondary	Yes
DW-04-DM-10	Delamar Mountains (NV)			4400	Elgin SW	Secondary	Yes
DW-04-DM-11	Delamar Mountains (NV)			3910	Elgin SW	–	Yes
DW-04-MVM-1	Meadow Valley Mountains (NV)			4730	Vigo NW	Primary *in situ*	Mixed

Table A-2-1 (continued). Locations of obsidian source specimens selected for trace element analysis. Table is continued on next page.

Sample No.	Source Area	Longitude	Latitude	Elevation (ft)	USGS Map 7.5	Primary/Secondary	Artifact Quality?
DW-04-MVM-2	Meadow Valley Mountains (NV)			4190	Vigo NE	Primary *in situ*	Mixed
DW-04-MVM-3	Meadow Valley Mountains (NV)			4280	Vigo NE	Secondary	Yes
DW-04-DM-12	Delamar Mountains (NV)			4030	Elgin SW	Primary	Yes
DW-04-DM-13	Delamar Mountains (NV)			4020	Elgin SW	Secondary	Yes
DW-04-DM-13A	Delamar Mountains (NV)			4020	Elgin SW	Secondary	Yes
DW-04-DM-14	Delamar Mountains (NV)			4000	Elgin SW	Secondary	Yes
DW-04-DM-15	Delamar Mountains (NV)			3920	Elgin SW	Primary	Yes

Appendix A-3

Visual Characteristics of Obsidian Source Specimens

APPENDIX A-3

Visual Characteristics of Obsidian Source Specimens

In this appendix, we provide descriptions of visual attributes for all obsidian source specimens that were geochemically analyzed as part of this project. The visual attributes recorded were:

1. Color: Hand Specimen
2. Color: Texture
3. Light Transmittance
4. Surface Luster
5. Surface Texture
6. Inclusions
7. Cortex Surface Morphology

These characteristics can serve as an indirect reflection of different geologic and geomorphic processes. Light transmittance and surface luster, for instance, indirectly indicate the degree of crystallinity of the glass. Similarly, the cortex morphology of obsidian nodules may provide clues about the depositional and transport environments. Some of these same attributes are also discussed by Shelley (1993) in the context of the description of secondary deposits of lithic materials.

Obsidian Descriptive Attributes: Definitions

1. Color: Hand Specimen

Refers to the color(s) of a wet opaque hand sample of obsidian. The Geological Society of America Rock-Color Chart is considered the color standard by which obsidian colors are assigned (Goddard et al., 1980). Colors may be described using Munsell color values for hue, value, and chroma (e.g., 5G 5/2) or by standardized color names (e.g., black, medium gray, greenish-black, etc.). When more than one color is present (as with mottled and other mixed color textures), the dominant color is listed first with other minor colors listed in descending order of abundance. Any unusual colors should be described in narrative.

Not Applicable. Use in additional color fields when only one color is present or when a sample is too small or thin to determine the true color.

Some common obsidian colors (and their Munsell designations) include:
Black (N 1/0)
Grayish Black (N 2/0)
Dark Gray (N 3/0)
Medium Dark Gray (N 4/0)

The color of obsidian is related largely to the degree of crystallinity of the glass and the mineral phase of some of the crystalline components of the glass. Chemical composition is typically not affected by the color of the obsidian.

2. Color: Texture

Color texture describes the way in which the colors are distributed throughout the obsidian. The color texture is often best determined using a thin flake or edge.

Not Applicable. Use when the presence of cortex or patina prevents the determination of this attribute.
Banded, Distinct. Banding occurs in distinct and easily definable bands with easily delineated borders; banding may be linear to curvilinear.
Banded, Indistinct. Banding can be seen but is often indistinct with "fuzzy" boundaries and little contrast.
Mottled. Colors occur in random patches; variegated.
Veined. Colors occur in a "mossy" pattern with thin dendritic stringers identifiable; glass may appear as almost cloudy.
Uniform. The color is consistent or nearly so throughout the sample.
Other. Other color texture.

Color texture terminology is from Adams (1980) and Skinner (1983 and 1987). Banding that is clearly visible in a thin obsidian flake is often undetectable in a hand sample of glass.

3. Light Transmittance

Refers to the degrees of transparency (clarity) or light transmittance qualities of a thin obsidian flake or edge (approximately 1 mm in thickness) when viewed with a 60 watt incandescent light.

Not Applicable. Use when the presence of cortex or patina prevents the determination of this attribute.
Opaque. Little to no light passes through the glass.
Translucent. Light passes through the glass but letters and numbers are obscured and cannot be read.
Transparent. Light passes through easily and letters or numbers can be easily read.

The degree of light transmittance is most often a direct reflection of the degree of crystallinity of the glass.

4. Surface Luster

Refers to the luster or quality of light reflected from a clean and patina-free fractured surface of obsidian. If the surface luster is variable (as it often is with banded glass), the luster should be recorded for the only for the glassiest portion of the surface.

Not Applicable. Use when the presence of cortex or patina prevents the determination of this attribute.
Adamantine. Having a hard, brilliant luster like that of a diamond.
*Chatoyant *.* The surface exhibits a pearl-like sheen or iridescence. Sometimes referred to as pearlescence or opalescence. A movable wavy or silky sheen is concentrated in a narrow band of light that changes its position as the glass is turned.
*Earthy *.* A lack of luster produced by a surface that scatters light; matte and grainy surface textures often exhibit an earthy luster.
Greasy. Looking as if covered by a thin layer of oil.
*Resinous *.* Having the appearance of resin.
*Vitreous *.* A glassy texture with the luster of freshly broken window glass.

Most of the surface luster attributes of obsidian are highly dependent on the degree of crystallinity of the glass. A chatoyant luster is the result of the presence of very small (5-20 micron diameter) bubbles in the glass. Standard mineral surface luster terminology is primarily from Dana (1959) and has not been modified for use with obsidian. The types of luster most often encountered in obsidian are marked with an asterisk (*).

5. Surface Texture

Refers to the textural surface appearance of a fractured surface of obsidian.

Not Applicable. Use when the presence of cortex or patina prevents the determination of this attribute.
Smooth. Smooth and shiny surface similar to that of a broken piece of window glass.
Flawed. Small flaws are visible on the surface of the otherwise smooth glass (see Inclusions, microphenocrysts). A hand lens may be helpful in distinguishing this texture.
Matte. Surface has the appearance of a piece of matte paper; the surface is dull but individual phenocrysts cannot be distinguished with the naked eye.
Grainy. The surface has a decidedly grainy or sugary appearance though the grains may be quite small.
Hackly. Poor quality glass - surface may be very irregular when fractured. Rarely of artifactual quality. Easily visible phenocrysts are often present. The scale of the irregularities may range from those easily visible with the naked eye to those distinguishable only with a hand lens.
Other. Other surface texture is present.

The surface texture primarily reflects the degree of crystallinity of the glass. Glassy obsidian tend to be darker in color (most often black) than more crystalline obsidian (often gray). Surface texture terminology is from Adams (1980) and Skinner (1987).

6. Inclusions

Any structure found within the glassy obsidian groundmass that is visible with the naked eye or a hand lens.

Not Applicable. Use when the presence of cortex or patina prevents the determination of this attribute.
None. No inclusions in the glass.
Accidental. Accidental inclusion; a foreign inclusion in the glass (if genetically related to the glass, an autolith - if unrelated, an accidental inclusion or xenolith.
Bubbles. Bubbles in the glass that are visible to the naked eye.
Microphenocrysts. Phenocrysts too small to be discernable with the naked eye. Megascopically, their presence is indicated by a "flawed" appearance of a fractured surface of glass. A hand lens may be necessary to distinguish the presence of microphenocrysts.
Megascopic Phenocrysts. A crystal visible in the glassy obsidian groundmass (a porphyritic texture).
Spherulites. A spherical mass of acicular crystals radiating from a central point. Typically occur singly or in aligned "trains".
Other. Other types of inclusions are present.

7. Surface Cortex Morphology

Describes the characteristics (and presence or absence) of the original outer surface of unworked obsidian and the morphology of any cortex that is present.

Not Applicable. Cortex is absent and cannot be distinguished.
Cortex Presence or Absence. Is any original cortex present?
Cortex Present, Smooth. The cortex is relatively smooth and may be quite dull in appearance due to physical weathering, hydration, or the presence of patina. The surface cortex of young autobrecciated obsidian flows often exhibits few signs of weathering and can be easily confused with the interior surface of a culturally modified artifact. When suspected, the possibility of smooth young flow surfaces should be noted as a comment.
Cortex Present, Crenulated. The surface is covered by small fingernail-shaped (curved) grooves and arc-shaped chips that vaguely resemble the worm trails found in driftwood.

The type of cortex found can provide indications about the geomorphic processes involved in the transport of glass to secondary contexts and the distance traveled. Obsidian with smooth cortex is most often associated with flows, domes, and short transport distances. Obsidian with crenulated cortex is typical of glass that has been fluvially transported along gravel beds - the pitting is due primarily to mechanical abrasion of the glass (see Kuenen 1956).

References Cited

Adams, Rex K.
1980 *Debitage Analysis: Lithic Technology and Interpretations of an Archaic Base Camp Near Moquino, New Mexico.* Unpublished Master's Thesis, Department of Anthropology, Eastern New Mexico University, Portales, New Mexico.

Dana, James
1959 *Dana's Manual of Mineralogy*, 17th edition revised by C.S. Hurlbut, Jr. John Wiley & Sons, Inc., New York, New York.

Goddard, E.N., Parker D. Trask, Ronald K. DeFord, Olaf N. Rove, Joseph T. Singewald, Jr., and R.M. Overbeck
1980 *Rock-Color Chart*. Geological Society of America, Boulder, Colorado.

Kuenen, Ph. H.
1956 Experimental Abrasion of Pebbles: 2. Rolling by Current. *Journal of Geology* 64:336-368.

Shelley, Phillip H.
1993 A Geoarchaeological Approach to the Analysis of Secondary Lithic Deposits. *Geoarchaeology* 8:59-72.

Skinner, Craig E.
1983 *Obsidian Studies in Oregon: An Introduction to Obsidian and An Investigation of Selected Methods of Obsidian Characterization Utilizing Obsidian Collected from Prehistoric Quarry Sites in Oregon.* Unpublished Master's Project, Interdisciplinary Studies, University of Oregon, Eugene, Oregon.

Skinner, Craig E.
1987 Lithic Database Project: Software Documentation. Manuscript prepared for the Geo-Anthropology Research Program, University of Oregon, Eugene, Oregon.

Table A-3-1. Visual Characteristics of Obsidian Source Specimens. Table continued on next page.

NWROSL Lab Number	**Project Number**	**Sample Location**	**1 Color: Hand**	**2 Color: Texture**	**3 Light Trans.**	**4 Surface Luster**	**5 Surface Texture**	**6 Inclusions**	**7 Cortex**	**Comments [1]**
65-1070	HO1-15	Obsidian Butte	Black Brown	Uniform, Banded (distinct)	Translucent	Vitreous	Smooth	Spherulites	Smooth	Source = OBV4 Occasional small spherulites
65-1071	HO1-16	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1072	HO1-17	Obsidian Butte	Black	Uniform, Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2
65-1073	HO1-18	Obsidian Butte	Black	Uniform, Banded (distinct)	Translucent	Vitreous	Smooth	Spherulites	Smooth	Source = OBV2; Occasional small spherulites
65-1074	HO1-19	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	Phenocrysts	Smooth	Source = OBV4; Occasional small phenocrysts
65-1075	HO1-20	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1076	HO1-21	Obsidian Butte	Black	Uniform, Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1077	HO1-22	Obsidian Butte	Black	Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1078	HO1-23	Obsidian Butte	Black	Uniform, Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2
65-1079	HO1-24	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1080	HO1-25	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1081	HO1-26	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2; Nearly opaque

[1] SOURCES: KSWCV1 = Kane Springs Wash Caldera Variety 1, NV; KSWCV2 = Kane Springs Wash Caldera Variety 2 (Kane Springs); ; MVM = Meadow Valley Mountains; NV; OBV1 = Obsidian Butte, NV, Variety 1 ; OBV2 = Obsidian Butte, NV, Variety 2 (Airfield Canyon); OBV3 = Obsidian Butte, NV, Variety 3 (Obsidian Butte); OBV4 = Obsidian Butte, NV, Variety 4 (Obsidian Butte); OBV5 = Obsidian Butte, NV, Variety 5 (Unknown C). See Appendix A-1 for the trace element composition of the individual obsidian specimens.

Table A-3-1 (continued). Visual Characteristics of Obsidian Source Specimens. Table continued on next page.

NWROSL Lab Number	Project Number	Sample Location	1 Color: Hand	2 Color: Texture	3 Light Trans.	4 Surface Luster	5 Surface Texture	6 Inclusions	7 Cortex	Comments [1]
65-1082	HO1-27	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2
65-1083	HO3-28	Tempiute Range	Black	Uniform, Banded (indistinct)	Translucent	Vitreous	Flawed	Micro-phenocrysts	Smooth	Source = Tempiute Mountain
65-1084	HO3-29	Delamar Mountains	Medium dark gray	NA	Opaque	Vitreous	Flawed	Megascopic phenocrysts	Smooth	Source = Delamar Range A, B, C; High density of phenocrysts; Not artifact quality;
65-1085	HO3-30	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1086	HO3-30A	Kane Springs Wash	Black	Uniform	Opaque	Vitreous	Smooth	None	Crenulated	Source = KSWCV1
65-1087	HO3-31	Oak Spring Butte	Olive Black	Mottled	Opaque	Vitreous	Smooth	None	Smooth	Source = Oak Spring Butte
65-1088	HO3-32	Oak Spring Butte	Olive Black	Mottled	Opaque	Vitreous	Smooth	None	Smooth	Source = Oak Spring Butte; Occasional phenocrysts up to 3mm
65-1089	HO3-33	South Kawich Range	Black, Medium dark gray	Veined	Opaque	Vitreous, Earthy	Hackly	Bubbles	Smooth	Source = South Kawich Range; Highly vesicular glass; Not artifact quality
65-1090	HO3-34	Apache Tear Canyon	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = South Kawich Range
65-1091	HO3-35	Shoshone Mountain	Black	Uniform, Banded (distinct)	Translucent	Vitreous	Flawed	Micro-phenocrysts	Smooth	Source = Shoshone Mountain; Small microphenocrysts common in glassy matrix
65-1092	HO3-36	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	Spherulites	Smooth	Source = OBV5; occasional occasional spherulites up to 7mm
65-1093	HO3-37	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5

[1] SOURCES: KSWCV1 = Kane Springs Wash Caldera Variety 1, NV; KSWCV2 = Kane Springs Wash Caldera Variety 2 (Kane Springs) ; MVM = Meadow Valley Mountains; NV; OBV1 = Obsidian Butte, NV, Variety 1 ; OBV2 = Obsidian Butte, NV, Variety 2 (Airfield Canyon); OBV3 = Obsidian Butte, NV, Variety 3 (Obsidian Butte); OBV4 = Obsidian Butte, NV, Variety 4 (Obsidian Butte); OBV5 = Obsidian Butte, NV, Variety 5 (Unknown C). See Appendix A-1 for the trace element composition of the individual obsidian specimens.

Table A-3-1 (continued). Visual Characteristics of Obsidian Source Specimens. Table continued on next page.

NWROSL Lab Number	Project Number	Sample Location	1 Color: Hand	2 Color: Texture	3 Light Trans.	4 Surface Luster	5 Surface Texture	6 Inclusions	7 Cortex	Comments [1]
65-1094	HO3-38	Obsidian Butte	Black	Uniform, Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5
65-1095	HO3-39	Stonewall Canyon	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2 (N=1)
			Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5 (N=9)
65-1096	HO3-40	Stonewall Canyon	Black	Uniform, Banded (indistinct)	Translucent	Vitreous	Smooth	Spherulites	Smooth	Source = OBV3 (N=2); Occasional small spherulites up to 2mm
			Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5 (N=3)
65-1098	HO3-42	Stonewall Canyon	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2 (N=1)
			Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5 (N=4)
65-1099	HO3-43	Resting Spring Range	Black Brown	Mottled	Opaque	Vitreous	Flawed to hackly	Megascopic phenocrysts	Smooth	Source = Resting Spring Range; High density of phenocrysts; Not artifact quality
65-1100	HO3-44	Devil Peak East	Black	Banding (indistinct)	Translucent	Vitreous	Smooth, Bubbles	None, Bubbles	Smooth	No inclusions for most specimens
65-1125	Stonewall Flat	Stonewall Flat	Black	Uniform, Banded (indistinct)	Translucent	Vitreous	Smooth	Micro-phenocrysts	Smooth	Source = Goldfield Hills
65-1126	DW-04-OB-1	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1127	DW-04-OB-2	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1128	DW-04-OB-4	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2

[1] SOURCES: KSWCV1 = Kane Springs Wash Caldera Variety 1, NV; KSWCV2 = Kane Springs Wash Caldera Variety 2 (Kane Springs); MVM = Meadow Valley Mountains; NV; OBV1 = Obsidian Butte, NV, Variety 1 ; OBV2 = Obsidian Butte, NV, Variety 2 (Airfield Canyon); OBV3 = Obsidian Butte, NV, Variety 3 (Obsidian Butte); OBV4 = Obsidian Butte, NV, Variety 4 (Obsidian Butte); OBV5 = Obsidian Butte, NV, Variety 5 (Unknown C). See Appendix A-1 for the trace element composition of the individual obsidian specimens.

Table A-3-1 (continued). Visual Characteristics of Obsidian Source Specimens. Table continued on next page.

NWROSL Lab Number	Project Number	Sample Location	1 Color: Hand	2 Color: Texture	3 Light Trans.	4 Surface Luster	5 Surface Texture	6 Inclusions	7 Cortex	Comments [1]
65-1129	DW-04-DM-1	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1130	DW-04-DM-2	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1135	DW-04-OB-5	Obsidian Butte	Black	Uniform, Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5
65-1136	DW-04-OB-6	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV5; Occasional spherulite up to 9 mm
65-1137	DW-04-OB-7	Obsidian Butte	Black	Uniform, Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1138	DW-04-OB-8	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1139	DW-04-OB-9	Obsidian Butte	Black	Uniform, Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1140	DW-04-OB-10	Obsidian Butte	Black	Uniform	Opaque	Vitreous	Hackly	None	Smooth	Source = OBV1; Marginal artifact quality
65-1141	DW-04-OB-11	Obsidian Butte	Black	Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2
65-1142	DW-04-OB-12	Obsidian Butte	Black Gray-black	Uniform, Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2
65-1143	DW-04-OB-13	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1144	DW-04-OB-14	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3

[1] SOURCES: KSWCV1 = Kane Springs Wash Caldera Variety 1, NV; KSWCV2 = Kane Springs Wash Caldera Variety 2 (Kane Springs); MVM = Meadow Valley Mountains; NV; OBV1 = Obsidian Butte, NV, Variety 1 ; OBV2 = Obsidian Butte, NV, Variety 2 (Airfield Canyon); OBV3 = Obsidian Butte, NV, Variety 3 (Obsidian Butte); OBV4 = Obsidian Butte, NV, Variety 4 (Obsidian Butte); OBV5 = Obsidian Butte, NV, Variety 5 (Unknown C). See Appendix A-1 for the trace element composition of the individual obsidian specimens.

Table A-3-1 (continued). Visual Characteristics of Obsidian Source Specimens. Table continued on next page.

NWROSL Lab Number	Project Number	Sample Location	1 Color: Hand	2 Color: Texture	3 Light Trans.	4 Surface Luster	5 Surface Texture	6 Inclusions	7 Cortex	Comments [1]
65-1145	DW-04-OB-15	Obsidian Butte	Black	Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
65-1146	DW-04-OB-16	Obsidian Butte	Black	Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV2; Occasional phenocrysts <1 mm
65-1147	DW-04-OB-17	Obsidian Butte	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV3
			Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = OBV4
65-1148	DW-04-SP-1	South Pahroc Range	Black	Uniform	Transparent	Vitreous	Smooth	None	Smooth	Source = South Pahroc
65-1149	26NY10827	Goldfield Hills	Black	Banded (indistinct)	Translucent	Vitreous	Smooth	Spherulites	Smooth	Source = Goldfield Hills; Spherulites up to 2mm
65-1150	DW-04-MCR-1	Monte Cristo Range	Black	Mottled	Translucent	Vitreous	Smooth	None	Smooth	Source = Crow Spring
65-1151	DW-04-DM-4	Delamar Mountains	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1152	DW-04-DM-5	Delamar Mountains	Black	Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1153	DW-04-DM-6	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1154	DW-04-DM-7	Delamar Mountains	Black	Banded (indistinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = KSWCV1
			Black	Mottled	Translucent	Vitreous	Smooth	None	Smooth	Source = Delamar Range A
65-1155	DW-04-DM-8	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1156	DW-04-DM-9	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1157	DW-04-DM-10	Delamar Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1158	DW-04-DM-11	Delamar Mountains	Black Gray-black	Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = KSWCV2

[1] SOURCES: KSWCV1 = Kane Springs Wash Caldera Variety 1, NV; KSWCV2 = Kane Springs Wash Caldera Variety 2 (Kane Springs); MVM = Meadow Valley Mountains; NV; OBV1 = Obsidian Butte, NV, Variety 1 ; OBV2 = Obsidian Butte, NV, Variety 2 (Airfield Canyon); OBV3 = Obsidian Butte, NV, Variety 3 (Obsidian Butte); OBV4 = Obsidian Butte, NV, Variety 4 (Obsidian Butte); OBV5 = Obsidian Butte, NV, Variety 5 (Unknown C). See Appendix A-1 for the trace element composition of the individual obsidian specimens.

Table A-3-1 (continued). Visual Characteristics of Obsidian Source Specimens. Table continued on next page.

NWROSL Lab Number	Project Number	Sample Location	1 Color: Hand	2 Color: Texture	3 Light Trans.	4 Surface Luster	5 Surface Texture	6 Inclusions	7 Cortex	Comments [1]
65-1159	DW-04-MVM-1	Meadow Valley Mountains	Black	Uniform	Opaque	Vitreous	Other	None	Crenulated	Source = MVM A; Nearly hackly surface texture; Not artifact quality.
			Black	Uniform	Opaque	Vitreous	Smooth	Flawed	Smooth	Source = MVM C; Not artifact quality.
			Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV2
65-1160	DW-04-MVM-2	Meadow Valley Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
			Black	Uniform	Opaque	Vitreous	Hackly	None	Smooth	Source = MVM B; Not artifact quality.
			Black	Uniform	Opaque	Vitreous	Hackly	Phenocrysts	Smooth	Source = MVM D; Not artifact quality.
65-1161	DW-04-MVM-3	Meadow Valley Mountains	Black	Uniform	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
			Black	Uniform	Opaque	Vitreous	Smooth	None	Crenulated	Source = KSWCV2
65-1181	DW-04-DM-12	Delamar Mountains	Black	Banded (distinct)	Transparent	Vitreous	Smooth	Phenocrysts	Smooth	Source = KSWCV2; Nearly opaque
65-1182	DW-04-DM-13	Delamar Mountains	Black	Banded (distinct)	Translucent	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1183	DW-04-DM-13A	Delamar Mountains	Black	Banded (indistinct)	Opaque	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1184	DW-04-DM-14	Delamar Mountains	Black	Uniform	Translucent	Vitreous	Smooth	None	Smooth	Source = KSWCV1
65-1185	DW-04-DM-115	Delamar Mountains	Black	Banded (indistinct)	Translucent	Vitreous	Smooth	Micro-phenocrysts	Smooth	Source = KSWCV2; Nearly opaque

[1] SOURCES: KSWCV1 = Kane Springs Wash Caldera Variety 1, NV; KSWCV2 = Kane Springs Wash Caldera Variety 2 (Kane Springs); MVM = Meadow Valley Mountains; NV; OBV1 = Obsidian Butte, NV, Variety 1 ; OBV2 = Obsidian Butte, NV, Variety 2 (Airfield Canyon); OBV3 = Obsidian Butte, NV, Variety 3 (Obsidian Butte); OBV4 = Obsidian Butte, NV, Variety 4 (Obsidian Butte); OBV5 = Obsidian Butte, NV, Variety 5 (Unknown C). See Appendix A-1 for the trace element composition of the individual obsidian specimens.

Appendix A-4

Alternate Names for Project Obsidian Sources

APPENDIX A-4

Alternate Names for Project Obsidian Sources

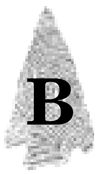
The obsidian sources described in this appendix have, over the course of many years, accumulated an often bewildering array of different names. This appendix lists all alternate source names of which we are aware and may be used to decode and decipher the obsidian source names that appear in geologic and archaeological literature and in unpublished reports prepared for a variety of different government agencies and cultural resource management firms.

Table A-4-1: Alternate names for project obsidian sources. Table is continued on next page.

Primary Source Name	Alternate Source Names
Crow Spring, NV	—
Delamar Range A, B, NV	—
Devil Peak East, NV	—
Goldfield Hills, NV	Stonewall Flat
Kane Springs Wash Caldera Variety 1, NV	Delamar Mountains Kane Springs C
Kane Springs Wash Caldera Variety 2 (Kane Springs), NV	Kane Spring Kane Springs Kane Springs A
Meadow Valley Mountains A, B, C, D, NV	—
Oak Spring Butte, NV	Dead Horse Flat Grouse Canyon Split Ridge/Pahute Mesa Tub Spring Tubb Spring
Obsidian Butte, NV, Variety 1	—
Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Airfield Canyon Airfield Canyon, Obsidian Butte Area Obsidian Butte Variety H-3 Sarcobatus Flat A
Obsidian Butte, NV, Variety 3 (Obsidian Butte)	Obsidian Butte, Obsidian Butte Area Obsidian Butte Variety H-5 Sarcobatus Flat B

Table A-4-1 (continued): Alternate names for project obsidian sources.

Primary Source Name	**Alternate Source Names**
Obsidian Butte, NV, Variety 4 (Obsidian Butte)	Obsidian Butte, Obsidian Butte Area Obsidian Butte Variety H-5 Sarcobatus Flat B
Obsidian Butte, NV, Variety 5 (Unknown C)	North Obsidian Butte, Obsidian Butte Area Stonewall Canyon Unknown C Unknown C (Obsidian Butte Area) West Obsidian Butte
Resting Spring Range, CA	Shoshone
Shoshone Mountain, NV	Fortymile/Topopah/Yucca Wash Shoshone Peak Shoshone
South Kawich Range, NV	Apache Tear Canyon Kawich Range
South Pahroc, NV	South Pahroc Range
Tempiute Mountain, NV	Butte Valley Unknown B Timpahute Range



APPENDIX B: Descriptions of Geologic Obsidian Collection Locations, 2001 and 2003

Richard E. Hughes

DESCRIPTIONS OF GEOLOGIC OBSIDIAN COLLECTION LOCATIONS, 2001 AND 2003

by

Richard E. Hughes

Introduction

Descriptions and location information for 14 obsidian collection loci from the eastern and southern portions of Obsidian Butte have been presented (Hughes 2001), but comparable information for subsequent collections have not. To redress this unpardonable omission, locations and brief descriptions of the geologic obsidian samples collected in 2001 and 2003 are presented here.

Background

On July 15, 2001, obsidian samples from five localities (H01-15 through H01-19) were collected by the author, Lynn Haarklau, and D.J. Haarklau (a sixth location, H01-20, was identified and collected by Keith Myhrer). Later that year (on December 8 and 9, 2001) Hughes, Lynn Haarklau, D.J. Haarklau, and Joe Kennedy collected samples from eight "new" locations (H01-21 through H01-27, including samples submitted by GeoMarine [locality Geo-01]).

No collections were made during 2002, but field research resumed in early 2003. On February 11, 2003, the author and Lynn Haarklau made collections from three localities (H03-28 through H03-30) and on March 22, 2003 the author, Lynn Haarklau, D.J. Haarklau, Nevada Test Site archaeologist Barbara Holz, and Lalovi Miller collected geologic samples from five locations on the Nevada Test Site (localities H03-31 through H03-35). The following day, March 23, 2003, the same four individuals (minus NTS archaeologist Barbara Holz) secured samples from another seven locations (H03-36 through H03-42) outside the NTS boundary. On March 24, 2003, Lynn Haarklau and the author made collections from two additional locations (H03-43 and H03-44) in the general study area. Figures B1a through B1e are topographic maps showing the locations of the NTTR and NTS geologic sample collection localities.

Figure B1a. Obsidian Butte Volcanic Center Collection Locations, 2001. The 1999 collection localities (Hughes 2001) are also plotted**.**

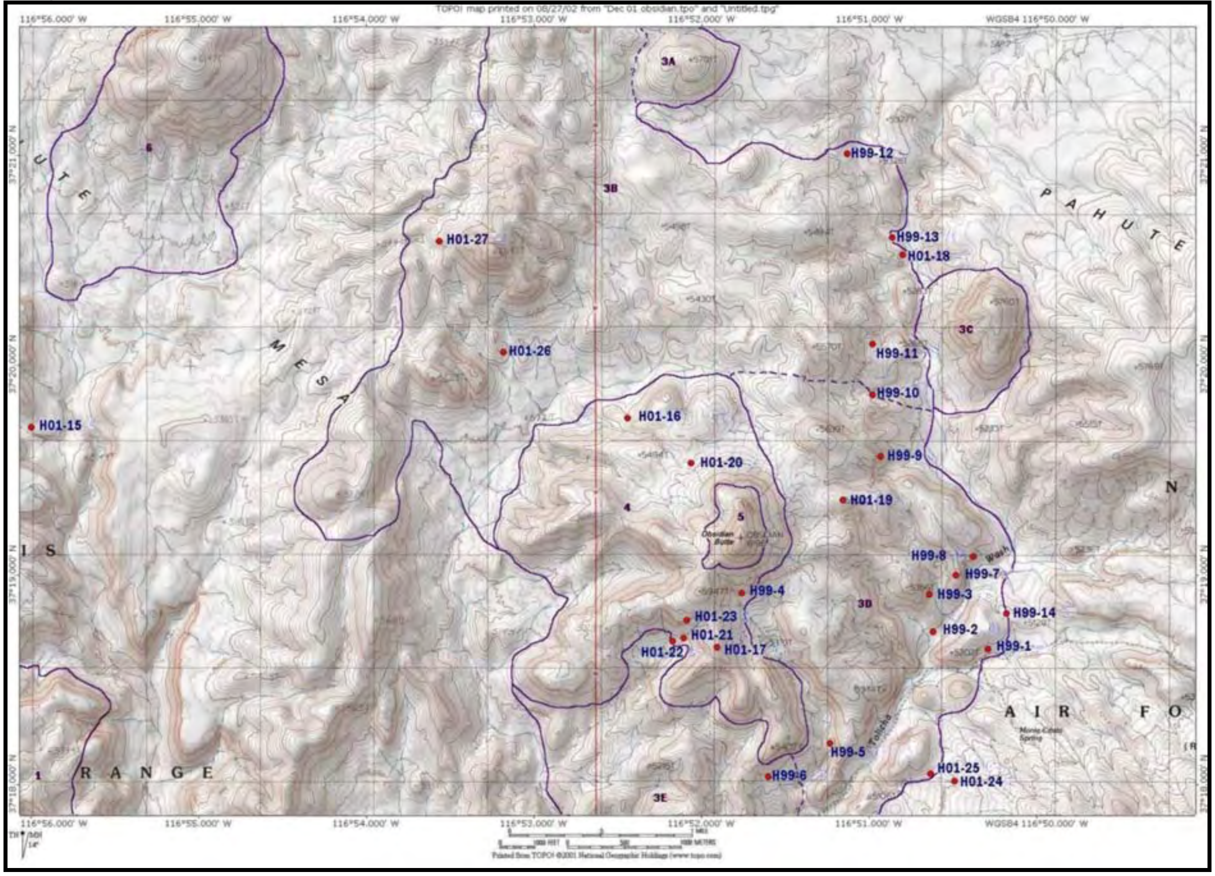


Figure B1b. Obsidian Butte Volcanic Center Collection Locations, 2003.

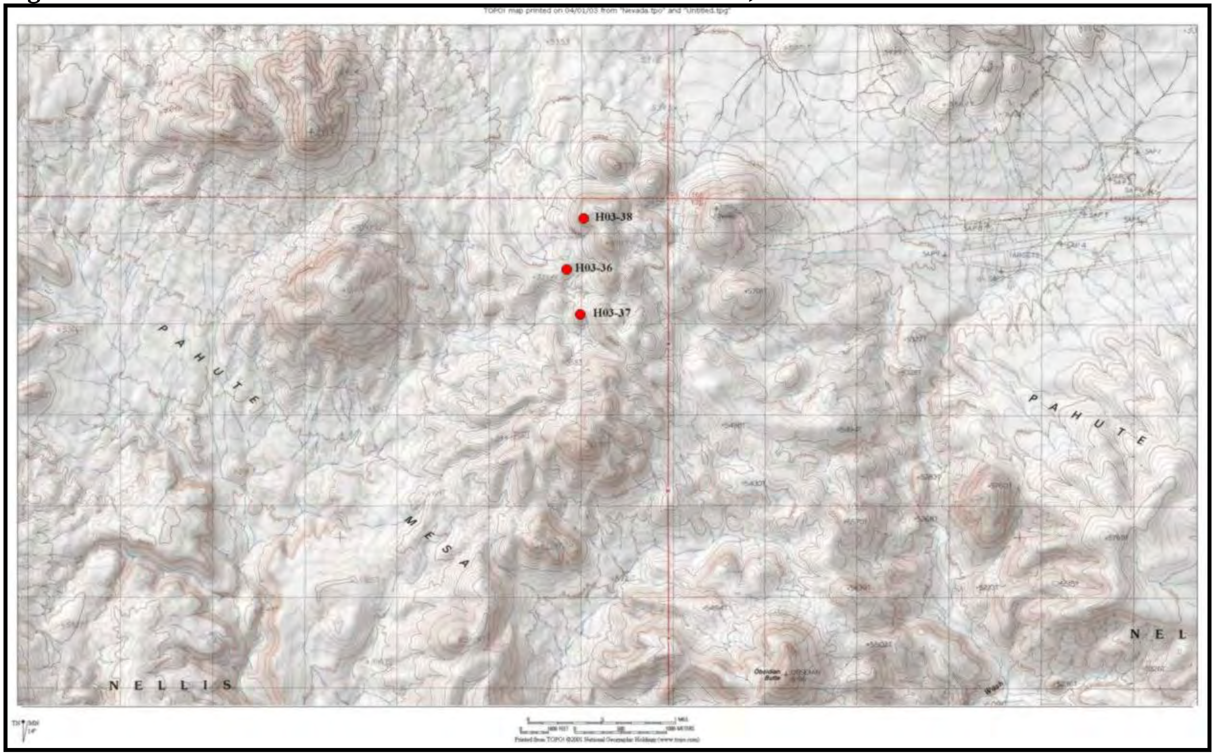


Figure B1c. Obsidian Butte Volcanic Center Collection Locations, 2003.

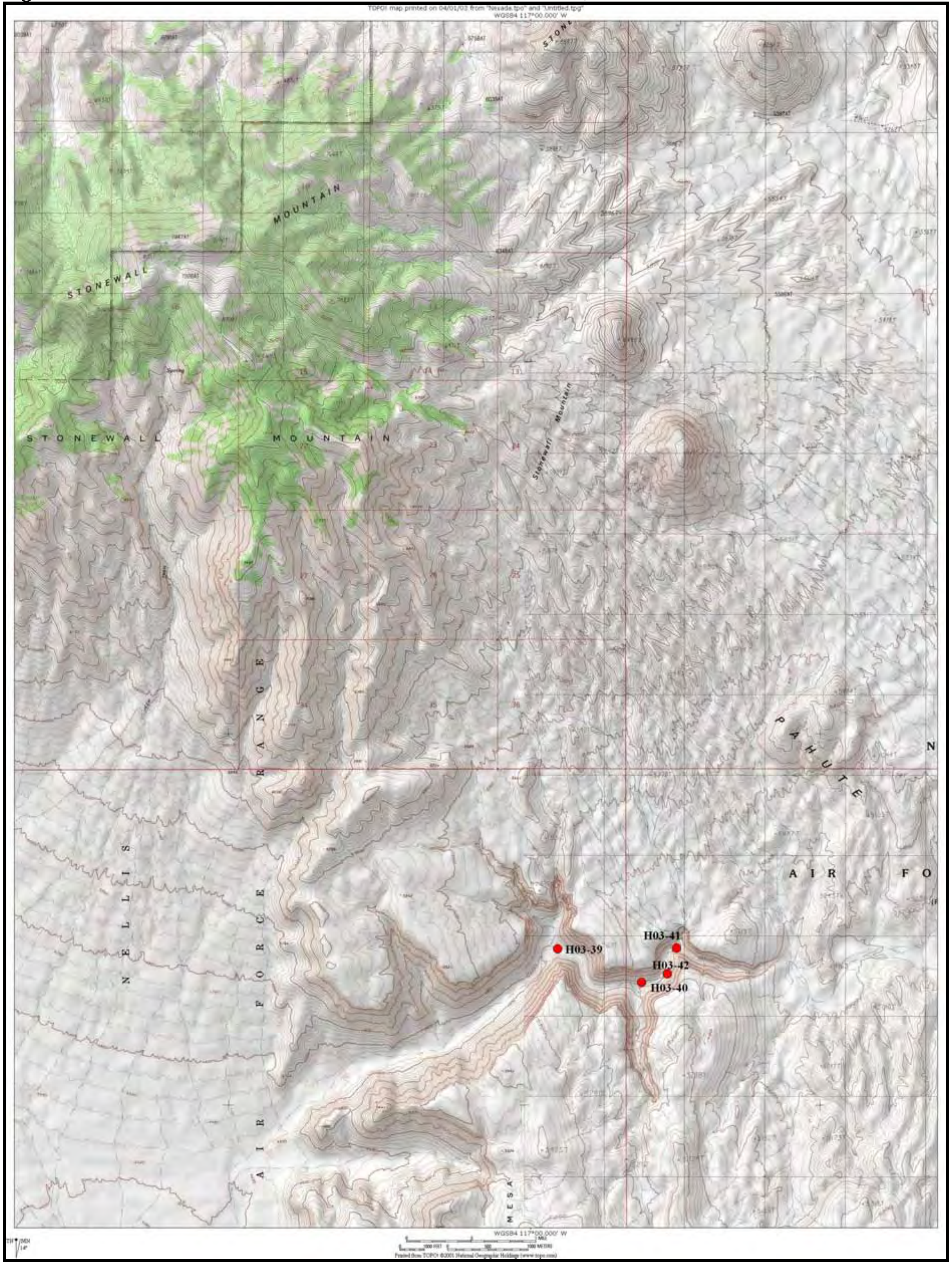


Figure B1d. Oak Spring Butte Collection Locations, 2003.

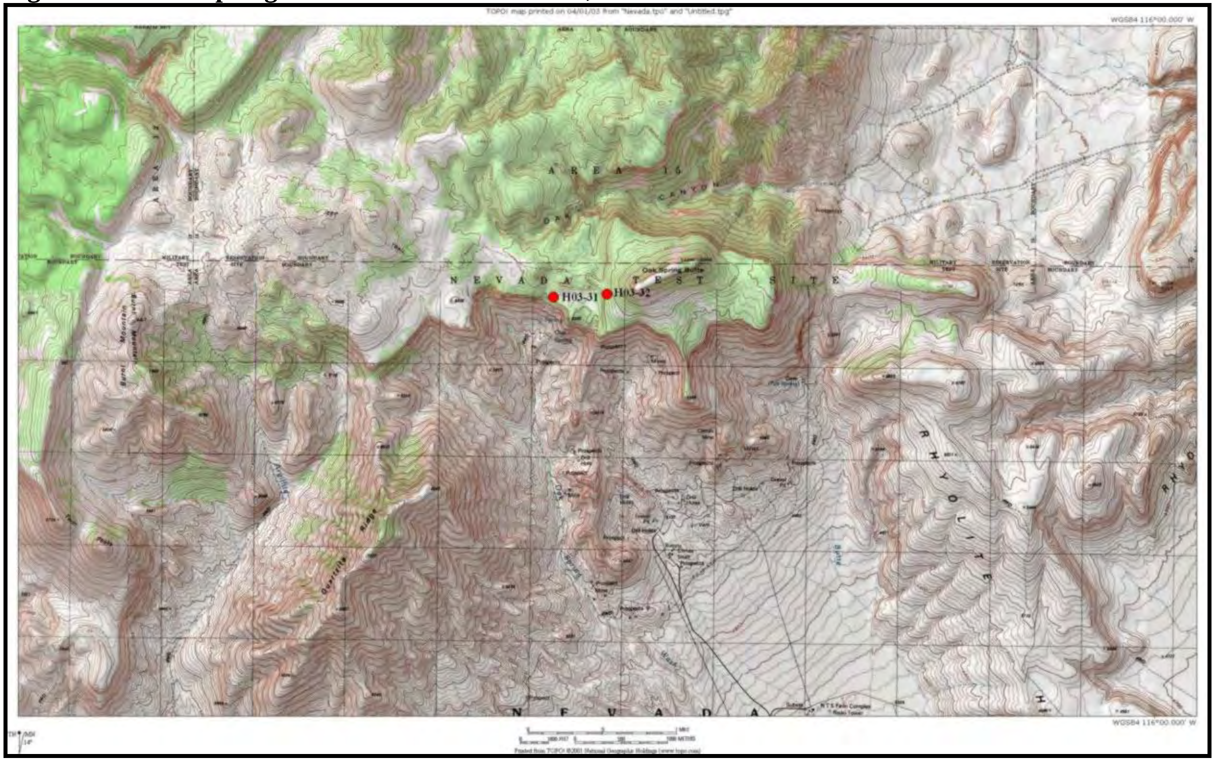


Figure B1e. Shoshone Mountain Collection Locations, 2003.

Location and Description of Areas Collected During 2001

Location H01-15. This obsidian occurrence consisted of nodules, up to 17 X 12 cm. in size, in place and eroding from an ashy exposure at about 5560' elevation approximately 4 miles west-northwest of Obsidian Butte. One small red-and-black colored nodule was collected, but otherwise the obsidian color was typically cloudy with a pink translucent hue, showing flow banding. Prehistoric lithic debris was abundant at this locality.

Figure B2. Locality H01-15, Obsidian Butte Volcanic Center.

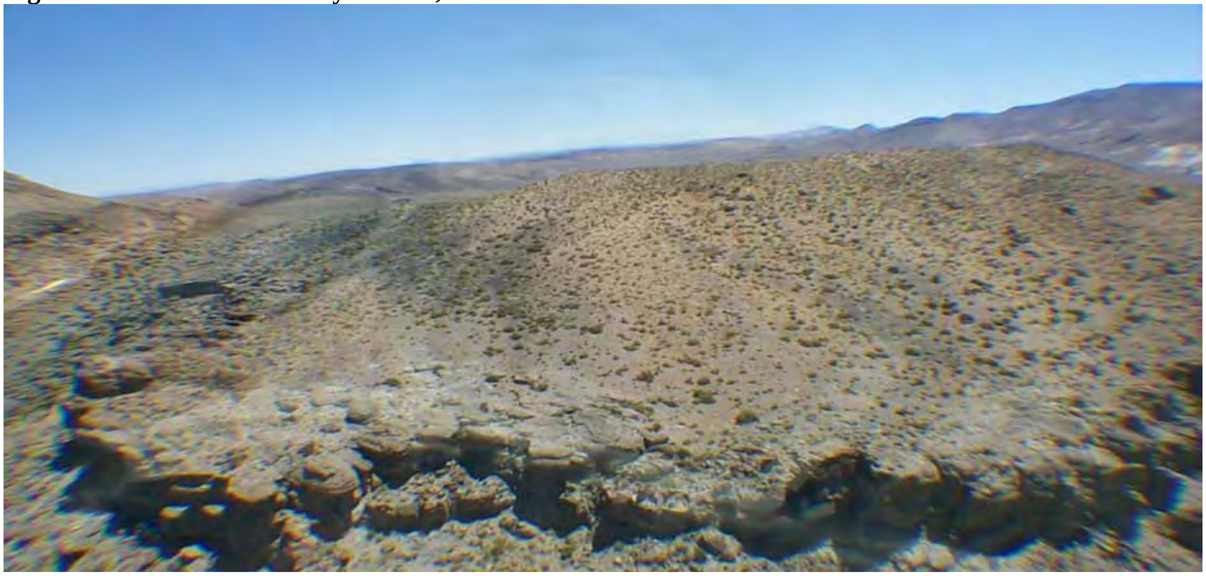
Figure B3. Core reduction flakes at H01-15.

Location H01-16. This outcrop exposure of obsidian was encountered weathering from a ridgetop at 5520’ elevation about one mile northwest of Obsidian Butte. The largest nodules observed here were 6 X 6 cm., with only modest evidence for prehistoric use.

Figure B4. Collection Locality H01-16, Obsidian Butte Volcanic Center.

Location H01-17. Another obsidian exposure weathering from a ridgetop at 5680’ elevation about one-half mile south of Obsidian Butte. Obsidian nodules here ranged up to 8 X 5 cm., with sparse evidence for prehistoric use.

Figure B5. Collection Locality H01-17, Obsidian Butte Volcanic Center.



Location H01-18. This is a major obsidian exposure located at 5257’ elevation in an ashy matrix in Airfield Canyon ca. 200 meters southeast of H99-13. Some of the largest obsidian nodules (cobbles) encountered anywhere in the Obsidian Butte area occurred here- the largest being over 24 X 12 cm in size.

Figure B6. Collection Locality H01-18, Obsidian Butte Volcanic Center.

Figure B7. Large Obsidian Cobbles (left) and Reduction Debris (right) at H01-18.

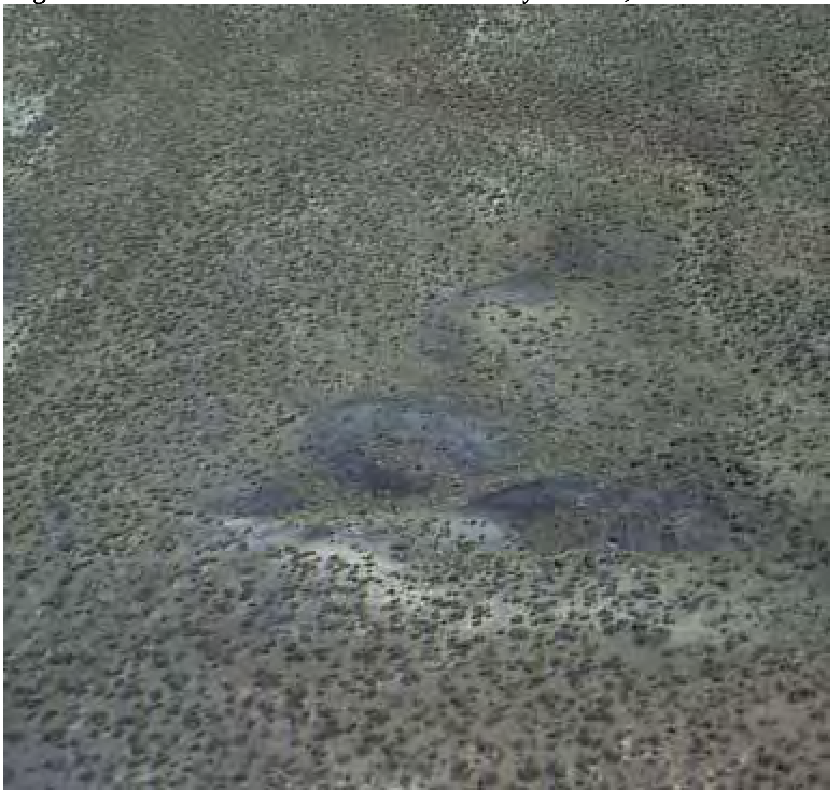
Location H01-19. Obsidian nodules, up to 10 X 9 cm., occur in a primary, ash-rich matrix at 5564’ elevation ca. 1000 meters northeast of Obsidian Butte. Abundant local evidence for use of this obsidian was observed- lithic reduction debris, and broken artifacts (I found a biface base here).

Figure B8. In Situ Obsidian Nodules at H01-19, Obsidian Butte Volcanic Center.

Figure B9. Eroded Obsidian Cobbles at H01-19, Obsidian Butte Volcanic Center. Photo inset shows core reduction debris.

Location H01-20. This sample was provided by Keith Myhrer, who collected it from a location about 1/2 mile northwest of Obsidian Butte. Notes indicate that the sample corresponds with Fridrich's Flow Unit 4 (north center). The obsidian nodules collected here range up to 11 X 6 cm.

Figure B10. Aerial View of Collection Locality H01-20, Obsidian Butte.



Location H01-21 . Obsidian nodules, up to 7 X 5 cm., occur in primary context at 5231’ elevation ca. 1000 meters south southwest of Obsidian Butte. Evidence for prehistoric use of this material was not observed here.

Figure B11. In Situ Obsidian Nodules at H01-21, Obsidian Butte Volcanic Center.

Location H01-22. Obsidian nodules, up to 8 X 7 cm., occur in primary context at 5198' elevation ca. 200 meters southwest of H01-21. As was the case at locality H01-21, no evidence for prehistoric use was observed here.

Figure B12. In Situ Obsidian Nodules at H01-22, Obsidian Butte Volcanic Center.

Location H01-23. Small exposure of obsidian nodules, up to 5 X 3 cm., in formation stratigraphically *above* occurrences at H01-21 and H01-22 at 5588' elevation ca. 200 meters north of H01-21. As was the case at adjacent localities H01-21 and H01-22, no evidence for prehistoric use was observed here.

Figure B13. Collection Locality H01-23, Obsidian Butte Volcanic Center.

Location H01-24. Comparatively sparse occurrence of obsidian nodules, up to 8 X 6 cm. in size, weathering from formation at 5046' elevation ca. 1/2 mile southwest of Monte Cristo Spring. Sparse evidence for prehistoric use was observed here.

Figure B14. Collection Locality H01-24, Obsidian Butte Volcanic Center.

Location H01-25. Comparatively sparse occurrence of obsidian nodules, up to 8 X 6 cm., weathering from formation at 5036' elevation ca. 250 meters west northwest of H01-24. No evidence for prehistoric use was observed here.

Figure B15. Collection Locality H01-25, Obsidian Butte Volcanic Center.

Location H01-26. This very sparse occurrence of very small (3 X 2 cm.) obsidian nodules is located ca. 2500 meters northwest of Obsidian Butte at an elevation of 5296'. Although there was an archaeological site located nearby, there was no local evidence for prehistoric use of these miniscule nodules.

Location H01-27. About 1100 meters northwest of H01-26, at 5606' elevation, a larger more dense concentration of obsidian nodules (ca. 10 X 6 cm.) was encountered. Despite the larger size of the nodules here, there was no evidence of prehistoric tool manufacturing observed.

Figure B16. Aerial View of Collection Locality H01-27, Obsidian Butte Volcanic Center.

Figure B17. H01-27 Close-up.

GeoMarine Locality 01. Obsidian nodules were collected from secondary context(s) between UTM coordinates 4135879 - 4139019 N and 508798 - 509655 E by archaeologists from GeoMarine, Inc. Eleven samples were collected, the largest of which was 12 X 9 cm.

Location and Description of Areas Collected During 2003

Location H03-28. Obsidian nodules, up to 10 X 8 cm., were collected from a fan at 5404' elevation about 4 miles north of the Timpahute Range on the eastern edge of Sand Spring Valley. The obsidian is so thick it appears as "pavement" in some areas- looks to be residual on an old deflated surface, with no evidence that this is a actual primary outcrop. Nonetheless, there was abundant evidence of prehistoric use of the material, as evidenced by numerous bifaces, biface fragments, and reduction debitage.

Figure B18. H03-28, Sand Spring Valley. Inset shows core reduction debris.

Location H03-29. Phenocryst-rich glass grading to a more aphyric variety, located in the southern Delamar Mountains. The obsidian here is of marginal archaeological utility, but collections were made of the "better" (i.e. more aphyric) variants. No evidence for prehistoric use of material from this locality was noted, though phenocryst-charged specimens up to 11 X 6 cm were observed.

Location H03-30. Obsidian nodules, up to 5 X 3 cm., collected from roadbed leading from H03-29 to Kane Springs Wash. These nodules were very high quality unlike most of the material at H03-29- so if these H03-30 nodules originated from the same formation that produced glass at H03-29, they likely derive from an exposure lower in the unit's glassy zone. No evidence for prehistoric use was observed here.

Location H03-30A. Sparse, secondary occurrence of obsidian nodules (largest 4 X 3 cm.) collected from a wash at about 2723' elevation in southern Coyote Spring Valley just north of Kane Springs Wash. No evidence at this locality of prehistoric tool manufacture.

Location H03-31. Angular obsidian nodules, up to 10 X 6 cm. in diameter, were recovered at about 6383' elevation in ash-flow tuff matrix deposits to the west of Oak Spring Butte on the Nevada Test Site. Evidence of prehistoric use of this material consisted of split nodules, biface fragments, and manufacturing debris.

Figure B19. Collection Localities H03-31 and H03-32, Oak Spring Butte.

Location H03-32. Obsidian nodules, up to 5 X 5 cm. in diameter, recovered from exposures at about 6461' elevation in ash-flow tuff matrix deposits to the west of Oak Spring Butte on the Nevada Test Site. Evidence of prehistoric use of this material consisted of split nodules, biface fragments, and manufacturing debris.

Notes on Locations H03-31 and H03-32. In this general area west of Oak Spring Butte bedded tuffs with distinctly different visual characteristics were encountered; a lower, very white finely-bedded ash, capped by a thick, darker tuff. We began collecting obsidian nodules at locality H03-31, *below* both tuff units. But as reconnaissance continued upslope (i.e., east toward Oak Spring Butte), it became clear that nodules also were weathering out of the upper tuff unit. On the basis of these in-field observations a collection (H03-32) was made *solely* from the upper tuff unit to: 1) determine whether the obsidian from the upper units is chemically distinct from that collected below at H03-31, and 2) to be sure that no intra-unit mixing “contaminated “ the collection from the lowermost area (H03-31). There was no obvious visual difference between obsidian from the upper and lower units, but the integrity of any potential chemical differences was ensured using this collection strategy.

Location H03-33. From the air this locality first appeared as a dark spot in an unnamed canyon wall, at about 6172’ elevation, in the Dead Horse Flat area on the eastern side of the Kawich Range. On-the-ground inspection revealed that the obsidian here is highly fractured and devitrified-completely unsuited for prehistoric tool manufacture. A small collection was made here to assist in chemical correlation efforts.

Figure B20. In Situ Collection Locality H03-33, South Kawich Range.

Location H03-34. This locality consisted of dispersed nodules, up to 4 cm. in diameter, collected from an open flat at the mouth of Apache Tear Canyon at about 5637 ‘ elevation. A brief helicopter search was made in adjacent canyons (Apache Tear Canyon and South Fork of Apache Tear Canyon) but no *in situ* obsidian occurrences were observed. Nonetheless, the primary geologic exposure(s) of this glass must lie to the east/southeast in the western portion of the Kawich Range. No evidence of prehistoric use of nodules was observed at this collection locality.

Location H03-35. Located just northwest of Shoshone Peak at about 6660' elevation, this locality appears as a weathered primary exposure of obsidian, perhaps the topmost glassy zone. Although from the air, this occurrence appeared rather small, on-the-ground inspection revealed that it was in fact a dense concentration of extremely high-quality obsidian, with abundant local evidence of prehistoric tool manufacture (broken bifaces, cores, and other manufacturing debris was observed). Though most were smaller, nodules up to 20 cm. in diameter occur here. At least one red-and-black nodule was observed, and a number of other visual variants are represented in the collection (e.g., rootbeer colored with dark banding; a dark, vitreous variety). This primary outcropping is located at a high elevation, and it is obvious that material eroding from primary context has moved downslope where it has no doubt become redistributed by local washes, serving thereby as both a primary and secondary toolstone source.

Figure B21. Collection Locality H03-35, Shoshone Mountain. Inset shows tested cobble.

Location H03-36 . This obsidian-bearing locality was observed weathering out of the top of a low knoll at about 5641' elevation about 3 miles northwest of Obsidian Butte. In places the ground surface was "paved" with obsidian, the largest nodules of which were up to ca. 10-15 cm. in diameter. Chipping debris was abundant in areas adjacent to, but not directly in, areas of primary obsidian exposure.

Figure B22. Collection Locality H03-36, Obsidian Butte Volcanic Field. Inset shows core reduction debris.

Location H03-37. Like locality H03-36, this obsidian occurrence was identified from the air weathering out of the top of a low knoll at about 5613' elevation approximately 400 meters south of H03-36. On-the-ground inspection revealed nodules, somewhat smaller than those encountered at H03-36 (up to 8 cm. in diameter), eroding from an ashy matrix miles northwest of Obsidian Butte. No prehistoric tool manufacturing debris was observed at this locality.

Location H03-38. About 400 meters north-northeast of H03-36, obsidian was identified eroding from a formation capped by rhyolite at about 5810' elevation. Small "Apache Tears" were observed in formation, and abundant larger obsidian nodules were observed eroding from primary geologic context. Nodules observed here were about the same size as those recorded at H03-36 (i.e. ca. 10-15 cm. in diameter) and, like the aforementioned locality, abundant chipping debris was observed and several artifacts fragments were photographed.

Figure B23. In Situ Obsidian Deposits at H03-38, Obsidian Butte Volcanic Center.

Location H03-39. Obsidian nodules, in obvious secondary (redeposited) context, were collected from the bottom of a southwest draining wash in Stonewall Canyon at about 4661’ elevation. Despite the problematic context, samples were collected here to assist in tracing the geographic distribution of glass type(s). No local prehistoric use (i.e. debitage, other manufacturing debris) of these nodules was observed. The largest nodule collected was 8 X 6 cm. in diameter, though most were considerably smaller.

Location H03-40. This collection consisted of a secondary (redeposited) occurrence of obsidian nodules from the bottom Stonewall Canyon at about 4723’ elevation. This collection was made about 3/4 of a mile east southeast from H03-39 up the eastern arm of Stonewall Canyon, to help trace the distribution of glass type(s). No prehistoric use (i.e. debitage, other manufacturing debris) of these nodules was observed. The largest nodule collected here was 7 X 7 cm. in diameter, though most were smaller.

Location H03-41. This locality provided stratigraphic evidence of a basal vitrophyre immediately above a yellowish brown ash-flow tuff unit in the south wall at the bottom of Stonewall Canyon. Although neither material was of direct archaeological significance (since toolstone caliber samples were absent from this local exposure) samples of both materials were collected to potentially assist in tracing the geographic distribution of glass type(s).

Figure B24. Collection Locality H03-41, Obsidian Butte Volcanic Center.

Location H03-42. This is another collection of secondary (redeposited) obsidian nodules from the bottom Stonewall Canyon at about 4780’ elevation. This collection was made about 3/4 of a mile east southeast from H03-39 up the eastern arm of Stonewall Canyon, to help trace the distribution of glass type(s). . The largest nodule collected here was 7 X 6 cm. in diameter, but no prehistoric use (i.e. debitage, other manufacturing debris) of these nodules was observed.

Location H03-43. Comparatively poor-quality obsidian in a visually impressive ash-flow tuff exposed at 2338 ‘ elevation in a road cut in Highway 178 about 3 1/2 miles northeast of the town of Shoshone, California. Exposure consists mostly of densely-welded ash, yielding obsidian in brown, black, and red-and-black varieties up to 8 X 4 cm in size. Incompletely welded ash also occurs within densely welded zones within the matrix. No prehistoric use of this material was observed here, but the large-scale disturbance resulting from road construction and maintenance may have obscured or destroyed any that once may have existed. Other, better-quality, exposures of this material may exist elsewhere in the Resting Spring Range.

Figure B25. Collection Locality H03-43, Resting Spring Range.

Location H03-44 (35°42.296’ N latitude, 115°25.505’ W longitude). Obsidian nodules, up to ca. 3-4 cm. in diameter, were collected from a perlite matrix at about 3397’ elevation on the east face of Devil Peak. Though no evidence for prehistoric use was observed during our visit, the glass quality is quite high and the obsidian has been identified geochemically at nearby archaeological sites. This source has been described by Shackley (1994) who also presents trace element data.

Figure B26. Collection Locality H03-44, Devil Peak East. Inset shows close-up of in situ deposits.

REFERENCES

Hughes, Richard E.

2001 Geochemical Characterization of Obsidian from Outcrops on the Eastern and Southern Flanks of Obsidian Butte, Nellis Air Force Range, Nevada. *In* **Investigation of Geochemical Variability in Obsidian Raw Material and Artifact Sources on the North Nellis Air Force Range, Nevada**, by Lynn Haarklau, pp. 27-54. Nellis Air Force Base Cultural Resource Report 00-04, Nellis Air Force Base, Nevada.

Shackley, M. Steven

1994 Intersource and Intrasource Geochemical Variability in Two Newly Discovered Archaeological Obsidian Sources in the Southern Great Basin. **Journal of California and Great Basin Anthropology** 16: 118-129.

APPENDIX C: Table of Point Metrics and Point Graphics

Lynn Haarklau

Notes on Appendix C

The author measured and evaluated all artifacts listed in the following *Table of Point Metrics* to maintain the highest level of consistency. Collections are organized based on the sub-regions discussed in chapters 5 and 6. Artifacts collected from the stratified deposits in Conaway Shelter and O'Malley Shelter of the Eastern sub-region are listed in order of stratigraphic unit. Units from which the points were retrieved were determined based on the catalog numbers that DRI researchers assigned to the artifacts. Catalog number prefixes cross-referencing artifacts to stratigraphic units are listed in Fowler et al. (1973:56, 67).

Point type determinations are listed in two columns. The first column contains the final type determinations, which are based on Justice (2002), Thomas (1981), Basgall et al. (1995), Basgall and Hall (2000), and Bettinger and Eerkens (1999). The second column contains point type determinations using only Thomas' (1981) Monitor Valley key, and is included as comparative data.

In some cases, discrepancies exist between the table of point metrics and the table of point geochemistries (Appendix D). Discrepancies include inconsistent catalog numbers and artifacts listed in one data set but absent in the other. To assist the reader in cross-referencing inconsistencies between the two data sets, those catalog numbers and the *Comments* column are highlighted in green. The highlighted *Comments* block contains an explanation rectifying the discrepancy. Rows highlighted in pink are those artifacts for which geochemical data are indeterminate or absent.

Following the table of point metrics are point graphics. The first two pages of point graphics are pencil sketches, drawn by Chris Schmitz, graphics artist, of the ideal point type examples (i.e. least damaged) in the NTTR collection. The remaining graphics are compilations of photographs or computer scans, completed by the author, of all point collections examined for this study. The collections graphics are also organized by sub-region. Missing from the point graphics is the Waucoba Spring (Iny441) collection, Death Valley National Park. Unfortunately, the loan period for that collection was insufficient to complete the time-consuming photo/scan documentation process.

References Cited

Basgall, M.E. and M.C. Hall
2000 Morphological and Temporal Variation in Bifurcate-Stemmed Dart Points of the Western Great Basin. *Journal of California and Great Basin Anthropology*, Vol. 22, No.2, pp. 237-276.

Basgall, M.E., M. G. Delacorte, and M.C. Hall
1995 Fish Slough Side-notched Projectile Points: An Early Holocene Time Marker in the Western Great Basin. *Current Research in the Pleistocene* 12:1-4.

Bettinger, R. L. and J. Eerkens
1999 Point Typologies, Cultural Transmission, and the Spread of Bow and Arrow Technology in the Prehistoric Great Basin. *American Antiquity*, Volume 64, Number 2, pp. 231-263.

Fowler, D. D., D. B. Madsen, and E. M. Hattori
1973 Prehistory of Southeastern Nevada. *Desert Research Institute Publications in the Social Sciences*, No. 6. Reno, NV.

Justice, N.D.
2002 *Stone Age Spear and Arrow Points of California and the Great Basin*. Indiana University Press, Bloomington & Indianapolis.

Thomas, D.H.
1981 How to Classify the Projectile Points from Monitor Valley, Nevada. In *Journal of California and Great Basin Anthropology*, Volume 3, No. 1, pp.7-43.

C4

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
Total Sample = 1,654																					
STUDY AREA (n=301)																					
Nevada Test & Training Range, Nevada, n=209																					
5-453-5	Ny375	>19.6 mm	>19.6 mm	N/A	1.00	13.3 mm	NM	NM (LMW=3.8 mm)	11.5 mm	0.86	N/A	3.6 mm	N/A	N/A	N/A	>0.90	Fish Springs, Owens Valley, CA	Cottonwood leaf shaped	Cottonwood leaf shaped	tip snapped, corner of base chipped, edges worn	
NY0377-0049	Ny377	>12.4 mm	>12.4 mm	N/A	1.00	10.6 mm	NM	NM (LMW=1.6 mm)	9.3 mm	0.88	N/A	1.9 mm	N/A	N/A	N/A	>0.30	Tempiute Mountain, NV	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
NY0377-0047	Ny377	>13.9 mm	>13.0 mm	N/A	0.94	10.0 mm	NM	0%	10.0 mm	1.00	N/A	1.7 mm	N/A	N/A	N/A	>0.30	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	tip snapped	
MCK-274	Ny218	>22.9 mm	>20.6 mm	N/A	0.90	16.3 mm	NM	NM (LMW=1.3 mm)	15.9 mm	0.98	N/A	3.7 mm	N/A	N/A	N/A	>1.15	Oak Spring Butte, NV	Cottonwood triangular	Cottonwood triangular	tip snapped, one corner base chipped, edges worn	
NY0377-0042	Ny377	17.1 mm	16.0 mm	N/A	0.94	9.9 mm	1.73	0%	9.9 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	0.50	Oak Spring Butte, NV	Cottonwood triangular	Cottonwood triangular	one corner of base chipped	
12-17-120	Ny8	>19.5 mm	>18.5 mm	N/A	0.95	13.4 mm	NM	NM (LMW=0 mm)	13.4 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	>0.90	Oak Spring Butte, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, 1 corner base snapped, blade edges worn	NAGPRA item
NY0377-0045	Ny377	>24.9 mm	>24.4 mm	N/A	0.98	12.5 mm	NM	NM (LMW=2.2 mm)	11.6 mm	0.93	N/A	3.3 mm	N/A	N/A	N/A	>0.90	Obsidian Butte, NV, Variety 3	Cottonwood triangular	Cottonwood triangular	distal end snapped, one edge damaged and reworked	
Ny0377-0048	Ny377	>16.9 mm	>16.2 mm	N/A	0.96	12.1 mm	NM	NM (LMW=1.4 mm)	11.7 mm	0.97	N/A	2.8 mm	N/A	N/A	N/A	>0.60	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
NY0377-0040	Ny377	17.6 mm	17.1 mm	8.2 mm	0.97	12.1 mm	1.45	0%	12.1 mm	1.00	7.7 mm	2.5 mm	195°	171°	25°	0.50	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	complete	Desert type, minimal pressure-flaking; not on xrf list, from Haarklau 2001
75W-A-0001	isolate	>16.0 mm	>16.0 mm	>5.9 mm	NM	≈11.8 mm	NM	NM	>9.9 mm	NM	7.3 mm	3.0 mm	215°	160°	55°	>0.60	Obsidian Butte, NV, Variety 5 (Unknown C)	Desert side notched	Desert side notched	base snapped diagonally from one notch to 3.5 mm below opposing notch, hydration cut (gives appearance of second	Desert type; not on xrf list, from Kolvet et al 2000 study
NY10850-0005	Ny10850	30.2 mm	30.2 mm	7.5 mm	1.00	20.8 mm	1.45	41%	16.0 mm	0.77	10.4 mm	4.4 mm	179°	138°	40°	>1.80	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	one shoulder tang chipped, blade edges worn, hydration notch	serrated & barbed blade edges
CK4856-0120	Ck4856	>29.8 mm	>29.8 mm	10.0 mm	1.00	22.2 mm	NM	NM (LMW=14.2 mm)	12.1 mm	0.55	12.3 mm	7.2 mm	169°	125°	45°	>4.20	Kane Springs Wash Caldera Variety 2, NV	Elko corner notched	Elko corner notched	tip snapped, blade edges heavily worn, large hydration notch in base	looks different than other Elkos (end of distal notch rounded upward, longer, thinner neck)
12-17-117	Ny8	>15.5 mm	>14.2 mm	5.3 mm	0.92	22.5 mm	NM	NM (LMW=5.0 mm)	13.4 mm	0.60	10.7 mm	3.2 mm	139°	118°	33°	>2.00	Oak Spring Butte, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder tang chipped	NAGPRA item
76-INT2-0006	isolate	>24.0 mm	>24.0 mm	7.3 mm	1.00	>18.8 mm	NM	NM (LMW=15.6 mm)	>10.0 mm	NM	>9.0 mm	5.0 mm	189°	144°	45°	>2.10	Obsidian Butte, NV, Variety 3	Elko corner notched	Elko corner notched	one shoulder snapped through base, distal end snapped	
NY10897-0001	Ny10897	>34.9 mm	>32.7 mm	8.2 mm	>0.94	19.6 mm	NM	NM (LMW=17.8 mm)	17.8 mm	0.91	12.3 mm	4.5 mm	160°	116°	44°	>3.40	Obsidian Butte, NV, Variety 3	Elko corner notched	Elko corner notched	distal end snapped , 1 shoulder snapped, blade edges reworked, hydration notch	not on xrf list, from Kolvet et al 2000 study
75W-8-0001	isolate	49.4 mm	48.2 mm	8.3 mm	0.98	33.3 mm	1.50	26%	18.1 mm	0.54	12.0 mm	5.5 mm	160°	136°	20°	7.20	Obsidian Butte, NV, Variety 4	Elko corner notched	Elko corner notched	one base tang chipped, hydration notch	exceptionally large
NY10848-0002	Ny10848	34.9 mm	34.4 mm	6.5 mm	0.99	23.6 mm	1.48	17%	16.8 mm	0.71	12.4 mm	5.8 mm	152°	130°	23°	3.30	Obsidian Butte, NV, Variety 5 (Unknown C)	Elko corner notched	Elko corner notched	one shoulder tang chipped, heavily weathered, CaO^3 build-up on one side	serrated edges
26CK3905-500-1	Ck3905	>21.8 mm	>21.8 mm	6.3 mm	1.00	>17.6 mm	NM	NM	>14.0 mm	NM	12.7 mm	5.8 mm	197°	121°	76°	>2.10	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	blade shattered from 3 directions, partly reworked, one base tang snapped & reworked	
MK073-1191	Ny218	>30.1 mm	>30.1 mm	5.3 mm	1.00	26.5 mm	NM	NM (LMW=11.5 mm)	15.2 mm	0.57	15.0 mm	4.8 mm	178°	120°	78°	>4.60	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped, base tangs snapped-edge reworked, blade edges heavily worn	
65N-1:2-0002	Ck5814	31.2 mm	30.1 mm	4.7 mm	0.96	19.5 mm	1.60	19%	10.7 mm	0.55	9.2 mm	3.8 mm	154°	121°	34°	>2.10	Tempiute Mountain, NV	Elko corner notched	Elko corner notched	blade edges worn, especially at tip, hydration notch	not on xrf list, from Kolvet et al 2000 study
26LN3106-2	Ln3106	>18.7 mm	>17.6 mm	5.3 mm	0.94	17.4 mm	NM	NM (LMW=9.0 mm)	11.7 mm	0.70	10.2 mm	4.9 mm	175°	127°	52°	>1.60	Tempiute Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped, 1 shoulder snapped, 1 shoulder chipped	
26LN3133-2	Ln3133	>21.5 mm	>20.5 mm	7.8 mm	0.95	>19.1 mm	NM	NM	14.7 mm	NM	10.4 mm	4.1 mm	168°	121°	61°	>1.60	Tempiute Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped diagonally, one shoulder snapped through base	
NY10850-0002	Ny10850	32.1 mm	31.2 mm	8.4 mm	0.97	23.0 mm	1.40	27%	17.8 mm	0.77	12.7 mm	5.0 mm	152°	120°	31°	>2.50	Tempiute Mountain, NV	Elko corner notched	Elko corner notched	blade edges reworked, hydration notch	slightly serrated blade edges
NY10942-0113	Ny10942	38.8 mm	36.2 mm	8.9 mm	0.93	19.7 mm	1.97	27%	15.2 mm	0.77	12.5 mm	6.1 mm	172°	107°	68°	>3.20	Montezuma Range, NV	Elko eared	Elko eared	blade edges worn, hydration notch	slightly serrated blade edges; not on xrf list, from Kolvet et al 2000 study
NY10942-0152	Ny10942	38.7 mm	33.6 mm	11.6 mm	0.87	20.3 mm	1.91	40%	>14.9 mm	NM	14.9 mm	6.9 mm	220°	111°	70°	>3.90	Montezuma Range, NV	Elko eared	Elko eared	one base tang snapped, blade edges slightly worn	slightly serrated blade edges
76-19-0004	isolate	37.2 mm	34.0 mm	8.7 mm	0.91	24.8 mm	1.09	34%	>17.0 mm	NM	11.9 mm	6.2 mm	191°	142°	49°	>4.20	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Elko eared	Elko eared	1 base tang snapped, blade edges heavily reworked, 2 hydration notches	lichen on 1 side; not on xrf list, from Kolvet et al 2000 study
NY9356-0001	Ny9356	>27.9 mm	>25.3 mm	6.2 mm	0.91	22.2 mm	NM	NM (LMW=8.5 mm)	12.5 mm	0.56	10.6 mm	4.4 mm	143°	109°	35°	>2.50	Obsidian Butte, NV, Variety 3	Elko eared	Elko eared	distal end snapped, hydration notch	not on xrf list, from Kolvet et al 2000 study
NY10859-0002	Ny10859	>31.6 mm	>24.9 mm	7.5 mm	0.79	31.0 mm	NM	NM (LMW=7.0 mm)	24.0 mm	0.71	23.7 mm	5.4 mm	199°	124°	75°	>6.30	Obsidian Butte, NV, Variety 5 (Unknown C)	Elko eared	Elko eared	distal end snapped, one basal ear chipped, blade edges heavily worn/reworked	large for Elko eared, similar to 10653-0002
NY10942-0100	Ny10942	36.2 mm	33.7 mm	8.8 mm	0.93	22.5 mm	1.61	33%	12.4 mm	0.55	10.0 mm	5.0 mm	185°	108°	77°	2.90	Obsidian Butte, NV, Variety 5 (Unknown C)	Elko eared	Elko eared	one shoulder appears snapped	not on xrf list, from Kolvet et al 2000 study
NY10942-0070	Ny10942	>33.0 mm	30.6 mm	>4.5 mm	<0.92	20.0 mm	NM	NM	>14.5 mm	NM	14.0 mm	4.9 mm	204°	112°	92°	>3.00	Saline Range, CA, Variety 1 (Queen Impostor)	Elko eared	Elko eared	base snapped diagonally, blade edges reworked, slightly weathered	slightly serrated blade edges
65S-1-0003	isolate	>28.7 mm	>25.6 mm	6.8 mm	0.89	22.0 mm	NM	NM (LMW=11.2 mm)	>13.0 mm	NM	10.9 mm	4.5 mm	165°	115°	50°	>2.70	Shoshone Mountain, NV	Elko eared	Elko eared	distal end snapped, 1 base & 1 shoulder tang snapped, blade edges worn, hydration notch	not on xrf list, from Kolvet et al 2000 study
NY10848-0003	Ny10848	>23.7 mm	>21.7 mm	7.5 mm	0.92	17.7 mm	NM	NM (LMW=8.2 mm)	16.3 mm	0.92	13.1 mm	6.6 mm	196°	137°	60°	>2.90	Shoshone Mountain, NV	Elko eared	Elko eared	distal end snapped, heavily weathered	crude flake pattern
12-17-114	Ny8	>22.7 mm	>19.2 mm	8.1 mm	0.86	24.5 mm	NM	NM (LMW=8.4 mm)	>13.5 mm	NM	9.6 mm	4.2 mm	159°	138°	33°	>2.50	Obsidian Butte, NV, Variety 5 (Unknown C)	Elko eared	Elko eared	distal end snapped, 1 base tang snapped, blade edges worn at neck	NAGPRA item
5-440-16	Ny376	>28.3 mm	>28.3 mm	>4.3 mm	NM	20.0 mm	NM	NM	NM	NM	11.9 mm	4.1 mm	193°	82°	68°	>2.10	Obsidian Butte, NV, Variety 4	Gatecliff	Gatecliff	distal end snapped, base snapped	no data to sub-type; not on xrf list, from Haarklau 2001
75W-13-0003	isolate	>28.8 mm	>27.9 mm	12.6 mm	0.97	33.8 mm	NM	NM (LMW=16.3 mm)	>11.0 mm	NM	19.1 mm	7.9 mm	179°	84°	86°	>6.2	Tempiute Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped above shoulders, base snapped at both sides, heavily damaged & reworked	very large in comparison to others
LN4247-0001	Ln4247	45.1 mm	45.1 mm	6.0 mm	1.00	20.8 mm	2.17	16%	4.0 mm	0.19	10.8 mm	5.0 mm	198°	45°	152°	4.80	Kane Springs Wash Caldera Variety 2, NV	Gatecliff contracting stem	Gatecliff contracting stem	blade edges worn	not on xrf list, from Kolvet et al 2000 study
CK5522-0124	Ck5522	28.8 mm	28.8 mm	6.6 mm	1.00	22.7 mm	1.27	36%	8.6 mm	0.38	10.2 mm	5.4 mm	179°	83°	85°	>2.50	Oak Spring Butte, NV	Gatecliff contracting stem	Gatecliff contracting stem	one shoulder snapped & reworked, blade edges heavily worn	classification based on notch opening
64B-B:2-0001	isolate	>31.0 mm	>31.0 mm	8.3 mm	1.00	25.9 mm	NM	NM (LMW=10.0 mm)	9.9 mm	0.38	14.8 mm	5.3 mm	200°	66°	45°	>4.50	Oak Spring Butte, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, hydration notch	not on xrf list, from Kolvet et al 2000 study
71S-24-0001	isolate	29.9 mm	29.9 mm	2.9 mm	NM	>20.6 mm	NM	0%	10.2 mm	NM	12.5 mm	5.4 mm	151°	62°	90°	>3.00	Obsidian Butte, NV, Variety 4	Gatecliff contracting stem	Gatecliff contracting stem	blade edges & base heavily damaged & reworked, one shoulder tang snapped	
26LN3278-1	Ln3278	>30.5 mm	>27.7 mm	6.9 mm	0.91	17.7 mm	NM	NM (LMW=10.2 mm)	13.1 mm	0.74	11.8 mm	7.9 mm	237°	102°	119°	>4.40	Shoshone Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, one base tang chipped, heavily weathered, heavily reworked	
NY10687-0003&4	Ny10687	33.1 mm	33.1 mm	6.7 mm	1.00	>22.0 mm	NM	NM	9.7 mm	NM	12.1 mm	5.5 mm	148°	75°	78°	>3.00	Shoshone Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	snapped in half, one shoulder snapped, blade edges heavily worn & reworked	
NY10942-0011	Ny10942	>27.4 mm	>27.4 mm	4.6 mm	1.00	23.5	NM	NM (LMW=5.6 mm)	7.1 mm	0.30	11.3 mm	6.4 mm	197°	56°	144°	>3.40	Silver Peak/Fish Lake Valley, NV	Gatecliff contracting stem	Gatecliff contracting stem	tip snapped, weathered, blade edges worn	LS short for type
NY0377-0046	Ny377	>28.3 mm	>28.3 mm	6.5 mm	1.00	19.1 mm	NM	NM (LMW=16.9 mm)	10.0 mm	0.52	11.5 mm	4.5 mm	159°	83°	77°	>2.50	South Kawich Range, NV (Apache Tear Canyon)	Gatecliff contracting stem	Gatecliff contracting stem	tip snapped, blade edges reworked & worn	not on xrf list, from Haarklau 2001
26LN3094-11	Ln3094	>26.1 mm	>26.1 mm	6.1 mm	1.00	20.5 mm	NM	NM (LMW=8.3 mm)	4.7 mm	0.23	10.5 mm	6 mm	172°	84°	88°	>2.90	Tempiute Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, base chipped, blade edges & shoulders heavily damaged/reworked	
26LN3094-6	Ln3094	>22.1 mm	>22.1 mm	5.8 mm	1.00	24.0 mm	NM	NM (LMW=7.6 mm)	7.2 mm	0.30	10.6 mm	5.1 mm	163°	65°	81°	>2.40	Tempiute Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, one shoulder chipped, blade edges worn	
26LN3110-1	Ln3110	29.4 mm	29.4 mm	5.1 mm	1.00	20.4 mm	1.44	18%	6.5 mm	0.32	8.2 mm	5.2 mm	143°	47°	83°	2.40	Tempiute Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	base edge chipped, blade edges slightly worn	
71S-12-0002	isolate	>41.0 mm	>38.5 mm	8.6 mm	0.94	23.0 mm	NM	NM (LMW=12.5 mm)	10.8 mm	0.47	10.6 mm	5.3 mm	210°	97°	115°	>4.00	Montezuma Range, NV	Gatecliff split stem	Gatecliff split stem	tip snapped, hydration notch, blade edges heavily worn on one side	not on xrf list, from Kolvet et al 2000 study
NY10942-0167	Ny10942	>35.5 mm	>31.8 mm	12.4 mm	0.90	34.9 mm	NM	NM (LMW=12.3 mm)	18.0 mm	0.52	21.0 mm	8.4 mm	164°	78°	86°	>9.60	Montezuma Range, NV	Gatecliff split stem	Gatecliff split stem	distal end snapped, blade edges worn, hydration notch	extremely large for Gatecliff
75W-17-0002	isolate	35.0 mm	31.8 mm	9.0 mm	0.91	21.2 mm	1.50	34%	12.2 mm	0.58	14.3 mm	5.3 mm	198°	98°	99°	3.90	Oak Spring Butte, NV	Gatecliff split stem	Gatecliff split stem	one shoulder snapped & reworked, tip reworked, blade edges worn	
MK074-268	Ny218	31.2 mm	27.9 mm	9.5 mm	0.89	22.8 mm	1.37	41%	18.5 mm	0.81	17.7 mm	5.0 mm	235°	97°	131°	3.55	Oak Spring Butte, NV	Gatecliff split stem	Gatecliff split stem	blade edges reworked	NAGPRA item
NY0377-0033	Ny377	>24.3 mm	>22.7 mm	7.1 mm	0.93	23.7 mm	NM	NM (LMW=7.4 mm)	10.0 mm	0.42	9.7 mm	6.8 mm	140°	81°	41°	>2.80	Oak Spring Butte, NV	Gatecliff split stem	Gatecliff split stem	tip snapped and reworked, bottom edge of base chipped	
75W-17-002A	isolate	35.1 mm	34.1 mm	7.8 mm	0.97	24.1 mm	1.46	40%	10.3 mm	0.43	12.0 mm	4.2 mm	190°	84°	110°	>3.00	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Gatecliff split stem	Gatecliff split stem	one shoulder snapped, tip reworked, blade edges worn, hydration notch	not on xrf list, from Kolvet et al 2000 study
76-INT5-0002	isolate	>28.7 mm	>25.5 mm	5.7 mm	0.89	21.6 mm	NM	NM (LMW=7.4 mm)	13.3 mm	0.62	13.5 mm	5.0 mm	202°	102°	100°	>3.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Gatecliff split stem	Gatecliff split stem	distal end snapped, conchoidal fracture above one shoulder, heavily reworked	
NY10848-0011	Ny10848	33.4 mm	31.9 mm	5.3 mm	0.96	15.9 mm	2.10	21%	10.5 mm	0.66	11.4 mm	6.0 mm	208°	70°	138°	3.20	Obsidian Butte, NV, Variety 5 (Unknown C)	Gatecliff split stem	Gatecliff split stem	complete, flake scars and edges weathered smooth	
NY10942-0135	Ny10942	41.6 mm	40.3	6.6 mm	0.97	23.5 mm	1.77	23%	11.3 mm	0.48	12.5 mm	6.7 mm	205°	85°	125°	4.10	Obsidian Butte, NV, Variety 4	Gatecliff split stem	Gatecliff split stem	complete but basal chip	
NY10942-0141	Ny10942	>29.1 mm	27.4 mm	>2.5 mm	≈ 0.94 (maximum)	21.2 mm	NM	NM	>13.0 mm	NM	13.7 mm	4.9 mm	199°	97°	102°	>2.20	Silver Peak/Fish Lake Valley, NV	Gatecliff split stem	Gatecliff split stem	bottom of base tangs snapped, blade edges worn, tip reworked, weathered	blade edges serrated
NY10942-0145	Ny10942	27.7 mm	25.5 mm	6.8 mm	0.92	17.1 mm	1.49	32%	10.0 mm	0.58	9.7 mm	5.0 mm	165°	100°	65°	>1.65	Tempiute Mountain, NV	Gatecliff split stem	Gatecliff split stem	one shoulder tang snapped, tip reworked, one base tang chipped, hydration notch	asymmetrical base
NY10942-0208	Ny10942	>35.3 mm	>28.1 mm	N/A	0.80	35.6 mm	NM	NM (LMW=30.2 mm)	30.8 mm	0.87	28.9 mm	7.4 mm	N/A	N/A	N/A	>10.00	Montezuma Range, NV	Great Basin fluted	*?Humboldt?*	blade snapped at haft/blade juncture	Great Basin fluted - NAGPRA item; not on xrf list, from Kolvet et al 2000 study
NY10682-0001	Ny10682	37.5 mm	37.5 mm	7.4 mm	1.00	28.7 mm	1.31	35%	19.1 mm	0.67	18.1 mm	6.9 mm	192°	97°	100°	>6.70	Castle Mountains, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	blade edges worn, tip reworked	Great Basin stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
NY10845-0001	Ny10845	42.7 mm	42.7 mm	11.1 mm	1.00	31.4 mm	1.36	40%	21.1 mm	0.67	21.4 mm	8.1 mm	200°	96°	105°	10.50	Crow Spring, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	complete	Great Basin Stemmed, Borax Lake widestem
NY10910-0002	Ny10910	>39.0 mm	>39.0 mm	11.9 mm	1.00	29.7 mm	NM	NM (LMW=23.0 mm)	19.7 mm	0.66	17.8 mm	6.8 mm	183°	92°	92°	>9.10	Crow Spring, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end snapped	Great Basin stemmed, Borax Lake widestem
NY10942-0181	Ny10942	37.3 mm	37.3 mm	8.5 mm	1.00	27.9 mm	1.34	34%	18.9 mm	0.68	22.1 mm	8.1 mm	221°	82°	139°	>6.80	Montezuma Range, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	blade edges reworked	Great Basin Stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
NY10942-0099	Ny10942	>20.5 mm	>20.5 mm	10.3 mm	1.00	37.0 mm	NM	NM (LMW=14.4 mm)	20.8 mm	0.56	18.9 mm	6.2 mm	160°	130°	30°	>4.60	Montezuma Range, NV	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	blade snapped above shoulders, weathered	Great Basin stemmed, Borax Lake widestem
NY10942-0053	Ny10942	>38.9 mm	>38.9 mm	14.7 mm	1.00	34.4 mm	NM	NM (LMW=17.5 mm)	23.2 mm	0.67	23.2 mm	7.1 mm	205°	104°	100°	>9.40	Montezuma Range, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end snapped, blade edges worn	Great Basin stemmed, Borax Lake widestem
NY10848-0041	Ny10848	>45.0 mm	>45.0 mm	10.4 mm	1.00	21.9 mm	NM	NM (LMW=21.0 mm)	16.0 mm	0.73	15.0 mm	6.1 mm	215°	82°	126°	>5.40	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end snapped at an angle, blade edges worn, heavily weathered	Great Basin stemmed, Borax Lake widestem
75W-D-0003	isolate	>37.0 mm	>37.0 mm	13.4 mm	1.00	27.1 mm	NM	NM (LMW=16.2 mm)	18.5 mm	0.68	16.4 mm	8.1 mm	230°	104°	127°	>6.5	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Borax Lake	out-of-key	tip snapped, blade edges worn	Great Basin stemmed, Borax Lake widestem
NY10942-0025	Ny10942	>32.7 mm	>32.7 mm	16.5 mm	1.00	29.2 mm	NM	NM (LMW=21.0 mm)	15.9 mm	0.54	16.9 mm	8.2 mm	220°	94°	121°	>6.10	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	blade snapped diagonally above shoulders, snapped edge reworked	Great Basin Stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
NY10942-0035	Ny10942	25.0 mm	25.0 mm	10.2 mm	1.00	22.3 mm	1.12	53%	>10.4 mm	NM	15.9 mm	7.7 mm	208°	94°	114°	>3.55	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	heavily weathered, blade heavily reworked, bottom stem edge snapped on both corners	Great Basin stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
NY10846-0003	Ny10846	>34.9 mm	>34.9 mm	14.4 mm	1.00	33.1 mm	NM	NM (LMW=15.8 mm)	21.6 mm	0.65	19.6 mm	8.2 mm	195°	112°	84°	>9.85	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	distal end snapped, blade edges damaged & reworked	Great Basin stemmed, Borax Lake widestem
NY10942-0017	Ny10942	36.8 mm	36.8 mm	14.3 mm	1.00	25.7 mm	1.43	43%	21.0 mm	0.82	22.3 mm	7.2 mm	204°	82°	122°	7.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	weathered, blade edges heavily worn & reworked, one shoulder snapped	Great Basin Stemmed, Borax Lake widestem
NY10942-0182	Ny10942	>37.5 mm	>36.2 mm	16.9 mm	0.97	>32.5 mm	NM	NM	16.2 mm	NM	23.2 mm	6.9 mm	201°	86°	115°	>9.60	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end snapped, 1 shoulder & blade edges worn/reworked, base reworked	Great Basin stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
71S-INT4-0008	isolate	>40.5 mm	>40.5 mm	14.4 mm	1.00	39.9 mm	NM	NM (LMW=17.8 mm)	17.9 mm	0.45	18.4 mm	8.4 mm	173°	99°	75°	>11.50	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	distal end snapped, blade edges heavily worn, one shoulder & one edge of stem reworked	Great Basin Stemmed, Borax Lake widestem
NY10728-0001	Ny10728	>37.6 mm	>37.3 mm	8.8 mm	0.99	>31.9 mm	NM	NM	19.3 mm	NM	19.1 mm	7.5 mm	197°	83°	116°	>8.50	Shoshone Mountain, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	blade snapped in two directions, blade edges worn & reworked	Great Basin Stemmed, Borax Lake widestem
NY8787-0019	Ny8787	44.8 mm	44.8 mm	15.8 mm	1.00	27.1 mm	1.65	42%	21.3 mm	0.78	22.5 mm	7.6 mm	220°	79°	140°	9.10	Shoshone Mountain, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	blade edges heavily worn/reworked	Great Basin stemmed, Borax Lake widestem
Ny10848-0066	Ny10848	32.2	32.2	11.7 mm	1.00	25.7 mm	1.25	49%	20.0 mm	0.78	21.2 mm	6.9 mm	247°	91°	157°	5.70	Silver Peak/Fish Lake Valley, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	heavily weathered, flake scars & edges smooth, stem possibly snapped along base edge	Great Basin Stemmed, Borax Lake widestem
NY10680-00A3	Ny10680	43.3 mm	42.5 mm	15.0 mm	0.98	24.8 mm	1.75	41%	14.8 mm	0.60	17.9 mm	8.2 mm	207°	84°	126°	>7.80	Tempiute Mountain, NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	blade edges worn, one shoulder & notch reworked	Great Basin Stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
5-414-4	Ny382	36.5 mm	36.5 mm	8.9 mm	1.00	24.5 mm	1.49	29%	18.2 mm	0.74	16.9 mm	9.9 mm	215°	129°	89°	>7.50	Tempiute Mountain, NV	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	base chipped on one side, blade edges heavily reworked	Great Basin Stemmed, Borax Lake widestem
NY10942-0185	Ny10942	44.4 mm	44.4 mm	12.2 mm	1.00	20.5 mm	2.17	38%	15.5 mm	0.76	14.2 mm	6.1 mm	220°	105°	112°	5.15	Unknown 3	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	heavily weathered, blade edges worn & reworked	Great Basin Stemmed, Borax Lake widestem
71S-21-0008	isolate	>30.4 mm	>30.4 mm	10.3 mm	1.00	25.5 mm	NM	NM (LMW=11.8 mm)	17.3 mm	0.69	15.1 mm	7.4 mm	198°	97°	91°	>5.40	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end snapped, blade edges worn/reworked, CaO^3 buildup on one side, weathered	Great Basin stemmed, Borax Lake widestem
NY10680-00B3	Ny10680	36.5 mm	36.5 mm	11.5 mm	1.00	27.8 mm	1.31	38%	18.9 mm	0.67	21.8 mm	8.1 mm	207°	95°	113°	>6.40	Wildhorse Canyon, Mineral Mountains, UT	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem*	blade edges worn	Great Basin Stemmed, Borax Lake widestem; not on xrf list, from Kolvet et al 2000 study
NY10942-0074	Ny10942	>43.4 mm	>43.4 mm	34.0 mm	1.00	>21.8 mm	NM	NM	12.7 mm	NM	19.9 mm	9.4 mm	253°	84°	169°	>10.00	Lookout Mountain, Casa Diablo, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders	Great Basin Stemmed, Lake Mohave
NY10911-0001	Ny10911	56 mm	56 mm	31.3 mm	1.00	25.2 mm	2.22	59%	14.4 mm	0.57	24.1 mm	7.3 mm	N/A	75°	N/A	9.30	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	out-of-key	blade edges worn & reworked	Great Basin Stemmed, Lake Mohave (very weak shoulders - PSA is smallest stem angle)
75W-D-0005	isolate	52.7 mm	52.7 mm	28.3 mm	1.00	25.6 mm	2.06	53%	9.2 mm	0.36	18.2 mm	7.6 mm	204°	85°	137°	>9.40	Oak Spring Butte, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem*	complete except for hydration notch	Great Basin Stemmed, Lake Mohave; not on xrf list, from Kolvet et al 2000 study
75W-6-1A-2	isolate	>34.4 mm	>34.4 mm	>26.5 mm	NM	>31.2 mm	NM	NM	≈20.0 mm	NM	28.6 mm	11.2 mm	233°	76°	158°	>13.00	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem*	blade snapped above shoulders, stem base snapped,	Great Basin Stemmed, Lake Mohave; not on xrf list, from Kolvet et al 2000 study
76-H-0001	isolate	52.1 mm	52.1 mm	31.0 mm	1.00	24.6 mm	2.12	64%	11.1 mm	0.45	22.9 mm	7.6 mm	N/A	81°	N/A	9.00	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Lake Mohave	out-of-key	blade heavily reworked, one edge of stem battered	Great Basin Stemmed, Lake Mohave (very weak shoulders - PSA is stem angle); not on xrf list, from Kolvet et al 2000 study
76-INT2-0009	isolate	>35.0 mm	>35.0 mm	18.0 mm	1.00	28.4 mm	NM	NM (LMW=30.0 mm)	13.6 mm	0.48	20.2 mm	7.0 mm	234°	87°	148°	>6.20	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem*	blade snapped above shoulders, one shoulder reworked	Great Basin Stemmed, Lake Mohave
NY10848-0067	Ny10848	>43.3 mm	>43.3 mm	28.4 mm	1.00	25.9 mm	NM	NM (LMW=32.8 mm)	11.2 mm	0.43	22.6 mm	6.9 mm	245°	88°	160°	>7.10	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem*	distal end snapped above shoulders, heavily weathered	Great Basin Stemmed, Lake Mohave
NY10942-0112	Ny10942	>40.2 mm	>40.2 mm	29.9 mm	1.00	>21.6 mm	NM	NM	15.9 mm	NM	18.0 mm	5.5 mm	232°	91°	141°	>4.90	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff split stem?*	blade snapped above shoulders % worked to a small stub, base edge snapped	Great Basin Stemmed, Lake Mohave
NY10942-0133	Ny10942	>46.3 mm	>46.3 mm	37.4 mm	1.00	25.3 mm	NM	NM (LMW=42.1 mm)	9.7 mm	0.38	21.8 mm	5.4 mm	230°	88°	150°	>6.80	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem*	distal end snapped, weathered	Great Basin Stemmed, Lake Mohave
NY10849-0002	Ny10849	>37.7 mm	>36.8 mm	27.6 m	0.98	>16.1 mm	NM	NM	13.3 mm	NM	15.2 mm	6.3 mm	231°	88°	143°	>4.25	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	heavily weathered, blade snapped at shoulders, heavily reworked, base edge snapped	Great Basin Stemmed, Lake Mohave
26NY5693 1-1	Ny5693	>34.0 mm	>34.0 mm	31.9 mm	1.00	>21.4 mm	NM	NM	11.5 mm	NM	≈20.7 mm	7.9 mm	NM	86°	NM	>6.60	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Lake Mohave	untypable	stem and bottom of one shoulder	Great Basin Stemmed, Lake Mohave (PSA is smallest stem angle)
75W-3-0001	isolate	>35.6 mm	>35.6 mm	29.6 mm	1.00	>26.0 mm	NM	NM	13.1 mm	NM	21.5 mm	7.0 mm	245°	86°	159°	>6.40	Shoshone Mountain, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem*	blade snapped above shoulders, base battered,	Great Basin Stemmed, Lake Mohave; not on xrf list, from Kolvet et al 2000 study
NY10725-0002	Ny10725	>45.7 mm	>45.7 mm	34.2 mm	1.00	>34.0 mm	NM	NM	12.1 mm	NM	31.2 mm	8.7 mm	235°	76°	159°	>12.20	Shoshone Mountain, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders in two directions, stem base ground	Great Basin Stemmed, Lake Mohave
NY10844-0006	Ny10844	>36.4 mm	>36.4 mm	>5.5 mm	NM	25.3 mm	NM	NM	NM	NM	18.4 mm	8.9 mm	191°	56°	55°	>9.15	Shoshone Mountain, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	heavily weathered blade edges damaged & reworked, stem snapped below neck	Great Basin Stemmed, probably Lake Mohave based on stem thickness at snap, mahogany obsidian
75E-14-0003	isolate	>31.2 mm	>31.2 mm	24.6 mm	1.00	>21.5 mm	NM	NM	15.4 mm	NM	≈20.7 mm	6.8 mm	247°	87°	160°	>4.70	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	snapped at shoulders, bottom of stem slightly worn	Great Basin Stemmed, Lake Mohave; not on xrf list, from Kolvet et al 2000 study
NY10657-0002	Ny10657	>32.0 mm	>32.0 mm	26.4 mm	1.00	>21.5 mm	NM	NM	10.4 mm	NM	≈21.0 mm	6.0 mm	245°	84°	161°	>3.90	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	snapped diagonally above one shoulder through stem	Great Basin Stemmed, Lake Mohave
NY10848-0083	Ny10848	30.2 mm	30.2 mm	12.7 mm	1.00	21.6 mm	1.40	52%	>16.5 mm	NM	18.5 mm	6.5 mm	239°	103°	54°	>4.25	Crow Spring, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	weathered, one corner base snapped & edge battered, blade edges heavily damaged & reworked	Great Basin Stemmed, Silver Lake
NY10680-00B1	Ny10680	42.5 mm	43.5 mm	8.9 mm	1.00	28.5 mm	1.49	31%	16.1 mm	0.56	21.6 mm	7.9 mm	207°	94°	112°	>8.75	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade edges reworked	Great Basin Stemmed, Silver Lake; not on xrf list, from Kolvet et al 2000 study
NY10848-0062	Ny10848	>41.3 mm	>41.3 mm	17.5 mm	1.00	25.2 mm	NM	NM (LMW=22.3 mm)	14.7 mm	0.58	17.2 mm	6.7 mm	230°	92°	138°	6.20 mm	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped diagonally above one shoulder to tip, flake scars and edges weathered nearly smooth	Great Basin Stemmed, Silver Lake
NY10848-0040	Ny10848	54.8 mm	53.0 mm	11.1 mm	0.97	26.5 mm	2.07	53%	16.5 mm	0.62	17.1 mm	10.4 mm	221°	84°	137°	14.50	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff split stem?*	heavily weathered, blade edges heavily worn & reworked, base possibly chipped	Great Basin Stemmed, Silver Lake
NY10942-0196	Ny10942	33.0 mm	33.0 mm	11.9 mm	1.00	19.1 mm	1.73	44%	13.3 mm	0.70	15.5 mm	6.6 mm	220°	79°	143°	4.70	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, blade edges worn & reworked	Great Basin Stemmed, Silver Lake
NY10942-0027	Ny10942	28.1 mm	28.1 mm	10.5 mm	1.00	22.3 mm	1.26	55%	11.8 mm	0.53	16.1 mm	6.1 mm	209°	70°	139°	3.65	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, blade heavily reworked	Great Basin Stemmed, Silver Lake; not on xrf list, from Kolvet et al 2000 study
NY10942-0193	Ny10942	34.3 mm	34.3 mm	14.8 mm	1.00	23.6 mm	1.45	55%	16.1 mm	0.68	19.1 mm	7.5 mm	228°	81°	149°	5.85	Mount Hicks, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade edges reworked & worn	Great Basin Stemmed, Silver Lake
NY10942-0169	Ny10942	37.8 mm	37.8 mm	15.4 mm	1.00	26.0 mm	1.45	43%	0.00 mm	0.00	16.3 mm	6.4 mm	182°	101°	82°	5.50	Oak Spring Butte, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	complete, heavily weathered	Great Basin Stemmed, Silver Lake
5-968-1	Ny1518	>32.3 mm	>32.2 mm	>8.1 mm	NM	22.5 mm	NM	NM	NM	NM	12.2 mm	6.0 mm	187°	72°	65°	>3.80	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	bottom of stem snapped, blade edges heavily worn & reworked	Great Basin Stemmed, Silver Lake
NY10675-0004	Ny10675	>29.5 mm	>29.5 mm	14.7 mm	1.00	23.5 mm	NM	NM (LMW=18.6 mm)	13.3 mm	0.57	16.1 mm	8.1 mm	204°	94°	110°	>5.15	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal end snapped, one shoulder reworked	Great Basin Stemmed, Silver Lake
NY10723-0001	Ny10723	36.0 mm	36.0 mm	22.6 mm	1.00	>22.7 mm	NM	71%	16.7 mm	NM	>18.2 mm	6.6 mm	206°	98°	108°	>5.80	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade heavily reworked (a stub) & edges worn, one notch chipped	Great Basin Stemmed, Silver Lake
NY10848-0069	Ny10848	32.8 mm	32.8 mm	14.5 mm	1.00	16.6 mm	1.98	52%	8.6 mm	0.52	12.6 mm	5.7 mm	201°	100°	102°	3.10	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, blade heavily damaged & reworked	Great Basin Stemmed, Silver Lake
MK102-246	Ny218	33.5 mm	33.5 mm	13.3 mm	1.00	24.0 mm	1.40	51%	19.1 mm	0.80	20.0 mm	6.9 mm	133°	105°	128°	5.10	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem*	complete	Great Basin Stemmed, Silver Lake
76-L-0003	isolate	37.9 mm	37.9 mm	17.2 mm	1.00	24.1 mm	1.57	55%	14.0 mm	0.37	18.4 mm	6.9 mm	202°	96°	106°	>5.70	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade edges damaged & heavily reworked	Great Basin Stemmed, Silver Lake; not on xrf list, from Kolvet et al 2000 study
NY10625-0008	Ny10625	47.2 mm	47.2 mm	14.5 mm	1.00	26.1 mm	1.80	38%	11.0 mm	0.42	14.8 mm	6.9 mm	201°	92°	115°	>7.50	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade edges worn & reworked	Great Basin Stemmed, Silver Lake; not on xrf list, from Kolvet et al 2000 study
NY10848-0024	Ny10848	33.7 mm	33.7 mm	14.7 mm	1.00	20.5 mm	1.64	46%	14.4 mm	0.70	15.1 mm	6.3 mm	226°	104°	120°	4.60	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, flake scars and edges nearly smooth but blade appears reworked	Great Basin Stemmed, Silver Lake
NY10942-0044	Ny10942	>27.6 mm	>27.6 mm	16.0 mm	1.00	>28.1 mm	NM	NM	19.3 mm	NM	21.8 mm	6.7 mm	188°	72°	118°	>4.90	Shoshone Mountain, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	weathered, distal end snapped, one shoulder snapped & reworked, blade edges worn	Great Basin Stemmed, Silver Lake
NY10679-0008	Ny10679	>34.6 mm	>34.6 mm	14.1 mm	1.00	23.6 mm	NM	NM (LMW=14.0 mm)	16.5 mm	0.70	16.6 mm	7.0 mm	192°	108°	85°	>5.10	Tempiute Mountain, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	broken and reworked tip, hydration notch	Great Basin Stemmed, Silver Lake; not on xrf list, from Kolvet et al 2000 study
NY10942-0024	Ny10942	33.2 mm	33.2 mm	9.8 mm	1.00	22.7 mm	1.46	36%	13.3 mm	0.59	12.2 mm	6.2 mm	202°	103°	80°	4.10	unknown - Unknown Variety G (Gatecliff shelter Group 1) Gatecliff shelter	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade reworked, base chipped, heavily weathered	Great Basin stemmed, Silver Lake
NY10942-0051	Ny10942	>20.4 mm	>20.4 mm	13.3 mm	1.00	>22.8 mm	NM	NM	16.2 mm	NM	≈22.8 mm	6.3 mm	218°	80°	138°	>2.30	Tempiute Mountain, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped at shoulders	Great Basin Stemmed stem, Silver Lake
CK5270-0002	Ck5270	31.0 mm	27.3 mm	11.9 mm	0.88	18.9 mm	1.64	44%	15.5 mm	0.82	15.2 mm	5.5 mm	225°	105°	125°	3.10	Kane Springs Wash Caldera Variety 1, NV	Great Basin stemmed, Stanislaus	*?Gatecliff split stem?*	blade edges heavily reworked	Great Basin Stemmed, Stanislaus broad stem
NY10942-0206	Ny10942	>24.5 mm	>24.0 mm	17.5 mm	0.98	>30.6 mm	NM	NM	21.1 mm	NM	20.9 mm	7.2 mm	213°	87°	127°	>5.00	Montezuma Range, NV	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	blade snapped above shoulders, heavily weathered	Great Basin Stemmed, Stanislaus broad stem
NY10942-0207	Ny10942	>34.3 mm	>33.4 mm	12.3 mm	0.97	>27.6 mm	NM	NM (LMW=16.3 mm)	20.0 mm	NM	22.3 mm	9.1 mm	216°	95°	121°	>6.80	Montezuma Range, NV	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	blade snapped diagonally from one shoulder to tip, snapped edge & other blade edges reworked	Great Basin Stemmed, Stanislaus broad stem
NY10680-00D1	Ny10680	33.8 mm	32.7 mm	12.4 mm	0.97	23.0 mm	1.47	48%	20.4 mm	0.89	18.3 mm	8.6 mm	202°	99°	120°	>6.00	Shoshone Mountain, NV	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	blade edges worn	Great Basin Stemmed, Stanislaus broad stem; not on xrf list, from Kolvet et al 2000 study
NY10821-0001	Ny10821	39.7 mm	39 mm	15.2 mm	0.98	25.8 mm	1.54	47%	19.9 mm	0.77	18.6 mm	7.3 mm	229°	93°	136°	7.00	Tempiute Mountain, NV	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	complete, heavily weathered, CaO^3 build-up on one side	Great Basin Stemmed, Stanislaus broad stem
71S-25-0006	isolate	49.9 mm	43.6 mm	N/A	0.87	23.0 mm	2.19	47%	21.3 mm	0.93	N/A	9.0 mm	N/A	N/A	N/A	9.85	Montezuma Range, NV	Humboldt	out-of-key	distal end damaged & reworked, hydration notch	large, thick, shoulderless, concave-base point, oblique flake scars, closest in appearance to Humboldt cluster; not on xrf list, from Kolvet et al 2000 study
NY10942-0139	Ny10942	>19.9 mm	>15.2 mm	N/A	0.76	>19.5 mm	NM	NM	16.6 mm	<0.85	N/A	5.9 mm	N/A	N/A	N/A	>1.90	Montezuma Range, NV	Humboldt	Humboldt	blade snapped diagonally slightly above haft element, weathered	

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
5-442-4	Ny372	37.9 mm	36.7 mm	N/A	0.97	20.6 mm	1.84	41%	10.9 mm	0.53	N/A	5.7 mm	N/A	N/A	N/A	4.30	Oak Spring Butte, NV	Humboldt	Humboldt	blade edges worn, slightly reworked	not on xrf list, from Haarklau 2001
12-17-118	Ny8	>25.5 mm	>24.8 mm	N/A	0.97	13.3 mm	NM	NM (LMW=12.3 mm)	6.3 mm	0.47	N/A	5.7 mm	N/A	N/A	N/A	>1.90	Oak Spring Butte, NV	Humboldt	Humboldt	distal end snapped, blade edges worn	length >30 mm if complete, but very small for Humboldt - looks most like thick Cottonwood leaf shaped - NAGPRA item
NY10942-0197	Ny10942	>37.8 mm	>34.4 mm	N/A	0.91	18.1 mm	NM	NM (LMW=15.3 mm)	15.7 mm	0.87	N/A	5.1 mm	N/A	N/A	N/A	>3.90	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Humboldt	Humboldt	tip snapped, blade edges worn, hydration notch	not on xrf list, from Kolvet et al 2000 study
NY0377-0041	Ny377	>50.9 mm	>40.6 mm	N/A	0.80	25.1 mm	NM	NM (LMW=28.2 mm)	≈15.0 mm	0.60	N/A	5.3 mm	N/A	N/A	N/A	>6.70	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Humboldt	Humboldt	distal end, one base tang snapped, blade edges worn & reworked	WB estimated assuming relative symmetry; not on xrf list, from Haarklau 2001
71N-D-0003	isolate	>17.1 mm	>14.9 mm	N/A	0.87	>19.4 mm	NM	NM	19.4 mm	NM	N/A	5.7 mm	N/A	N/A	N/A	>1.70	Obsidian Butte, NV, Variety 5 (Unknown C)	Humboldt	out-of-key	blade snapped diagonally at haft element/blade juncture	appearance Humboldt cluster (lack WM measurement)
71N-F-0001	isolate	>28.9 mm	>21.2 mm	N/A	0.73	25.8 mm	NM	NM LMW=23.3 mm)	15.7 mm	0.61	N/A	4.2 mm	N/A	N/A	N/A	>3.60	Obsidian Butte, NV, Variety 5 (Unknown C)	Humboldt	Humboldt	blade snapped at WM	
Ny10850-0001	Ny10850	>25.8 mm	>24.1 mm	N/A	0.93	>27.8 mm	NM	NM	16.4 mm	<0.59	N/A	5.5 mm	N/A	N/A	N/A	>3.80	Obsidian Butte, NV, Variety 4/5 (Unknown C)	Humboldt	Humboldt	distal end snapped diagonally above haft element, blade edges worn	
NY10859-0001	Ny10859	>19.0 mm	>15.0 mm	N/A	0.78	>26.9 mm	NM	NM	19.1 mm	<0.71	N/A	5.2 mm	N/A	N/A	N/A	>2.50	Obsidian Butte, NV, Variety 5 (Unknown C)	Humboldt	Humboldt	blade snapped diagonally at haft element/blade juncture	
12-17-73	Ny8	>35.5 mm	>31.1 mm	N/A	0.88	26.5 mm	NM	NM (LMW=15.4 mm)	21.0 mm	0.79	N/A	6.4 mm	N/A	N/A	N/A	>6.90	Shoshone Mountain, NV	Humboldt	Humboldt	distal end snapped, blade edge damaged, blade heavily reworked	NAGPRA item
12-17-116	Ny8	>28.1 mm	>25.0 mm	N/A	0.91	23.5 mm	NM	0%	23.5 mm	1.00	N/A	6.8 mm	N/A	N/A	N/A	>4.70	Shoshone Mountain, NV	Humboldt	out-of-key	distal end snapped, blade edges heavily worn	Humboldt cluster, Humboldt type - triangular - NAGPRA item
NY10942-0109	Ny10942	>40.6 mm	>36.9 mm	N/A	0.90	22.3 mm	NM	NM (LMW=23.1 mm)	18.5 mm	0.82	N/A	8.0 mm	N/A	N/A	N/A	>6.75	Silver Peak/Fish Lake Valley, NV	Humboldt	Humboldt	tip snapped, one base tang chipped, blade edges worn	blade edges serrated
71S-11-0006	isolate	39.8 mm	35.7 mm	N/A	0.89	17.2 mm	2.43	43%	16.6 mm	0.96	N/A	5.2 mm	N/A	N/A	N/A	>3.20	Unknown Variety F	Humboldt	out-of-key	tip worn, one base tang chipped, hydration notch	Humboldt cluster, Humboldt type
71S-7-0004	isolate	66.6 mm	66.6 mm	8.5 mm	1.00	40.1 mm	1.66	25%	0.0 mm	0.00	13.2 mm	8.8 mm	163°	63°	80°	27.00	Montezuma Range, NV	Large basal notched, Unknown	*?Gatecliff contracting stem?*	heavily weathered, tip appears reworked on one side	huge, basal-notched point with fluted flake scars on both sides at opposing base notches, probably early Holocene based on general appearance and majority of diagnostic artifacts from Stonewall Flat (Range 71 south)
26LN3094-3	Ln3094	>25.4 mm	>25.4 mm	7.8 mm	1.00	20.8 mm	NM	NM (LMW=12.8 mm)	>15.0 mm	NM	3.3 mm	5.2 mm	240°	159°	82°	>2.6	Oak Spring Butte, NV	Large side notched, Sudden	Large side notched	blade snapped along two edges and reworked, one side of base snapped	Sudden type
NY10845-0006	Ny10845	>22.6 mm	>22.1 mm	8.2 mm	0.98	21.0 mm	NM	NM (LMW=12.4 mm)	21.0 mm	1.00	11.0 mm	4.1 mm	163°	155°	8°	>2.30	Obsidian Butte, NV, Variety 5 (Unknown C)	Large side notched, unknown	Large side notched	blade snapped, flake scars weathered smooth	unknown type, based on appearance and majority of diagnostics collected from the "site", probably early Holocene
NY10848-0016	Ny10848	>23.5 mm	>23.5 mm	7.5 mm	1.00	>31.8 mm	NM	NM (LMW=6.1 mm)	13.6 mm	NM	13.4 mm	6.0 mm	169°	138°	31°	>4.20	Obsidian Butte, NV, Variety 5 (Unknown C)	Large side notched, unknown	out-of-key	1 shoulder snapped, 1 corner base snapped, distal end smashed, heavily weathered	unknown type, based on appearance and majority of diagnostics collected from the "site", probably early Holocene
71S-25-0003	isolate	>25.7 mm	>25.7 mm	4.2 mm	1.00	>20.5 mm	NM	NM (LMW=2.9 mm)	5.7 mm	NM	7.0 mm	3.3 mm	134°	94°	40°	>1.70	Montezuma Range, NV	Parowan basal notched	*?Gatecliff contracting stem?*	1 blade edge snapped through shoulder, distal snapped/reworked, blade edge worn	based on LS & thickness, Parowan basal notched
5-442-3	Ny372	25.9 mm	24.8 mm	0.7 mm	0.96	12.9 mm	2.01	0%	3.7 mm	0.29	5.1 mm	3.2 mm	118°	55°	63°	0.90	Oak Spring Butte, NV	Parowan basal notched	out-of-key	tip chipped, blade edges slightly worn	Parowan basal notched (shoulder tangs extend below base, thus MW > WB); not on xrf list, from Haarklau 2001
NY10698-0002	Ny10698	>16.8 mm	>16.8 mm		1.00	14.6 mm	NM	NM (LMW=6.1 mm)	6.7 mm	0.48	6.4 mm	3.8 mm	167°	102°	65°	>0.90	Obsidian Butte, NV, Variety 3	Parowan basal notched	out-of-key	distal end snapped, blade edges worn	Parowan basal notched
NY0377-0039	Ny377	>20.6 mm	>20.6 mm	5.1 mm	1.00	>18.2	NM	NM (LMW=7.0 mm)	4.3 mm	NM	8.9 mm	3.1 mm	162°	65°	84°	>1.30	Obsidian Butte, NV, Variety 3	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, blade edges heavily worn, shoulders reworked	based on LS & thickness, Parowan basal notched; not xrf list, from Haarklau 2001
75W-17-003A	isolate	>16.9 mm	>16.9 mm	2.7 mm	1.00	>19.9 mm	NM	NM (LMW=3.6 mm)	8.4 mm	NM	9.1 mm	3.8 mm	123°	76°	47°	>1.40	Obsidian Butte, NV, Variety 5 (Unknown C)	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, blade edges heavily reworked & worn	Parowan basal notched
26LN3094-9-1	Ln3094	>26.3 mm	>26.3 mm	3.6 mm	1.00	>15.9 mm	NM	NM (LMW=5.6 mm)	4.6 mm	NM	7.7 mm	4.8 mm	210°	65°	145°	>1.60	Tempiute Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped, blade split on axial through one shoulder, blade edges worn	based on LS & thickness, Parowan basal notched
26LN3159-1	Ln3159	>14.5 mm	>14.0 mm	5.1 mm	0.97	>15.8 mm	NM	0%	7.8 mm	NM	8.1 mm	3.8 mm	120°	80°	40°	>0.70	Tempiute Mountain, NV	Parowan basal notched	out-of-key	blade snapped diagonally from below tip through 1 shoulder, blade edge worn	Parowan basal notched
NY10848-0004	Ny10848	31.0 mm	28.7 mm	11.7 mm	0.91	22.8 mm	1.38	55%	15.7 mm	0.69	12.9 mm	8.4 mm	197°	105°	93°	5.55	Crow Spring, NV	Pinto	*?Gatecliff split stem?*	blade reworked, one shoulder chipped, heavily weathered	probably Pinto - looks like cross between GBS & Pinto, except for PSA, falls between all Basgall & Hall (2000) discriminants but closer to Pinto
NY10942-0005	Ny10942	44.3 mm	39.7 mm	10.6 mm	0.90	>24.1 mm	NM	NM (LMW=14.0 mm)	20.9 mm	NM	17.5 mm	7.8 mm	202°	107°	82°	>7.40	Montezuma Range, NV	Pinto	*?Elko eared?*	blade heavily damaged & reworked, 1 base tang chipped, 1 shoulder snapped	Pinto - generally fits Basgall & Hall (2000) definition, especially NO; not on xrf list, from Kolvet et al 2000 study
NY10942-0019	Ny10942	22.6 mm	20.0 mm	6.7 mm	0.88	14.5 mm	1.56	36%	12.5 mm	0.86	11.7 mm	5.4 mm	224°	98°	142°	1.80	Oak Spring Butte, NV	Pinto	*?Gatecliff split stem?*	heavily reworked & weathered, one base tang snapped, small base snap	probably Pinto. LS/LM=0.30, WB/WM, & DSA fit but PSA slightly low for Basgall & Hall (2000) definition
71N-2-0001	isolate	>44.0 mm	>38.8 mm	11.1 mm	0.88	21.5 mm	NM	NM (LMW=15.5 mm)	19.5 mm	0.91	17.0 mm	8.5 mm	200°	115°	96°	>8.20	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Pinto	*?Elko eared?*	tip snapped, blade edges heavily worn, heavily weathered	Pinto - NO indicates Pinto according to Basgall & Hall (2000)
NY10844-0005	Ny10844	>44.3 mm	>42.7 mm	12.0 mm	0.96	29.1 mm	NM	NM (LMW=17.1 mm)	19.0 mm	0.65	18.9 mm	7.1 mm	163°	99°	74°	>8.60	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Pinto	*?Gatecliff split stem?*	tip snapped, blade edges heavily worn, two hydration notches	probably Pinto - measurements fall between Pinto & Gatecliff (Basgall & Hall 2000); not on xrf list, from Kolvet et al 2000 study
NY10848-0099	Ny10848	>38.0 mm	>35.0 mm	9.4 mm	0.92	18.2 mm	NM	NM (LMW=10.5 mm)	15.1 mm	0.83	13.7 mm	5.4 mm	205°	123°	104°	3.80	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Pinto	*?Elko eared?*	tip snapped, 1 shoulder tang chipped, heavily weathered	NO=Pinto according to Basgall & Hall (2000)
NY10625-0006	Ny10625	43.3 mm	41.4 mm	14.6 mm	0.96	28.1 mm	1.54	37%	18.5 mm	0.66	16.2 mm	8.8 mm	199°	105°	98°	>8.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Gatecliff split stem?*	base tang edges chipped, blade edges worn & reworked, 2 hydration notches	probably Pinto - DSA & WB/WM low for Basgall & Hall (2000) definition; not on xrf list, from Kolvet et al 2000 study
NY10653-0002	Ny10653	>23.7 mm	>17.2 mm	8.5 mm	0.73	29.6 mm	NM	NM (LMW=15.1 mm)	19.2 mm	0.65	19.4 mm	4.2 mm	167°	98°	67°	>3.10	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Gatecliff split stem?*	blade snapped above shoulders, remaining edges heavily worn	does not remotely resemble GSS - looks most like very large, parallel stemmed Elko eared
NY10848-0070	Ny10848	37.8 mm	33.6 mm	9.7 mm	0.88	19.4 mm	1.95	27%	16.4 mm	0.85	15.0 mm	5.3 mm	210°	110°	88°	4.10	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Elko eared?*	blade edges heavily worn, heavily weathered	Pinto - LS/LM=0.26, NO=Pinto, fits Basgall & Hall (2000)
NY10942-0010	Ny10942	53.3 mm	49.6 mm	19.5 mm	0.93	39.3 mm	1.36	37%	26.2 mm	0.66	21.9 mm	6.9 mm	179°	113°	60°	11.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Elko eared?*	blade edges slightly worn	probably Pinto (looks like a cross between a GBS and Pinto). LS/LM=0.37, WB/WM, & PSA nearly correct for Basgall & Hall (2000) definition but not DSA or NO - definitely not Elko eared
NY10942-0066	Ny10942	29.8 mm	28.5 mm	8.0 mm	0.96	25.8 mm	1.16	32%	16.7 mm	0.65	14.5 mm	5.9 mm	167°	95°	45°	3.60	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Gatecliff split stem?*	blade reworked, weathered	LS/LM=0.27, Pinto Basgall & Hall (2000), angles are Gatecliff, appearance closest to Elko eared; not on xrf list, from Kolvet et al 2000 study
NY10942-0125	Ny10942	29.1 mm	25.7 mm	9.8 mm	0.88	15.8 mm	1.84	51%	12.5 mm	0.79	10.1 mm	5.3 mm	223°	104°	120°	1.90	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Gatecliff split stem?*	tip snapped, blade edges heavily worn, heavily weathered	Pinto - LS/LM=0.34, all discriminants fit Basgall & Hall (2000) definition
NY10643-0003	Ny10643	22.9 mm	20.1 mm	7.2 mm	0.88	16.7 mm	1.39	41%	15.5 mm	0.93	13.8 mm	4.7 mm	220°	106°	125°	1.80	Queen/Truman Meadows, CA/NV	Pinto	*?Gatecliff split stem?*	complete but appears heavily reworked along blade edges	Pinto - PSA, DSA, & LS/LM fit Basgall & Hall (2000) definition but WB/WM slightly high
NY10704-0001	Ny10704	>21.9 mm	>18.3 mm	9.3 mm	0.84	>23.8 mm	NM	NM	24.0 mm	NM	20.5 mm	6.6 mm	239°	122°	118°	>3.60	Saline Range, CA, Variety 2	Pinto	*?Elko eared?*	blade snapped above notches	Pinto - NO = Pinto, other metrics only slightly high for Basgall & Hall (2000) definition
NY10942-0192	Ny10942	34.7 mm	30.0 mm	8.7 mm	0.86	27.1 mm	1.28	45%	24.3 mm	0.90	13.9 mm	5.2 mm	251°	107°	145°	2.75	Saline Range, CA, Variety 1 (Queen Impostor)	Pinto	*?Elko eared?*	blade heavily damaged & reworked	Pinto - PSA & LS/LM=0.25 correct & WB/WM only 0.01 too high for Basgall & Hall (2000) NO=Pinto
NY10942-0129	Ny10942	31.3 mm	28.9 mm	7.3 mm	0.92	17.1 mm	1.80	43%	16.0 mm	0.94	14.2 mm	5.3 mm	242°	102°	140°	7.60	Saline Range, CA, Variety 1 (Queen Impostor)	Pinto	*?Gatecliff split stem?*	blade heavily reworked, heavily weathered	Pinto - generally fits Basgall & Hall (2000) definition (metrics slightly high for Pinto but much too high for Gatecliff)
CK3906-0001	Ck3906	26.0 mm	22.7 mm	9.2 mm	0.87	17.9 mm	1.45	45%	>11.0 mm	NM	NM	6.1 mm	227°	105°	122°	>2.50	Shoshone Mountain, NV	Pinto	*?Gatecliff split stem?*	base snapped on diagonal from above neck to basal indentation	Pinto - metrics within Basgall & Hall (2000) definition
75W-17-0003	isolate	28.4 mm	24.1 mm	8.1 mm	0.85	18.3 mm	1.55	35%	15.5 mm	0.85	14.1 mm	5.9 mm	220°	105°	114°	2.40	Shoshone Mountain, NV	Pinto	*?Gatecliff split stem?*	tip reworked, blade edges worn	Pinto - LS/LM=0.34, all discriminants fit Basgall & Hall (2000) definition
NY10942-0156	Ny10942	31.9 mm	27.7 mm	11.3 mm	0.87	25.1 mm	1.28	34%	16.3 mm	0.65	16.1 mm	5.8 mm	168°	97°	70°	>3.30	Silver Peak/Fish Lake Valley, NV	Pinto	*?Gatecliff split stem?*	blade reworked, hydration notch	between Pinto/Gatecliff/Elko. LS/LM=0.35, Pinto, WB/WM between types, PSA & DSA Gatecliff according to Basgall & Hall (2000) definition; not on xrf list, from Kolvet et al 2000 study
NY10942-0107	Ny10942	24.3 mm	21.0 mm	7.2 mm	0.86	16.7 mm	1.46	58%	13.4 mm	0.80	12.0 mm	5.3 mm	255°	119°	136°	1.85	Obsidian Butte, NV, Variety 4	Pinto	*?Elko eared?*	heavily reworked	Pinto - LS/LM & WB/WM fit Pinto, Basgall & Hall (2000) but PSA & DSA do not, NO = Pinto
26LN3097-6	Ln3097	>21.0 mm	>21.0 mm	3.5 mm	1.00	16.0 mm	NM	NM (LMW=4.5 mm)	>6.5 mm	NM	8.4 mm	2.6 mm	163°	128°	35°	>1.00	Kane Springs Wash Caldera Variety 1, NV	Rosegate	Rosegate	distal end snapped, base snapped diagonally below neck, blade edges worn	WB would definitely be < 10 mm if complete
71S-6-0001	isolate	>15.1 mm	>14.5 mm	4.7 mm	0.96	13.3 mm	NM	NM (LMW=7.1 mm)	8.2 mm	0.62	7.5 mm	4.0 mm	157°	117°	39°	>0.80	Montezuma Range, NV	Rosegate	Rosegate	distal end snapped, blade edges heavily damaged/worn	
5-440-15	Ny376	>15.8 mm	>14.5 mm	4.2 mm	0.92	15.8 mm	NM	NM (LMW=6.3 mm)	9.1 mm	0.58	8.9 mm	3.3 mm	152°	123°	30°	>1.00	Oak Spring Butte, NV	Rosegate	out-of-key	distal end snapped, blade edges & one base corner heavily damaged, worn, & reworked	probably was a Rosegate; not on xrf list, from Haarklau 2001
12-17-119	Ny8	>16.3 mm	>15.9 mm	4.4 mm	0.98	16.2 mm	NM	NM (LMW=5.3 mm)	9.2 mm	0.60	6.3 mm	4.1 mm	117°	116°	37°	>1.10	Oak Spring Butte, NV	Rosegate	Rosegate	distal end snapped, blade edges worn	Rose Springs type - NAGPRA item
NY10848-0091	Ny10848	41.2 mm	40.6 mm	6.5 mm	0.99	15.6 mm	2.64	27%	7.9 mm	0.51	6.7 mm	7.0 mm	185°	110°	75°	4.15	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Rosegate	Rosegate?	flake scars weathered nearly smooth, tip appears reworked, 1 corner base chipped?	slightly thick for Rosegate
NY10942-0122	Ny10942	27.8 mm	27.8 mm	7.0 mm	1.00	17.0 mm	1.64	25%	8.7 mm	0.51	7.7 mm	4.1 mm	155°	115°	45°	1.60	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Rosegate	Rosegate	blade edges worn & reworked, slightly weathered	
5-446-8	Ny366	>19.5 mm	>19.5 mm	5.7 mm	1.00	>16.7 mm	NM	NM (LMW=3.3 mm)	9.1 mm	NM	7.8 mm	4.8 mm	140°	112°	27°	>1.35	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Rosegate	Rosegate	tip snapped, one shoulder tang snapped, base chipped	not on xrf list, from Haarklau 2001
NY0377-0050	Ny377	33.1 mm	33.1 mm	5.8 mm	1.00	16.0 mm	2.06	14%	8.4 mm	0.53	6.9 mm	3.4 mm	155°	118°	36°	1.30	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Rosegate	Rosegate	blade edges worn, tip reworked	not on xrf list, from Haarklau 2001
71N-5-0003	isolate	>25.6 mm	>25.6 mm	7.9 mm	1.00	16.8 mm	NM	NM (LMW=7.7 mm)	12.3 mm	0.73	9.1	3.2 mm	170°	108°	62°	>1.60	Obsidian Butte, NV, Variety 5 (Unknown C)	Rosegate	*?Elko corner notched?*	distal end snapped, blade edges worn	blade & neck are Rosegate-size, base is lopsided, unevenly flaked, actually side notched on one side
NY10701-0003	Ny10701	31.3 mm	30.4 mm	5.8 mm	0.97	>18.5 mm	NM	NM (LMW=2.6 mm)	8.5 mm	NM	7.3 mm	3.5 mm	140°	99°	42°	>1.50	Obsidian Butte, NV, Variety 5 (Unknown C)	Rosegate	Rosegate	one shoulder tang snapped , hydration notch, blade edges worn	not on xrf list, from Kolvet et al 2000 study
12-17-115	Ny8	>24.1 mm	>24.1 mm	5.2 mm	1.00	15.5 mm	NM	NM (LMW=8.0 mm)	7.0 mm	0.45	6.0 mm	4.2 mm	140°	115°	36°	>1.40	Obsidian Butte, NV, Variety 5 (Unknown C)	Rosegate	Rosegate	distal end snapped	Rose Springs type - NAGPRA item
Ny10836-0002	Ny10836	>49.2 mm	>48.3 mm	4.1 mm	0.98	19.3 mm	NM	NM (LMW=4.0 mm)	8.9 mm	2.17	8.2 mm	4.0 mm	137°	108°	30°	>3.20	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	tip snapped, hydration notch, blade edges worn	not on xrf list, from Kolvet et al 2000 study
26LN3094-8	Ln3094	>21.4 mm	NM	4.5 mm	NM	13.1 mm	NM	NM (LMW=5.1 mm)	>4.5 mm	NM	6.7 mm	4.3 mm	175°	116°	59°	>1.20	Shoshone Mountain, NV	Rosegate	Rosegate	tip snapped, half of base snapped, blade edges reworked & worn	WB would definitely be < 10 mm if complete
MK021-1476	Ny218	>18.1 mm	>18.1mm	5.3 mm	1.00	18.3 mm	NM	NM (LMW=5.9 mm)	9.5 mm	0.52	8.3 mm	4.1 mm	158°	106°	44°	>1.30	Shoshone Mountain, NV	Rosegate	Rosegate	distal end snapped, blade edges worn	
26LN3086-1	Ln3086	>18.2 mm	>18.2 mm	≈4.4 mm	NM	>20.1 mm	NM	NM	>9.2 mm	NM	9.1 mm	3.1 mm	154°	123°	30°	>1.20	Tempiute Mountain, NV	Rosegate	Rosegate	distal end snapped, bottom of base snapped, one shoulder tang snapped	Eastgate type
26LN3094-2	Ln3094	30.6 mm	30.1 mm	4.1 mm	0.98	16.4 mm	1.87	16%	9.1 mm	0.55	8.1 mm	3.4 mm	157°	113°	44°	1.50	Tempiute Mountain, NV	Rosegate	Rosegate	blade edges worn	
26LN3117-1	Ln3117	>20.1 mm	>20.1 mm	5.4 mm	1.00	>15.2 mm	NM	NM (LMW=9.8 mm)	11.5 mm	NM	10.0 mm	4.5 mm	163°	117°	46°	>1.50	Tempiute Mountain, NV	Rosegate	*?Elko corner notched?*	distal end snapped, one shoulder snapped, one shoulder chipped	looks more like Rosegate (Rose Springs type) with slightly large base
26LN3124-4	Ln3124	17.3 mm	17.3 mm	5.3 mm	1.00	13.1 mm	1.32	34%	8.3 mm	0.63	7.3 mm	3.7 mm	163°	100°	64°	0.70	Tempiute Mountain, NV	Rosegate	Rosegate	blade edges heavily reworked	
26LN3118-1	Ln3118	41.6 mm	41.6 mm	N/A	1.00	22.3 mm	1.87	19%	14.9 mm	0.67	N/A	6.7 mm	N/A	N/A	N/A	6.00	Oak Spring Butte, NV	Unknown leaf shaped	out-of-key	complete	medium-sized, shoulderless, leaf shaped point, hydrated obsidian (nearly perlite)
NY10942-0189	Ny10942	40.5 mm	34.0 mm	N/A	0.84	25.0 mm	1.62	0%	25.0 mm	1.00	N/A	10.0 mm	N/A	N/A	N/A	8.20	Montezuma Range, NV	Unknown shoulderless concave-base	out-of-key	one base tang snapped, blade edges heavily reworked	large, thick, shoulderless, concave-base point, random flake scars
NY10850-0004	Ny10850	39.1 mm	30.3 mm	N/A	0.77	30.0 mm	1.30	37%	29.5 mm	0.98	N/A	11.3 mm	N/A	N/A	N/A	9.80	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Unknown shoulderless concave-base	out-of-key	blade extensively reworked	large, concave base, shoulderless point
75W-B-0006	isolate	61.6 mm	57.7 mm	N/A	0.94	29.1 mm	2.20	47%	26.7 mm	0.92	21.9 mm	12.2 mm	N/A	N/A	N/A	18.10	Obsidian Butte, NV, Variety 3	Unknown shoulderless concave-base	out-of-key	distal end heavily reworked, edges of haft element ground/damaged	looks most like Humboldt cluster, Buchanan eared type
NY10942-0166	Ny10942	>53.4 mm	>50.2	N/A	0.94	19.4 mm	NM	NM (LMW=4.1 mm)	17.9 mm	0.92	N/A	8.6 mm	N/A	N/A	N/A	>7.20	Obsidian Butte, NV, Variety 5 (Unknown C)	Unknown shoulderless concave-base	out-of-key	tip snapped, blade edges worn, weathered	long, thick, triangular, concave-base shoulderless point, random flake scars
NY10942-0178	Ny10942	44.0 mm	41.4 mm	N/A	0.94	22.2 mm	1.98	27%	19.7 mm	0.89	N/A	9.0 mm	N/A	N/A	N/A	>7.50	Saline Range, CA, Variety 1 (Queen Impostor)	Unknown shoulderless concave-base	out-of-key	large conchoidal fracture toward tip, blade edges reworked	large, thick, shoulderless, concave-base point
NY10942-0069	Ny10942	34.9 mm	32.9 mm	N/A	0.94	20.4 mm	1.71	25%	19.2 mm	0.94	N/A	7.9 mm	N/A	N/A	N/A	5.25	Unknown Variety F	Unknown shoulderless concave-base	out-of-key	blade heavily reworked	large, thick, shoulderless, concave-base point, random flake scars
NY10848-0036	Ny10848	>17.0 mm	>17.0 mm	6.1 mm	1.00	20.5 mm	NM	NM (LMW=4.9 mm)	7.6 mm	0.37	7.6 mm	4.5 mm	169°	105°	59°	>1.30	Saline Range, CA, Variety 1 (Queen Impostor)	Unknown type, Rosegate-like	out-of-key	tip snapped, blade edges worn, heavily weathered	looks most like a parallel-stemmed Rose Spring with barbed shoulders
26LN3285-2	Ln3285	23.0 mm	19.7 mm	N/A	0.86	36.6 mm	0.63	70%	N/A	N/A	N/A	8.1 mm	N/A	N/A	67°	>6.70	Shoshone Mountain, NV	Winged crescent	out-of-key	convex edge heavily damaged & reworked	Winged Crescent
NY10942-0172	Ny10942	>25.9 mm	N/A	N/A	N/A	>15.6 mm	N/A	N/A	N/A	N/A	N/A	5.4 mm	N/A	N/A	N/A	>2.50	Montezuma Range, NV	unidentifiable type	untypable	heavily worked, heavily weathered fragment	
NY10942-0183	Ny10942	>21.6 mm	>21.6 mm	8.5 mm	NM	>34.6 mm	NM	NM (LMW=9.0 mm)	23.6 mm	NM	23.3 mm	>5.2 mm	178°	98°	80°	>3.60	Montezuma Range, NV	unidentifiable type	*?Gatecliff contracting stem?*	blade snapped above shoulders, one shoulder snapped, one corner base reworked	definitely not a Gatecliff but type is indeterminable
26LN3094-10	Ln3094	>21.4 mm	>19.9 mm	N/A	0.93	15.7 mm	NM	NM (LMW=6.4 mm)	12.7 mm	0.81	N/A	6.9 mm	N/A	N/A	N/A	>2.40	Oak Spring Butte, NV	unidentifiable type	out-of-key	extensively reworked to a stub	may have been a Pinto or Humboldt - too heavily reworked to type
NY10848-0037	Ny10848	>36.0 mm	>36.0 mm		NM	24.3 mm	NM	NM	NM	NM	8.4 mm	4.6 mm	NM	NM	NM	>4.10	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	unidentifiable type	untypable	base snapped off at neck, flake scars and edges heavily weathered	
NY1492-0033	Ny1492	>13.0 mm	NM		NM	15.9 mm	NM	NM	NM	NM	7.2 mm	2.7 mm	167°	NM	NM	>0.70	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	unidentifiable type	untypable	distal end snapped, base snapped at neck	
26Ny5688	Ny5688	>34.8 mm	>34.8 mm		NM	18.8 mm	NM	NM	NM	NM	7.8 mm	4.2 mm	NM	NM	NM	>2.30	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	unidentifiable type	untypable	blade only, base snapped at neck	
NY10848-0064	Ny10848	>25.4 mm	NM		NM	24.9 mm	NM	NM	NM	NM	9.6 mm	4.9 mm	165°	NM	NM	>3.90	Obsidian Butte, NV, Variety 3	unidentifiable type	untypable	base snapped at neck, blade snapped, heavily weathered	Gatecliff-like but no data to ascertain
NY10942-0143	Ny10942	>40.5 mm	>40.0 mm		NM	>30.7 mm	NM	NM	>13.9 mm	NM	12.1 mm	4.5 mm	138°	NM	NM	>4.20	Obsidian Butte, NV, Variety 3	unidentifiable type	untypable	base snapped at neck, one shoulder tang missing	might be an Elko
NY1492-0030	Ny1492	>18.0 mm	>18.0 mm		1.00	>14.2 mm	NM	NM	NM	NM	NM	2.8 mm	172°	115°	58°	0.60	Obsidian Butte, NV, Variety 3	unidentifiable type	untypable	snapped diagonally across entire point	probably an Elko or Rosegate but undeterminable without base elements
NY0364-0029	Ny364	>28.3 mm	N/A	N/A	N/A	>17.5 mm	N/A	N/A	N/A	N/A	N/A	4.4 mm	N/A	N/A	N/A	>2.00	Obsidian Butte, NV, Variety 3	unidentifiable type	untypable	heavily reworked fragment	
75W-B-0004	isolate	>32.2 mm	>32.2 mm		NM	>20.2 mm	NM	NM	NM	NM	≈11.0 mm	4.1 mm	NM	NM	NM	>2.30	Obsidian Butte, NV, Variety 5 (Unknown C)	unidentifiable type	out-of-key	base snapped above neck, distal end snapped	
71N-12-0001	isolate	41.8 mm	NM		NM	27.2 mm	NM	NM	NM	NM	NM	6.9 mm	NM	NM	NM	>7.90	Obsidian Butte, NV, Variety 5 (Unknown C)	unidentifiable type	untypable	biface fragment	
NY10848-0055	Ny10848	>18.3 mm	>18.3 mm		NM	>20.5 mm	NM	NM	NM	NM	11.1 mm	3.4 mm	140°	NM	NM	>1.40	Obsidian Butte, NV, Variety 4	unidentifiable type	untypable	base snapped above neck, distal end snapped	
75E-7-0002	isolate	>44.6 mm	>44.6 mm		N/A	35.5 mm	NM	NM	NM	NM	19.8 mm	10.0 mm	140°	NM	NM	>13.00	Shoshone Mountain, NV	unidentifiable type	out-of-key	base snapped at neck, some CaO^{3} buildup	huge
26LN3137-2	Ln3137	NM	NM		NM	>21.6 mm	NM	NM	15.4 mm	NM	14.0 mm	6.5 mm	NM	NM	NM	>5.00	Shoshone Mountain, NV	unidentifiable type	untypable	heavily, bifacially-worked piece of obsidian	corner notches worked on opposing sides (total of 3), may have once been a point
26LN3123-3	Ln3123	>18.0 mm	>18.0 mm		1.00	>14.0 mm	NM	NM	18.7 mm	NM	14.3 mm	6.8 mm	NM	NM	NM	>2.30	Tempiute Mountain, NV	unidentifiable type	untypable	base only	
Nevada State Museum, Carson City, Nevada (n=92)																					
Mud Lake, Nevada Test & Training Range, Nye County, NV (26Ny1101), n=35																					
467	Ny1101	>26.8 mm	>25.5 mm	N/A	0.95	22.2 mm	NM	NM (LMW=18.6 mm)	20.0 mm	0.90	N/A	5.1 mm	NM	87°	NM	>4.05	Obsidian Butte, NV, Variety 4	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end snapped, one corner base chipped	stem only, Great Basin stemmed, Borax Lake wide stem
172	Ny1101	29.8 mm	28.2 mm	8.6 mm	0.95	27.5 mm	1.08	43%	15.7 mm	0.57	19.8 mm	5.7 mm	220°	92°	128°	4.05	Unknown 3	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	base & stem damaged & reworked, distal blade edges reworked	Great Basin stemmed, Borax Lake wide stem
459	Ny1101	>34.7 mm	>34.7 mm	31.1 mm	1.00	>21.6 mm	NM	NM	17.1 mm	NM	21.1 mm	10.7 mm	256°	83°	173°	>8.90	Bodie Hills, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped at shoulders, base chipped	Great Basin stemmed, Lake Mohave
225	Ny1101	>21.4 mm	>21.4 mm	≥24.1 mm	1.00	>23.8 mm	NM	NM	14.3 mm	NM	≥23.8 mm	7.1 mm	NM	80°	NM	>3.70	Crow Spring, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped below or at neck	Great Basin stemmed, Lake Mohave
251	Ny1101	>46.0 mm	>46.0 mm	>18.2 mm	NM	30.3 mm	NM	NM (LMW>16.0 mm)	NM	NM	23.0 mm	7.0 mm	223°	79°	144°	>9.85	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal blade edges damaged & reworked, base snapped, weathered	Great Basin stemmed, Lake Mohave
200	Ny1101	44.2 mm	44.2 mm	32.9 mm	1.00	25.2 mm	1.75	77%	6.5 mm	0.26	23.9 mm	9.8 mm	NM	71°	NM	9.00	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal end snapped above shoulders, remainder reworked into stubby point	Great Basin stemmed, Lake Mohave
211	Ny1101	>32.0 mm	>32.0 mm	24.5 mm	1.00	>21.5 mm	NM	NM	8.1 mm	NM	19.7 mm	7.6 mm	248°	83°	165°	>5.05	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders	Great Basin stemmed, Lake Mohave
222	Ny1101	>26.1 mm	>26.1 mm	≥26.1 mm	1.00	>21.9 mm	NM	NM	13.2 mm	NM	≥21.1 mm	7.1 mm	NM	82°	NM	>4.00	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped below or at neck	Great Basin stemmed, Lake Mohave
471	Ny1101	>36.9 mm	>36.9 mm	28.9 mm	1.00	>21.0 MM	NM	NM	8.6 mm	NM	18.3 mm	7.4 mm	250°	78°	172°	>5.05	Mount Hicks, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped at shoulders from at least two directions	Great Basin stemmed, Lake Mohave
231	Ny1101	>49.4 mm	>49.4 mm	40.7 mm	1.00	>18.8 mm	NM	NM	12.8 mm	NM	16.6 mm	8.9 mm	245°	79°	166°	>8.90	Mount Hicks, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders, base chipped	Great Basin stemmed, Lake Mohave
212	Ny1101	>38.5 mm	>38.5 mm	21.6 mm	1.00	>25.1 mm	NM	NM	16.4 mm	NM	21.4 mm	7.4 mm	200°	83°	117°	>6.20	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulder, stem damaged	Great Basin stemmed, Lake Mohave - flake scars on 1 face of stem, indicate fragment reworked to shoulderless concave-base
255	Ny1101	>42.8 mm	>42.8 mm	34.8 mm	1.00	32.3 mm	NM	NM (LMW=38.8 mm)	10.3 mm	0.32	26.1 mm	7.0 mm	232°	83°	148°	>9.00	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal end snapped above shoulders	Great Basin stemmed, Lake Mohave
239	Ny1101	>30.7 mm	>30.7 mm	24.9 mm	1.00	>21.1 mm	NM	NM	8.3 mm	NM	20.6 mm	6.6 mm	250°	78°	172°	>4.20	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders, base chipped	Great Basin stemmed, Lake Mohave
221	Ny1101	>28.4 mm	>28.4 mm	≥28.4 mm	1.00	>24.1 mm	NM	NM	12.1 mm	NM	≥24.1 mm	5.4 mm	NM	78°	NM	>3.80	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped below or at neck, base chipped	Great Basin stemmed, Lake Mohave
214	Ny1101	>30.4 mm	>30.4 mm	>18.2 mm	1.00	≈29.3 mm	NM	NM (LMW=30.4 mm)	13.2 mm	≈0.45	21.4 mm	8.2 mm	226°	70°	156°	>6.70	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped diagonally above shoulders, stem snapped & reworked	Great Basin stemmed, Lake Mohave
466	Ny1101	>55.2 mm	>55.2 mm	20.9 mm	1.00	20.6 mm	NM	NM (LMW=34.5 mm)	3.2 mm	0.16	16.7 mm	9.2 mm	252°	86°	166°	>10.6	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal end snapped, stem & blade heavily damaged on one face	Great Basin stemmed, Lake Mohave
464	Ny1101	>39.6 mm	>39.6 mm	31.8 mm	1.00	>21.6 mm	NM	NM	12.3 mm	NM	19.6 mm	8.4 mm	256°	84°	172°	>5.95	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped at shoulders from three directions	Great Basin stemmed, Lake Mohave
468	Ny1101	>34.1 mm	>34.1 mm	21.2 mm	1.00	22.6 mm	NM	NM (LMW=26.9 mm)	10.6 mm	0.47	20.1 mm	8.3 mm	245°	79°	166°	>6.80	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders	Great Basin stemmed, Lake Mohave
463	Ny1101	>45.6 mm	>45.6 mm	44.2 mm	1.00	>21.7 mm	NM	NM	12.1 mm	NM	21.2 mm	7.9 mm	NM	85°	NM	>9.20	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped at neck	Great Basin stemmed, Lake Mohave
195	Ny1101	>61.4 mm	>61.4 mm	>11.4 mm	NM	38.4 mm	NM	NM (LMW>24.1 mm)	NM	NM	29.9 mm	7.6 mm	229°	83°	146°	>17.20	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	stem snapped, distal end damaged	massive point, GBS-style blade, mahogany obsidian
253	Ny1101	>45.5 mm	>45.5 mm	39.1 mm	1.00	>25.0 mm	NM	NM	14.3 mm	NM	22.8 mm	10.5 mm	248°	84°	164°	>12.30	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped above shoulders	Great Basin stemmed, Lake Mohave, mahogany obsidian
179	Ny1101	>39.8 mm	>39.8 mm	≥39.8 mm	1.00	>21.1 mm	NM	NM	16.0 mm	NM	≥20.3 mm	5.7 mm	NM	86°	NM	>6.30	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped below or at neck, weathered	Great Basin stemmed, Lake Mohave
472	Ny1101	>27.4 mm	>27.4 mm	≥27.4 mm	1.00	>21.7 mm	NM	NM	11.9 mm	NM	≥21.7 mm	6.1 mm	NM	78°	NM	>3.45	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped below or at neck	Great Basin stemmed, Lake Mohave, mahogany obsidian
234	Ny1101	44.1 mm	44.1 mm	27.8 mm	1.00	20.8 mm	2.12	65%	11.7 mm	0.56	19.7 mm	7.4 mm	249°	81°	168°	7.60	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade severely damaged & reworked, likely much larger originally	Great Basin stemmed, Lake Mohave
216	Ny1101	>34.4 mm	>34.4 mm	25.5 mm	1.00	>22.3 mm	NM	NM	4.9 mm	NM	18.6 mm	9.6 mm	255°	85°	170°	>5.85	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped diagonally above shoulders, stem reworked	Great Basin stemmed, Lake Mohave
465	Ny1101	>36.2 mm	>36.2 mm	31.2 mm	1.00	>20.0 mm	NM	NM	8.6 mm	NM	19.5 mm	6.8 mm	254°	81°	173°	>5.40	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped at shoulders	Great Basin stemmed, Lake Mohave
232	Ny1101	>46.2 mm	>46.2 mm	36.7 mm	1.00	>26.4 mm	NM	NM	12.2 mm	NM	23.6 mm	11.4 mm	201°	85°	116°	>11.95	Tempiute Mountain, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal end smashed at shoulders, stem damaged	Great Basin stemmed, Lake Mohave
223	Ny1101	>23.2 mm	>23.2 mm	≥23.2 mm	1.00	>19.6 mm	NM	NM	13.8 mm	NM	≥19.6 mm	5.5 mm	NM	82°	NM	>3.00	Tempiute Mountain, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped below or at neck	Great Basin stemmed, Lake Mohave
244	Ny1101	40.9 mm	40.9 mm	13.3 mm	1.00	25.5 mm	1.60	41%	21.9 mm	0.86	20.9 mm	8.9 mm	210°	103°	107°	8.65	Montezuma Range, NV	Great Basin stemmed, Silver Lake	out-of-key	distal edged reworked, weathered	Great Basin stemmed, Silver Lake
224	Ny1101	>21.9 mm	>21.9 mm	≥21.9 mm	1.00	>20.1 mm	NM	NM	13.8 mm	NM	≥20.1 mm	7.6 mm	NM	81°	NM	>3.00	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped below or at neck	Great Basin stemmed, Silver Lake
215	Ny1101	>26.5 mm	>26.5 mm	19.5 mm	1.00	>30.0 mm	NM	NM (LMW=26.5 mm)	18.2 mm	NM	22.9 mm	7.1 mm	222°	91°	131°	>5.50	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped at shoulders due to flaw in obsidian (pocket of macro-crystals visible along snap)	Great Basin stemmed, Silver Lake
220	Ny1101	>24.1 mm	>23.4 mm	13.3 mm	0.97	28.4 mm	NM	NM (LMW=19.9 mm)	13.0 mm	0.46	23.0 mm	7.8 mm	223°	84°	139°	>5.55	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped above shoulders, stem snapped, damaged, & reworked	Great Basin stemmed, Silver Lake
470	Ny1101	>25.2 mm	>25.2 mm	20.6 mm	1.00	>23.0 mm	NM	NM	14.3 mm	NM	21.9 mm	6.3 mm	227°	82°	145°	>3.50	Goldfield Hills, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped at shoulders, base chipped	Great Basin stemmed, Silver Lake
230	Ny1101	56.0 mm	55.3 mm	10.1 mm	0.99	30.5 mm	1.84	21%	20.9 mm	0.69	19.5 mm	7.5 mm	186°	106°	80°	11.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Stanislaus	*?Elko corner notched?*	tip snapped, slight damage on distal blade edges & one corner of base, weathered	Great Basin stemmed, Stanislaus broad stem
245	Ny1101	>39.0 mm	>39.0 mm	>8.2 mm	NM	22.7 mm	NM	NM (LMW>11.2 mm)	NM	NM	16.0 mm	6.4 mm	173°	91°	83°	>5.15	Montezuma Range, NV	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	distal blade edges damaged & reworked, base snapped, weathered	Great Basin stemmed, Stanislaus broad stem

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
Tippipah Spring, Nevada Test Site, Nye County, NV (26Ny3, Wheeler site 12-10), n=57																					
12-10 59	Ny3	>19.4 mm	>17.7 mm	N/A	0.91	11.0 mm	NM	0%	11.0 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	≈0.35	Oak Spring Butte, NV	Cottonwood triangular	Cottonwood triangular	tip snapped	red paint (hematite?) visible on both faces
12-10 39	Ny3	18.1 mm	16.9 mm	N/A	0.93	9.1 mm	1.99	0%	9.1 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	0.40	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Cottonwood triangular	Cottonwood triangular	complete	red paint (hematite?) visible on both faces
12-10 37	Ny3	>16.1 mm	>13.3 mm	N/A	0.83	10.5 mm	NM	0%	10.5 mm	1.00	N/A	2.9 mm	N/A	N/A	N/A	>0.45	Obsidian Butte, NV, Variety 4	Cottonwood triangular	Cottonwood triangular	distal end snapped	red paint (hematite?) visible on both faces
12-10 51	Ny3	>15.6 mm	>14.4 mm	N/A	0.92	11.6 mm	NM	NM (LMW=3.3 mm)	11.4 mm	0.98	N/A	2.8 mm	N/A	N/A	N/A	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped, distal blade edges damaged	red paint (hematite?) visible on both faces
12-10 16	Ny3	19.9 mm	18.8 mm	N/A	0.94	10.1 mm	1.95	0%	10.1 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	0.55	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	complete	
12-10 30	Ny3	>12.1 mm	>11.0 mm	N/A	0.91	11.7 mm	NM	0%	11.7 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>0.50	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	blade snapped	distal blade edges appear serrated
12-10 17	Ny3	18.8 mm	17.9 mm	5.7 mm	0.95	12.5 mm	1.50	0%	12.5 mm	1.00	5.2 mm	2.7 mm	202°	171°	31°	0.35	Shoshone Mountain, NV	Desert side notched	Desert side notched	complete	Sierra type, red paint (hematite?) visible on base & one notch
12-10 83	Ny3	21.7 mm	18.2 mm	8.6 mm	0.84	12.5 mm	1.74	45%	12.1 mm	0.97	8.5 mm	3.3 mm	213°	135°	78°	0.80	Shoshone Mountain, NV	Desert side notched	Desert side notched	complete	Delta type, red paint on base
12-10 70	Ny3	18.2 mm	18.2 mm	6.4 mm	1.00	11.8 mm	1.54	48%	9.8 mm	0.83	6.9 mm	3.8 mm	206°	134°	72°	0.70	Shoshone Mountain, NV	Desert side notched	Desert side notched	distal edges, base, & shoulders reworked	Desert type
12-10 74	Ny3	23.7 mm	20.3 mm	6.9 mm	0.86	>10.3 mm	NM	0%	>10.3 mm	1.00	7.5 mm	3.7 mm	271°	142°	129°	>0.60	Shoshone Mountain, NV	Desert side notched	Desert side notched	one base tang snapped at shoulder	Delta type, point appears unfinished - likely broken during manufacture
12-10 56	Ny3	>12.6 mm	>10.7 mm	5.0 mm	0.85	9.9 mm	NM	0%	9.9 mm	1.00	5.9 mm	2.5 mm	156°	150°	6°	>0.30	Shoshone Mountain, NV	Desert side notched	Desert side notched	distal end snapped	Sierra type, red paint (hematite?) visible on both faces
12-10 66	Ny3	>14.2 mm	>13.0 mm	6.7 mm	0.92	11.0 mm	NM	NM (LMW=7.6 mm)	10.8 mm	0.98	6.7 mm	3.1 mm	206°	156°	50°	>0.50	Shoshone Mountain, NV	Desert side notched	Desert side notched	distal end snapped	Sierra type
12-10 1	Ny3	25.6 mm	23.9 mm	7.5 mm	0.93	14.1 mm	1.82	0%	14.1 mm	1.00	7.7 mm	2.5 mm	207°	171°	36°	0.80	Tempiute Mountain, NV	Desert side notched	Desert side notched	complete	Sierra type, red paint (hematite?) visible on both faces
12-10 463	Ny3	17.9 mm	16.0 mm	7.5 mm	0.89	13.9 mm	1.29	0%	13.9 mm	1.00	10.8 mm	3.5 mm	238°	141°	97°	0.90	Unknown 6	Desert side notched	Desert side notched	heavily weathered	closest to Redding type, red paint visible, especially on base - looks more like a very small "Pinto" than Dsn
12-10 10	Ny3	>13.3 mm	>13.3 mm	2.9 mm	1.00	16.2 mm	NM	NM (LMW=3.4 mm)	4.8 mm	0.30	4.9 mm	3.3 mm	144°	103°	41°	>0.75	?? - not done - ??	Parowan basal notched	out-of-key	blade snapped	similar to contracting stem arrow points from Ln126 & Ln418 - Parowan basal notched; missing in xrf analysis
12-10 90	Ny3	>28.6 mm	>28.6 mm	4.0 mm	1.00	15.9 mm	NM	NM (LMW=4.6 mm)	7.1 mm	0.43	6.8 mm	3.6 mm	126°	107°	19°	>1.40	Oak Spring Butte, NV	Parowan basal notched	out-of-key	tip snapped, one shoulder tang snapped	looks like Rosegate but WB too small in comparison to WN for classification - Parowan basal notched
12-10 29	Ny3	>28.4 mm	>28.4 mm	4.6 mm	1.00	21.4 mm	NM	NM (LMW=4.8 mm)	4.9 mm	0.23	11.3 mm	5.3 mm	186°	69°	117°	>3.50	Shoshone Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges reworked	looks more like contracting stem Rose Spring (Parowan basal notched?)
12-10 65	Ny3	>18.9 mm	>18.9 mm	4.5 mm	1.00	20.6 mm	NM	NM (LMW=6.7 mm)	>6.1 mm	NM	10.7 mm	4.3 mm	163°	74°	89°	>1.60	Shoshone Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges damaged & reworked	looks more like contracting stem Rose Spring (Parowan basal notched?), macroscopic crystals visible on snapped edges
12-10 89	Ny3	>19.9 mm	>19.9 mm	3.6 mm	1.00	>21.1 mm	NM	NM (LMW=2.6 mm)	7.4 mm	NM	10.0 mm	4.4 mm	131°	86°	45°	>1.45	Shoshone Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang snapped, edges damaged & reworked	looks more like contracting stem Eastgate (Parowan basal notched?), macroscopic crystals visible on snapped edges
12-10 6	Ny3	>24.7 mm	>24.1 mm	3.2 mm	0.98	21.7 mm	NM	NM (LMW=4.3 mm)	12.8 mm	0.59	13.2 mm	3.7 mm	172°	62°	110°	>2.00	Shoshone Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped, distal blade edges damaged & reworked	looks more like contracting stem Eastgate (Parowan basal notched?), macroscopic crystals visible on snapped edge, pink clay or paint visible on both surfaces
12-10 93	Ny3	>22.5 mm	>21.9 mm	3.5 mm	0.97	17.0 mm	NM	NM (LMW=5.8 mm)	9.1 mm	0.54	9.2 mm	3.8 mm	155°	95°	60°	>1.50	Shoshone Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped diagonally, distal blade edges damaged & reworked	pink clay or paint visible on both surfaces, looks more like contracting stem Eastgate (Parowan basal notched?)
12-10 41	Ny3	>20.7 mm	>20.7 mm	4.1 mm	1.00	15.6 mm	NM	NM (LMW=5.9 mm)	10.9 mm	0.70	10.9 mm	3.7 mm	146°	67°	79°	>1.15	Shoshone Mountain, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped diagonally, one edge snapped, distal blade edges damaged	looks more like contracting stem Rose Spring (Parowan basal notched?), macroscopic crystals visible on snapped edges
12-10 98	Ny3	37.1 mm	NM	5.5 mm	NM	15.3 mm	2.42	16%	>7.5 mm	NM	7.7 mm	3.6 mm	153°	128°	25°	>1.70	Oak Spring Butte, NV	Rosegate	Rosegate	base snapped diagonally	classification based on assumed symmetry of base
12-10 14	Ny3	>17.4 mm	>17.4 mm	3.1 mm	1.00	17.6 mm	NM	NM (LMW=3.2 mm)	8.5 mm	0.48	8.0 mm	3.1 mm	147°	108°	39°	>1.05	Oak Spring Butte, NV	Rosegate	Rosegate	distal end snapped, one shoulder tang snapped	
12-10 9	Ny3	>20.2 mm	>20.2 mm	5.4 mm	1.00	18.5 mm	NM	NM (LMW=7.3 mm)	7.6 mm	0.41	6.9 mm	3.9 mm	119°	106°	13°	>1.50	Obsidian Butte, NV, Variety 3	Rosegate	Rosegate	distal end snapped, one corner base chipped, distal blade edges reworked	red paint (hematite?) visible at notch opening
12-10 15	Ny3	25.9 mm	25.9 mm	5.0 mm	1.00	16.3 mm	1.59	22%	8.1 mm	0.50	7.5 mm	3.8 mm	140°	98°	42°	1.90	Shoshone Mountain, NV	Rosegate	Rosegate	one shoulder snapped, distal blade edges damaged	looks like small "eagle point"
12-10 53	Ny3	>13.9 mm	>11.0 mm	4.3 mm	0.79	15.8 mm	NM	NM (LMW=4.6 mm)	11.6 mm	0.73	10.0 mm	3.3 mm	174°	106°	68°	>0.75	Shoshone Mountain, NV	Rosegate	*?Elko eared?*	distal end snapped, one shoulder snapped	very, very small for an Elko - looks like an arrow size point, not a dart point (similar to Rosegate)
12-10 64	Ny3	21.7 mm	21.7 mm	3.6 mm	1.00	13.3 mm	1.63	25%	7.1 mm	0.53	6.3 mm	2.8 mm	164°	122°	42°	0.75	~~Shoshone Mountain, NV~~	Rosegate	Rosegate	complete	looks like small "eagle point", pink clay or paint visible, inconsistent xrf data
12-10 43	Ny3	>15.7 mm	>15.7 mm	3.5 mm	1.00	15.3 mm	NM	NM (LMW=7.3 mm)	8.5 mm	0.56	7.9 mm	3.1 mm	156°	112°	44°	>0.90	Shoshone Mountain, NV	Rosegate	Rosegate	distal end snapped	imperfection in obsidian (macroscopic crystal) visible on snapped edge, pink clay or paint visible
12-10 2	Ny3	>19.3 mm	>19.3 mm	4.5 mm	1.00	17.4 mm	NM	NM (LMW=4.8 mm)	9.5 mm	0.55	8.3 mm	4.3 mm	142°	112°	30°	>1.60	Shoshone Mountain, NV	Rosegate	Rosegate	distal end snapped, one distal edge severely damaged & reworked	
12-10 92	Ny3	>22.0 mm	>22.0 mm	5.9 mm	1.00	17.7 mm	NM	NM (LMW=6.9 mm)	8.5 mm	0.48	7.5 mm	4.7 mm	135°	101°	34°	>1.60	Shoshone Mountain, NV	Rosegate	Rosegate	distal end snapped, one shoulder tang snapped	imperfection in obsidian (macroscopic crystal) visible on snapped edge
12-10 23	Ny3	>16.5 mm	>16.5 mm	4.5 mm	1.00	>16.5 mm	NM	NM (LMW=4.2 mm)	9.7 mm	NM	7.4 mm	4.2 mm	142°	116°	26°	>0.90	Shoshone Mountain, NV	Rosegate	Rosegate	distal end snapped, one shoulder snapped	imperfections in obsidian (macroscopic crystals) visible on snapped edge, pink clay or paint visible
12-10 295	Ny3	>15.5 mm	>15.5 mm	5.6 mm	1.00	17.8 mm	NM	NM (LMW=7.3 mm)	9.2 mm	0.52	8.7 mm	4.0 mm	162°	109°	53°	>0.90	Shoshone Mountain, NV	Rosegate	Rosegate	blade snapped	
12-10 61	Ny3	31.3 mm	31.3 mm	12.5 mm	1.00	17.9 mm	1.75	45%	15.0 mm	0.84	12.0 mm	5.2 mm	230°	127°	103°	2.40	Oak Spring Butte, NV	Elko corner notched	Elko corner notched	complete	
12-10 68	Ny3	>33.4 mm	>31.8 mm	6.9 mm	0.95	27.8 mm	NM	NM (LMW=13.4 mm)	20.2 mm	0.73	18.2 mm	4.5 mm	199°	110°	79°	>4.65	Oak Spring Butte, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder is double notched	(looks like Oak Springs Butte)
12-10 49	Ny3	>33.8 mm	>33.8 mm	12.3 mm	1.00	24.5 mm	NM	NM (LMW=16.9 mm)	20.2 mm	0.82	17.0 mm	8.1 mm	225°	125°	100°	>7.20	Shoshone Mountain, NV	Elko corner notched	out-of-key	blade heavily damaged & worked	imperfections in obsidian (macroscopic crystals) visible throughout
12-10 32	Ny3	29.4 mm	29.4 mm	6.9 mm	1.00	21.3 mm	1.38	32%	16.3 mm	0.77	14.5 mm	5.3 mm	185°	141°	44°	3.00	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	distal end and one side damaged, edges reworked	
12-10 97	Ny3	>26.8 mm	>26.1 mm	9.2 mm	0.97	>26.1 mm	NM	NM (LMW=9.7 mm)	>16.6 mm	NM	15.2 mm	6.5 mm	186°	142°	NM	>4.00	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder tang snapped, opposite base tang snapped	imperfections in obsidian (macroscopic crystals) visible on snapped edges
12-10 84	Ny3	>29.1 mm	>28.2 mm	13.2 mm	0.97	27.0 mm	NM	NM (LMW=16.9 mm)	25.3 mm	0.94	16.5 mm	6.5 mm	182°	127°	55°	>5.10	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder damaged & reworked, one side extensively reworked	imperfections in obsidian (macroscopic crystals) visible throughout
12-10 34	Ny3	>18.6 mm	>18.6 mm	6.8 mm	1.00	>23.5 mm	NM	NM (LMW=9.6 mm)	17.5 mm	NM	16.8 mm	5.3 mm	179°	110°	69°	>2.05	South Kawich Range, NV	Elko corner notched	Elko corner notched	blade snapped diagonally above one shoulder & under the second shoulder	
12-10 82	Ny3	>33.0 mm	>32.5 mm	5.9 mm	0.98	>21.0 mm	NM	NM (LMW=6.4 mm)	13.7 mm	NM	8.8 mm	4.7 mm	130°	126°	4°	>2.60	Tempiute Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder tang snapped, distal blade edges damaged	pink clay or paint visible on both surfaces
12-10 390	Ny3	>21.2 mm	>19.8 mm	7.4 mm	0.93	13.5 mm	NM	NM (LMW=10.2 mm)	12.0 mm	0.89	10.8 mm	4.9 mm	250°	117°	133°	>1.60	Bodie Hills, CA	Elko eared	Elko eared	distal end snapped, blade edges heavily worn/reworked, heavily weathered	red paint (hematite?) visible on one face
12-10 300	Ny3	>26.9 mm	>24.6 mm	11.0 mm	0.91	>17.5 mm	NM	0%	>17.5 mm	1.00	12.1 mm	6.5 mm	210°	122°	88°	>2.70	Oak Spring Butte, NV	Elko eared	Elko eared	blade snapped from two directions, one base tang snapped	looks like what Jennings (1986) calls "Elko side notched"
12-10 100	Ny3	28.9 mm	26.5 mm	7.3 mm	0.92	21.8 mm	1.33	33%	15.9 mm	0.73	13.1 mm	6.2 mm	185°	139°	46°	3.20	Oak Spring Butte, NV	Elko eared	Elko eared	blade appears extensively damaged, one base tang appear to have been snapped & reworked	point may have been broken during manufacture (doesn't appear the thinning process was completed)
12-10 26	Ny3	>24.9 mm	>22.1 mm	7.5 mm	0.89	19.8 mm	NM	NM (LMW=12.2 mm)	18.4 mm	0.93	≈16.1 mm	4.8 mm	201°	128°	73°	>2.45	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Elko eared	Elko eared	distal end crushed, one shoulder snapped, edges damaged & some reworked	pink clay or paint visible on both surfaces
12-10 20	Ny3	>29.9 mm	>26.4 mm	9.1 mm	0.88	≈27.4 mm	NM	NM (LMW=12.4 mm)	14.5 mm	≈0.54	16.9 mm	5.4 mm	185°	76°	109°	>4.75	Shoshone Mountain, NV	Gatecliff split stem	Gatecliff split stem	blade snapped, one shoulder snapped	imperfections in obsidian (macroscopic crystals) visible on snapped edges
12-10 22	Ny3	>21.4 mm	>18.0 mm	8.2 mm	0.84	26.2 mm	NM	NM (LMW=8.5 mm)	12.0 mm	0.46	14.2 mm	4.4 mm	189°	83°	106°	>2.05	Shoshone Mountain, NV	Gatecliff split stem	Gatecliff split stem	blade snapped, shoulders reworked	
12-10 464	Ny3	38.2 mm	36.5 mm	N/A	0.96	14.3 mm	2.67	61%	11.6 mm	0.82	N/A	5.3 mm	N/A	N/A	N/A	2.70	Bodie Hills, CA	Humboldt	Humboldt	one corner of base chipped	streak of beige (faded red) paint on one face, parallel flake scars
12-10 105	Ny3	>20.1 mm	>17.6 mm	N/A	0.88	20.5 mm	NM	NM (LMW=7.3 mm)	18.3 mm	0.89	N/A	8.2 mm	N/A	N/A	N/A	>3.90	Shoshone Mountain, NV	Humboldt	Humboldt	snapped diagonally above haft element, edges reworked	quite similar to 12-10 7, but much thicker
12-10 95	Ny3	33.5 mm	30.2 mm	N/A	0.90	21.0 mm	1.60	31%	17.1 mm	0.81	N/A	7.3 mm	N/A	N/A	N/A	4.70	South Kawich Range, NV	Humboldt	Humboldt	all edges damaged & heavily reworked	quite similar to 12-10 7, but thicker. WB/WM "artificial" due to extensive resharpening
12-10 99	Ny3	42.3 mm	40.2 mm	14.6 mm	1.00	>24.1 mm	NM	0%	>24.1 mm	1.00	13.2 mm	6.2 mm	189°	185°	14°	>5.90	Oak Spring Butte, NV	Large side notched, Northern	Large side notched	one base tang snapped, distal blade edges damaged & reworked	basally-indented Large side notched
12-10 11	Ny3	>20.7 mm	>20.7 mm	7.0 mm	1.00	19.5 mm	NM	NM (LMW=6.2 mm)	>12.0 mm	NM	7.1 mm	4.6 mm	182°	180°	2°	>1.75	Oak Spring Butte, NV	Large side notched, Northern	Large side notched	distal end snapped, one base tang snapped diagonally	imperfection in obsidian (macroscopic crystal) visible on snapped edge
12-10 292	Ny3	>15.8 mm	>14.1 mm	14.4 mm	0.89	>19.7 mm	NM	NM	>19.7 mm	NM	10.6 mm	4.7 mm	204°	187°	17°	>1.50	Tempiute Mountain, NV	Large side notched, Northern	Large side notched	blade snapped at neck, one base tang snapped	
12-10 79	Ny3	25.0 mm	25.0 mm	9.1 mm	1.00	17.1 mm	1.46	0%	17.1 mm	1.00	12.5 mm	5.0 mm	194°	145°	49°	1.85	Shoshone Mountain, NV	Large side notched, Sudden	Large side notched	one shoulder snapped	convex base & size similar to 12-10 61. based on flake scar, it appears shoulder may have been snapped during manufacture
12-10 27	Ny3	>26.5 mm	>22.8 mm	12.7 mm	0.86	>20.9 mm	NM	NM	20.9 mm	NM	19.2 mm	7.5 mm	217°	105°	112°	>3.70	Shoshone Mountain, NV	Pinto	out-of-key	blade snapped, one shoulder snapped, distal edge damaged	macroscopic crystals visible on damaged edges, attributes present fit Basgall & Hall (2000) definition of Pinto
12-10 7	Ny3	31.5 mm	26.3 mm	N/A	0.83	23.6 mm	1.33	12%	21.7 mm	0.92	N/A	4.5 mm	N/A	N/A	N/A	3.00	Oak Spring Butte, NV	Unknown shoulderless concave-base	out-of-key	tip of one side of base chipped	large, wide, shoulderless, leaf shaped, concave-base point
12-10 24	Ny3	38.2 mm	38.2 mm	14.3 mm	1.00	27.3 mm	1.40	47%	17.0 mm	0.62	17.5 mm	7.8 mm	210°	114°	96°	7.15	Shoshone Mountain, NV	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	distal blade edges damaged & reworked, base damaged, one shoulder snapped	looks like Great Basin stemmed
NORTH OF STUDY AREA (n=138)																					
Joshua Tree National Park, California (Campbell collection); Big Smoky District, NV, n=33																					
6056 498G35-46A	n/a	>24.0 mm	>24.0 mm	5.2 mm	1.00	15.0 mm	NM	NM (LMW=8.3 mm)	7.9 mm	0.53	6.6 mm	3.4 mm	140°	115°	31°	>1.35	Montezuma Range, NV	Rosegate	Rosegate	distal end snapped, one shoulder snapped, edges reworked	
6478 A192 (C)	n/a	>31.9 mm	>31.9 mm	5.2 mm	1.00	15.4 mm	NM	NM (LMW=6.1 mm)	9.8 mm	0.64	7.0 mm	5.0 mm	175°	129°	46°	>2.20	Queen/Truman Meadows, CA/NV	Rosegate	Rosegate	distal end snapped	
6473 A128 (A)	n/a	>38.8 mm	>34.7 mm	11.1 mm	0.89	22.4 mm	NM	NM (LMW=16.3 mm)	6.5 mm	0.29	7.2 mm	5.3 mm	147°	111°	36°	>3.70	Montezuma Range, NV	Elko eared	Elko eared	distal end snapped, edges and base heavily damaged & reworked, 1 base tang snapped	
6478 A192 (B)	n/a	>33.4 mm	>33.4 mm	6.0 mm	1.00	18.6 mm	NM	NM (LMW=7.9 mm)	4.7 mm	0.25	8.7 mm	5.2 mm	201°	52°	153°	>3.45	Obsidian Butte, NV, Variety 5 (Unknown C)	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
6478 A192 (A)	n/a	>37.7 mm	>37.7 mm	5.6 mm	1.00	18.8 mm	NM	NM (LMW=8.0 mm)	3.7 mm	0.20	6.5 mm	4.2 mm	179°	68°	111°	>2.50	Queen/Truman Meadows, CA/NV	Gatecliff contracting stem	Gatecliff contracting stem	tip snapped	
6425 A241 (G)	n/a	>40.7 mm	>40.7 mm	17.6 mm	1.00	24.4 mm	NM	NM (LMW=21.0 mm)	21.8 mm	0.89	20.9 mm	6.4 mm	254°	115°	141°	>7.20	Crow Spring, NV	Pinto	*?Elko eared?*	blade heavily damaged, edges reworked	fits Basgall & Hall (2000) discriminants
6183 A275 (A)	n/a	34.1 mm	29.4 mm	12.6 mm	0.86	21.5 mm	1.59	37%	19.2 mm	0.89	17.3 mm	6.3 mm	253°	114°	139°	4.15	Montezuma Range, NV	Pinto	*?Elko eared?*	complete, weathered	weak shoulders, probably Pinto but PSA too high for Basgall & Hall (2000) definition - all else fits
6425 A241 (F)	n/a	>46.1 mm	>42.1 mm	11.2 mm	0.91	22.2 mm	NM	NM (LMW=17.3 mm)	18.2 mm	0.82	16.9 mm	7.4 mm	240°	94°	136°	>7.80	Montezuma Range, NV	Pinto	*?Gatecliff split stem?*	distal end heavily damaged, edges reworked	looks like Pinto although PSA slightly low for Basgall & Hall (2000) definition
6183 A275 (B)	n/a	>36.9 mm	>32.5 mm	11.3 mm	0.88	24.0 mm	NM	NM (LMW=13.9 mm)	21.9 mm	0.91	20.0 mm	7.8 mm	224°	97°	127°	>7.80	Silver Peak/Fish Lake Valley, NV	Pinto	*?Gatecliff split stem?*	distal end snapped, weathered	weak shoulders, probably Pinto but PSA too low for Basgall & Hall (2000) definition
6425 A241 (M)	n/a	>26.0 mm	>22.2 mm	12.9 mm	0.85	23.5 mm	NM	NM (LMW=15.1 mm)	18.0 mm	0.77	18.9 mm	6.7 mm	232°	83°	149°	>4.25	Silver Peak/Fish Lake Valley, NV	Pinto	*?Gatecliff split stem?*	distal end snapped, distal blade edges reworked	looks like Pinto, WB/WM fits & LS/LM likely would fit but PSA & DSA do not fit Basgall & Hall (2000) definition
6183	n/a	31.8 mm	29.8 mm	8.0 mm	0.94	21.4 mm	1.49	40%	15.1 mm	0.71	13.0 mm	6.3 mm	197°	124°	73°	4.00	Crow Spring, NV	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	small chip on tip and one base tang, weathered	Great Basin stemmed, Borax Lake wide stem
6183 A275 (C)	n/a	>29.0 mm	>26.6 mm	9.0 mm	0.92	20.6 mm	NM	NM (LMW=10.8 mm)	16.8 mm	0.82	13.5 mm	5.3 mm	146°	113°	33°	>2.90	Crow Spring, NV	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	tip snapped, one distal edge and shoulder reworked, weathered	Great Basin stemmed, Borax Lake wide stem
6425 A241 (E)	n/a	40.2 mm	40.2 mm	14.7 mm	1.00	23.0 mm	1.75	48%	17.2 mm	0.75	19.5 mm	8.2 mm	240°	108°	132°	7.70	Obsidian Butte, NV, Variety 5 (Unknown C)	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	distal blade edges heavily damaged & reworked	Great Basin stemmed, Borax Lake wide stem
6511 A215 (C)	n/a	>46.2 mm	>44.6 mm	18.1 mm	0.97	19.4 mm	NM	NM (LMW=21.8 mm)	18.1 mm	0.93	17.1 mm	9.2 mm	258°	102°	156°	>8.40	Crow Spring, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	heavily damaged and weathered	Great Basin stemmed, Lake Mohave
6511 A215 (D)	n/a	>30.8 mm	>30.8 mm	20.2 mm	1.00	>25.0 mm	NM	NM	13.0 mm	NM	18.2 mm	6.9 mm	216°	83°	133°	>4.10	Crow Spring, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	snapped diagonally at shoulders, weathered	Great Basin stemmed, Lake Mohave
6511 A215 (B)	n/a	40.1 mm	40.1 mm	15.3 mm	1.00	26.3 mm	1.52	46%	19.8 mm	0.75	17.8 mm	9.5 mm	188°	94°	84°	9.05	Garfield Hills, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal blade edges reworked, weathered	Great Basin stemmed, Lake Mohave
6511 A215 (A)	n/a	51.9 mm	51.9 mm	21.3 mm	1.00	20.1 mm	2.58	50%	9.0 mm	0.45	14.9 mm	6.0 mm	242°	97°	145°	6.20	Montezuma Range, NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	all edges reworked, weathered	Great Basin stemmed, Lake Mohave
6425 A241 (I)	n/a	>35.1 mm	>35.1 mm	28.4 mm	1.00	>22.3 mm	NM	NM	17.0 mm	NM	20.6 mm	7.5 mm	228°	88°	140°	>7.00	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	blade snapped at shoulders	Great Basin stemmed, Lake Mohave
6425 A241 (O)	n/a	>26.1 mm	>26.1	≈26.1	1.00	>18.8 mm	NM	NM	13.9 mm	NM	18.8 mm	7.1 mm	NM	81°	NM	>3.90	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal end snapped at shoulders	Great Basin stemmed, Lake Mohave
6243 A271 (A)	n/a	50.0 mm	49.2 mm	23.2 mm	0.98	22.6 mm	2.21	49%	10.5 mm	0.46	16.9 mm	8.1 mm	216°	83°	133°	8.90	Crow Spring, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	most of distal blade edges and stem damaged & reworked, one shoulder snapped	Great Basin stemmed, Silver Lake
6425 A241 (N)	n/a	40.5 mm	40.5 mm	16.9 mm	1.00	26.6 mm	1.52	48%	14.6 mm	0.55	18.3 mm	8.3 mm	212°	82°	130°	7.70	Crow Spring, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	all edges damaged & reworked	Great Basin stemmed, Silver Lake
6060 498G3692 (A)	n/a	38.5 mm	38.5 mm	14.1 mm	1.00	24.7 mm	2.73	40%	15.1 mm	0.61	16.8 mm	7.4 mm	200°	94°	106°	6.50	Garfield Hills, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	tip and base appear reworked, weathered	Great Basin stemmed, Silver Lake
6473 A128 (B)	n/a	>30.0 mm	>30.0 mm	14.7 mm	1.00	34.2 mm	NM	NM (LMW=20.3 mm)	17.3 mm	0.51	21.4 mm	7.5 mm	140°	84°	56°	>7.50	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped above shoulders	Great Basin stemmed, Silver Lake
6425 A241 (C)	n/a	40.1 mm	40.1 mm	9.0 mm	1.00	25.3 mm	1.58	46%	16.0 mm	0.63	14.2 mm	7.0 mm	207°	100°	107°	7.00	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	tip, base, and distal blade edges appear reworked, weathered	Great Basin stemmed, Silver Lake
6425 A241 (H)	n/a	>36.7 mm	>36.7 mm	19.0 mm	1.00	26.8 mm	NM	NM (LMW=21.2 mm)	>12.9 mm	NM	21.2 mm	7.8 mm	211°	85°	126°	8.20	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	all edges heavily damaged & reworked, base chipped	Great Basin stemmed, Silver Lake
6425 A241 (L)	n/a	36.9 mm	36.9 mm	12.8 mm	1.00	23.6 mm	1.56	38%	17.1 mm	0.72	17.6 mm	7.1 mm	201°	85°	116°	6.30	Montezuma Range, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	all edges damaged & reworked	Great Basin stemmed, Silver Lake
6425 A241 (D)	n/a	39.4 mm	39.4 mm	12.3 mm	1.00	25.4 mm	1.55	42%	15.5 mm	0.61	16.2 mm	6.4 mm	216°	99°	117°	5.85	Obsidian Butte, NV, Variety 3	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	all edges reworked	Great Basin stemmed, Silver Lake
6243 A271 (B)	n/a	32.5 mm	32.5 mm	14.0 mm	1.00	22.6 mm	1.44	52%	17.0 mm	0.75	17.4 mm	7.4 mm	214°	93°	121°	5.35	Unknown 14, probably Cloverdale Canyon A, NV	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal blade edges & base damaged & reworked	Great Basin stemmed, Silver Lake
6425 A241 (J)	n/a	51.8 mm	48.1 mm	N/A	0.93	18.8 mm	2.76	0%	18.8 mm	1.00	N/A	7.8 mm	N/A	N/A	N/A	6.00	Montezuma Range, NV	Black Rock concave base	out-of-key	distal blade edges heavily damaged & reworked, faint shoulder on one side	shoulderless, concave base point, probably Black Rock concave base
6690 (no spec. no.)	n/a	>42.6 mm	>40.6 mm	N/A	0.95	24.6 mm	NM	NM (LMW=22.3 mm)	19.9 mm	0.81	N/A	4.9 mm	N/A	N/A	N/A	>6.60	Fish Springs, Owens Valley, CA	Unknown shoulderless concave-base	*?Humboldt?*	distal end snapped, weathered	very large, crude for Humboldt
6511 A215 (E)	n/a	>33.7 mm	>32.9 mm	N/A	0.98	23.3 mm	NM	NM (LMW=12.3 mm)	16.4 mm	0.70	19.0 mm	7.5 mm	N/A	N/A	N/A	>6.50	Saline Range, CA, Variety 1 (Queen Impostor)	Unknown shoulderless concave-base	*?Humboldt?*	base & distal end snapped, distal blade edges heavily damaged & reworked, weathered	large, crude for Humboldt
6060 498G3692 (B)	n/a	>36.4 mm	>33.6 mm	8.5 mm	0.92	20.5 mm	NM	0%	20.5 mm	1.00	16.9 mm	6.5 mm	228°	116°	112°	>5.30	Silver Peak/Fish Lake Valley, NV	Unknown weak-shouldered concave base	out-of-key	tip snapped	large, weak-shouldered, side notched point or may be reworked GBS Lake Mohave stem
6425 A241 (K)	n/a	46.2 mm	46.2 mm	N/A	1.00	19.5 mm	2.37	26%	12.9 mm	0.66	N/A	6.8 mm	N/A	N/A	N/A	7.00	Queen/Truman Meadows, CA/NV	Unknown large shoulderless	out-of-key	edges damaged & reworked, especially tip	flat base, but otherwise similar to Black Rock concave base (oblique flake scars)
American Museum of Natural History, n=105																					
Alta Toquima Village (26Ny920), Nye County, NV, n=82																					
20.5 889	Ny920	>15.6 mm	>15.6 mm	N/A	1.00	12.5 mm	NM	NM (LMW=4.1 mm)	7.0 mm	0.56	N/A	2.9 mm	N/A	N/A	N/A	>0.55	Mono Glass Mountain, CA	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped, all edges damaged & worn	
20.5 2314	Ny920	27.9 mm	27.9 mm	N/A	1.00	10.3 mm	2.71	27%	6.8 mm	0.66	N/A	2.3 mm	N/A	N/A	N/A	>0.55	Obsidian Butte, NV, Variety 5 (Unknown C)	Cottonwood leaf shaped	Cottonwood leaf shaped	one edge of blade snapped, base chipped & worn, blade edge worn, tip reworked	wear indentation from hafting gives point appearance of a one-sided Parowan basal notched
20.4 6614	Ny920	13.5 mm	13.0 mm	N/A	0.96	8.3 mm	1.69	0%	8.3 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	0.35	Box Spring, NV	Cottonwood triangular	Cottonwood triangular	complete	
20.4 21	Ny920	23.9 mm	20.1 mm	N/A	0.84	18.5 mm	1.29	0%	18.5 mm	1.00	N/A	4.8 mm	N/A	N/A	N/A	1.10	Box Spring, NV	Cottonwood triangular	out-of-key	blade edges worn	looks like thick, serrated edge, Cottonwood triangular w/ deep BIR & stylized base tangs similar to Desert side notched
20.4 7047	Ny920	17.2 mm	16.5 mm	N/A	0.96	9.0 mm	1.91	0%	9.0 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.30	Crow Spring, NV	Cottonwood triangular	Cottonwood triangular	blade edges worn	
20.4 6791	Ny920	19.4 mm	17.4 mm	N/A	0.90	9.1 mm	2.13	0%	9.1 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.35	Crow Spring, NV	Cottonwood triangular	Cottonwood triangular	edges worn, small chip on one corner of base	deep BIR & stylized base tangs similar to Desert side notched
20.5 826	Ny920	>13.7 mm	>13.5 mm	N/A	0.99	9.9 mm	NM	0%	9.9 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.40	Garfield Hills, NV	Cottonwood triangular	Cottonwood triangular	blade snapped above haft element	
20.4 6965	Ny920	>18.0 mm	>18.0 mm	N/A	1.00	15.4 mm	NM	0%	15.4 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>1.00	Lookout Mountain, Casa Diablo, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped, blade edges worn	
20.4 6500	Ny920	11.7 mm	10.4 mm	N/A	0.89	10.1 mm	1.16	0%	10.1 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.20	Montezuma Range, NV	Cottonwood triangular	Cottonwood triangular	blade edges worn	
20.4 6601	Ny920	17.0 mm	14.7 mm	N/A	0.86	12.6 mm	1.35	0%	12.6 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	0.50	Montezuma Range, NV	Cottonwood triangular	out-of-key	complete	looks like a thick Cottonwood triangular - deep BIR & stylized base tangs similar to Desert side notched
20.4 6821	Ny920	15.0 mm	12.5 mm	N/A	0.83	10.2 mm	1.47	0%	10.2 mm	1.00	N/A	5.0 mm	N/A	N/A	N/A	0.40	Montezuma Range, NV	Cottonwood triangular	out-of-key	tip slightly worn	looks like a thick Cottonwood triangular with deep BIR & stylized base tangs similar to Desert side notched
20.5 365	Ny920	14.3 mm	14.3 mm	N/A	1.00	>9.1 mm	NM	0%	>9.1 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	>0.30	Mount Hicks, NV	Cottonwood triangular	Cottonwood triangular	tip damaged, one corner base snapped	
20.4 7048	Ny920	17.4 mm	14.7 mm	N/A	0.84	8.5 mm	2.05	0%	8.5 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	0.25	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Cottonwood triangular	Cottonwood triangular	complete	
20.4 6781	Ny920	>12.7 mm	>12.7 mm	N/A	1.00	14.9 mm	NM	NM (LMW=6.2 mm)	14.2 mm	0.95	N/A	2.5 mm	N/A	N/A	N/A	>0.50	Obsidian Butte, NV, Variety 5 (Unknown C)	Cottonwood triangular	Cottonwood triangular	blade snapped diagonally above haft element	
20.5 224	Ny920	15.7 mm	15.7 mm	N/A	1.00	10.3 mm	1.52	0%	10.3 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.40	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	tip worn or damaged during manufacture	
20.4 6424	Ny920	16.8 mm	15.5 mm	N/A	0.92	11.3 mm	1.49	0%	11.5 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	0.40	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	blade edges worn	band of oxide stain toward tip
20.4 6917	Ny920	>19.0 mm	>19.0 mm	N/A	1.00	9.5 mm	NM	0%	9.5 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.40	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, blade edges worn	mahogany obsidian
20.5 34	Ny920	12.8 mm	12.8 mm	N/A	1.00	12.3 mm	NM	0%	12.3 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	>0.50	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
20.5 588	Ny920	>12.0 mm	>12.0 mm	N/A	1.00	12.3 mm	NM	0%	12.3 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	>0.35	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	blade snapped above haft element	
20.5 715	Ny920	>13.9 mm	>13.2 mm	N/A	0.95	13.8 mm	NM	0%	13.8 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	>0.60	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	blade snapped above haft element	mahogany obsidian
20.4 6986	Ny920	>15.5 mm	>15.5 mm	N/A	1.00	≈14.0 mm	NM	0%	≈14.0 mm	1.00	N/A	2.3 mm	N/A	N/A	N/A	>0.45	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, one corner base snapped	
20.5 331	Ny920	>15.0 mm	>14.7 mm	N/A	0.98	15.0 mm	NM	NM (LMW=2.9 mm)	14.8 mm	0.99	N/A	2.7 mm	N/A	N/A	N/A	>0.70	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, edges worn	
20.5 590	Ny920	>21.6 mm	>18.8 mm	N/A	0.87	12.8 mm	NM	0%	12.8 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	>0.50	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	tip snapped, blade edges worn	deep BIR
20.4 6346	Ny920	>17.7 mm	>15.0 mm	N/A	0.85	16.5 mm	NM	0%	16.5 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	>0.90	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, all edges worn	
20.4 6850	Ny920	>12.0 mm	>10.7 mm	N/A	0.89	15.5 mm	NM	0%	15.5 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.50	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
20.4 6784	Ny920	>15.9 mm	>15.9 mm	N/A	1.00	>8.5 mm	NM	0%	>8.5 mm	1.00	N/A	2.6 mm	N/A	N/A	N/A	>0.35	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, one corner base snapped, blade edges damaged	
20.4 6959	Ny920	15.6 mm	15.5 mm	N/A	0.99	>12.4 mm	NM	0%	>12.4 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	>0.40	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	one corner base snapped	mahogany obsidian, very slight base & edge indentation suggest possibly an unfinished Desert side notched
20.4 6539	Ny920	>9.8 mm	>9.8 mm	N/A	1.00	>12.6 mm	NM	0%	>12.6 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	>0.30	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	blade snapped, one corner base snapped	
20.5 2523	Ny920	16.4 mm	16.4 mm	N/A	1.00	>8.7 mm	NM	0%	>8.7 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	>0.30	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	one corner base snapped, tip worn, slight hafting notch worn on one edge	
20.5 5838	Ny920	>9.5 mm	>9.5 mm	N/A	1.00	10.3 mm	NM	0%	10.3 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	>0.25	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
20.4 6391	Ny920	16.1 mm	16.1 mm	N/A	1.00	>11.7 mm	NM	0%	>11.7 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	>0.55	Tempiute Mountain, NV	Cottonwood triangular	Cottonwood triangular	one corner of base snapped, edges worn	

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
20.4 6660	Ny920	13.3 mm	11.7 mm	N/A	0.88	12.0 mm	1.11	0%	12.0 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.30	Unknown Variety G (Gatecliff shelter Group 1)	Cottonwood triangular	Cottonwood triangular	one blade edge damaged, edges worn	deep BIR & stylized base tangs similar to Desert side notched
20.4 6806	Ny920	20.2 mm	19.8 mm	N/A	0.98	12.5 mm	1.62	0%	12.5 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.70	Unknown Variety G (Gatecliff shelter Group 1)	Cottonwood triangular	Cottonwood triangular	distal end reworked	one face appears sooty
20.5 2418	Ny920	16.4 mm	14.5 mm	6.2 mm	0.88	11.9 mm	1.38	0%	11.9 mm	1.00	5.3 mm	2.8 mm	213°	161°	52°	0.40	Black Rock area, UT	Desert side notched	Desert side notched	blade edges worn	Sierra side notched
20.5 370	Ny920	>14.6 mm	>11.2 mm	8.3 mm	0.77	>9.3 mm	NM	0%	>9.3 mm	1.00	5.7 mm	2.9 mm	195°	159°	36°	>0.30	Black Rock area, UT	Desert side notched	Desert side notched	distal end snapped, one base tang snapped	Sierra side notched
20.5 328	Ny920	16.4 mm	15.7 mm	6.2 mm	0.96	10.4 mm	1.58	0%	10.4 mm	1.00	5.9 mm	2.9 mm	195°	152°	43°	>0.45	Box Spring, NV	Desert side notched	Desert side notched	one corner of bottom of base tang snapped, blade edges worn	Sierra side notched
20.4 6831	Ny920	17.7 mm	16.7 mm	6.7 mm	0.94	11.3 mm	1.57	0%	11.3 mm	1.00	6.2 mm	2.4 mm	196°	162°	34°	0.45	Crow Spring, NV	Desert side notched	Desert side notched	blade edges worn	Sierra side notched
20.5 2525	Ny920	>10.5 mm	>10.2 mm	8.2 mm	0.97	11.0 mm	NM	0%	11.0 mm	1.00	5.4 mm	2.8 mm	230°	170°	60°	>0.25	Garfield Hills, NV	Desert side notched	Desert side notched	blade snapped at shoulders	Panoche side notched
20.4 5	Ny920	>10.2 mm	>8.1 mm	7.3 mm	0.79	11.0 mm	NM	0%	11.0 mm	1.00	5.9 mm	2.3 mm	211°	146°	65°	>0.20	Garfield Hills, NV	Desert side notched	Desert side notched	blade snapped above shoulders	Desert side notched type
20.4 18	Ny920	18.7 mm	18.2 mm	6.7 mm	0.97	12.5 mm	1.50	0%	12.5 mm	1.00	7.8 mm	2.8 mm	230°	154°	76°	0.40	Montezuma Range, NV	Desert side notched	Desert side notched	notches very weak, blade edges slightly worn	Desert side notched type (looks more like a Cottonwood triangular with slight notches)
20.4 6910	Ny920	>16.7 mm	>16.7 mm	>2.5 mm	NM	>10.4 mm	NM	0%	>10.4 mm	1.00	5.7 mm	2.2 mm	203°	153°	50°	>0.25	Montezuma Range, NV	Desert side notched	Desert side notched	tip worn, base snapped diagonally under shoulder notches	Sierra side notched
20.5 4070	Ny920	>14.0 mm	>11.2 mm	6.5 mm	NM	>9.3 mm	NM	0%	>9.3 mm	1.00	6.2 mm	3.0 mm	223°	168°	55°	>0.30	Mount Hicks, NV	Desert side notched	Desert side notched	distal end snapped, one base tang snapped diagonally through base notch	Sierra side notched
20.5 273	Ny920	15.5 mm	15.1 mm	5.8 mm	0.97	11.7 mm	1.32	0%	11.7 mm	1.00	6.3 mm	2.7 mm	187°	164°	8°	0.35	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Desert side notched	Desert side notched	blade damaged, one base tang damaged	Sierra side notched
20.4 6944	Ny920	>13.8 mm	>13.3 mm	5.9 mm	0.96	10.9 mm	NM	0%	10.9 mm	1.00	5.8 mm	2.9 mm	206°	160°	46°	>0.40	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	distal end snapped, bottom edge of base snapped, blade edges worn	Bear River side notched, mahogany obsidian
20.5 374	Ny920	19.8 mm	17.5 mm	6.3 mm	0.88	12.4 mm	1.60	0%	12.4 mm	1.00	6.8 mm	2.5 mm	207°	153°	54°	0.40	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	distal end a curved barb, base tangs extremely asymmetric (manufacture errors?)	Sierra side notched, mahogany obsidian
20.4 12	Ny920	>16.0 mm	>13.3 mm	6.2 mm	0.83	15.4 mm	NM	NM (LMW=8.2 mm)	15.0 mm	0.97	12.1 mm	3.5 mm	209°	144°	65°	>0.90	Obsidian Butte, NV, Variety 5 (Unknown C)	Desert side notched	Desert side notched	distal end snapped, blade edges heavily worn & reworked	looks more like a small Elko
20.4 6816	Ny920	>10.6 mm	>9.1 mm	6.4 mm	0.86	11.7 mm	NM	0%	11.7 mm	1.00	5.4 mm	2.2 mm	221°	173°	48°	>0.15	Obsidian Butte, NV, Variety 5 (Unknown C)	Desert side notched	Desert side notched	blade heavily reworked & snapped	Sierra side notched
20.4 6934	Ny920	16.0 mm	14.1 mm	9.1 mm	0.88	12.8 mm	1.25	0%	12.8 mm	1.00	5.1 mm	2.8 mm	213°	175°	38°	0.40	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade edges worn	Sierra side notched
20.4 6685	Ny920	23.3 mm	17.0 mm	12.2 mm	0.73	11.8 mm	1.97	0%	11.8 mm	1.00	4.2 mm	2.9 mm	220°	173°	47°	0.40	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade edges worn	looks like cross between Sierra side notched & Delta side notched
20.5 2257	Ny920	21.3 mm	19.2 mm	8.5 mm	0.90	11.2 mm	1.90	0%	11.2 mm	1.00	5.7 mm	2.5 mm	191°	165°	10°	0.45	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade edges worn	Sierra side notched
20.4 6537	Ny920	>14.5 mm	>12.0 mm	7.9 mm	0.83	12.5 mm	NM	0%	12.5 mm	1.00	5.8 mm	2.7 mm	220°	147°	73°	>0.40	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade heavily damaged & reworked	Sierra side notched
20.5 2243	Ny920	20.3 mm	17.6 mm	5.8 mm	0.87	>10.4 mm	NM	0%	>10.4 mm	1.00	7.2 mm	3.1 mm	241°	156°	85°	>0.45	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	one base tang snapped, shoulders damaged, blade reworked	Sierra side notched
20.5 2566	Ny920	>16.2 mm	>14.2 mm	7.4 mm	0.88	13.7 mm	NM	0%	13.7 mm	1.00	4.9 mm	3.0 mm	188°	173°	15°	>0.50	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	distal end snapped & reworked to slightly convex edge	Sierra side notched
20.4 6987	Ny920	>17.1 mm	>13.9 mm	7.2 mm	0.81	>10.6 mm	NM	0%	>10.6 mm	1.00	5.6 mm	2.2 mm	200°	147°	53°	>0.30	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	distal end snapped, one base tang snapped, blade edges worn	Sierra side notched, red-streaked obsidian
20.4 6516	Ny920	>13.3 mm	>10.4 mm	8.7 mm	0.78	14.4 mm	NM	0%	14.4 mm	1.00	6.0 mm	2.4 mm	204°	167°	37°	>0.40	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade snapped diagonally at shoulders	Sierra side notched
20.5 2577	Ny920	13.3 mm	11.6 mm	6.2 mm	0.87	12.2 mm	1.09	0%	12.2 mm	1.00	6.1 mm	2.2 mm	223°	164°	59°	0.20	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade edges heavily worn/reworked	Sierra side notched
20.4 6798	Ny920	>8.8 mm	>7.2 mm	5.3 mm	0.82	11.2 mm	NM	0%	11.2 mm	1.00	5.6 mm	2.5 mm	179°	167°	12°	>0.25	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade snapped above shoulders	Sierra side notched, mahogany obsidian
20.5 3403	Ny920	>13.6 mm	>13.5 mm	9.0 mm	0.99	14.6 mm	NM	0%	14.6 mm	1.00	7.8 mm	2.3 mm	186°	184°	2°	>0.50	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade snapped above shoulders, one corner base snapped	Bear River side notched
20.5 2179	Ny920	>13.0 mm	>12.0 mm	6.2 mm	0.92	>13.3 mm	NM	0%	>13.3 mm	1.00	5.4 mm	2.3 mm	193°	175°	18°	>0.25	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	distal end snapped, one base tang snapped, blade edges worn	Sierra side notched, mahogany obsidian
20.5 118	Ny920	>8.9 mm	>5.5 mm	7.7 mm	0.62	14.6 mm	NM	0%	14.6 mm	1.00	6.8 mm	3.3 mm	195°	173°	22°	>0.30	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	blade snapped at shoulder	Sierra side notched
20.4 6833	Ny920	>12.0 mm	>8.6 mm	10.2 mm	0.72	17.2 mm	NM	0%	17.2 mm	1.00	6.9 mm	2.2 mm	200°	163°	37°	>0.30	Unknown Variety G (Gatecliff shelter Group 1)	Desert side notched	Desert side notched	blade snapped above shoulders	Delta side notched
20.5 669	Ny920	17.5 mm	>15.6 mm	5.6 mm	NM	>11.9 mm	NM	0%	>11.9 mm	1.00	5.5 mm	3.1 mm	219°	166°	53°	>0.40	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	one base tang snapped diagonally from neck to opposite tang tip, blade edges worn	Sierra side notched
20.5 2739	Ny920	20.9 mm	20.8 mm	3.1 mm	0.995	13.3 mm	1.57	22%	7.0 mm	0.53	7.0 mm	2.7 mm	203°	81°	122°	0.50	Box Spring, NV	Parowan basal notched	out-of-key	blade edges heavily worn	looks like contracting stem Rose Spring - Parowan basal notched
20.5 2609	Ny920	>19.1 mm	>19.1 mm	2.2 mm	1.00	>19.0 mm	NM	NM (LMW=4.5 mm)	10.4 mm	NM	10.1 mm	3.4 mm	131°	98°	33°	>0.85	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Parowan basal notched	*?Gatecliff contracting stem?*	tip & one shoulder tang snapped, blade edges reworked	looks more like an Eastgate
20.5 2717	Ny920	>14.4 mm	>14.1 mm	2.7 mm	1.00	18.6 mm	NM	NM (LMW=1.8 mm)	8.5 mm	0.46	8.5 mm	2.7 mm	127°	78°	49°	>0.60	Obsidian Butte, NV, Variety 5 (Unknown C)	Parowan basal notched	out-of-key	blade snapped at midpoint, small chip on corner of base, remaining blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
20.5 2201	Ny920	29.9 mm	29.9 mm	3.3 mm	1.00	17.2 mm	1.74	13%	6.7 mm	0.39	6.2 mm	3.1 mm	134°	106°	28°	1.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Rosegate	Rosegate	one shoulder tang & one edge of base chipped	serrated edges, Eastgate type
20.5 655	Ny920	>22.0 mm	>22.0 mm	4.2 mm	1.00	>15.9 mm	NM	NM (LMW=3.6 mm)	9.9 mm	NM	8.2 mm	3.0 mm	135°	105°	30°	>0.70	Obsidian Butte, NV, Variety 5 (Unknown C)	Rosegate	Rosegate	both blade edges snapped vertically from tip - one shoulder tang missing	Eastgate type
20.4 7321	Ny920	20.0 mm	18.9 mm	4.5 mm	0.95	14.9 mm	1.34	40%	>10.9 mm	NM	9.7 mm	4.4 mm	225°	136°	91°	>1.15	Box Spring, NV	Elko corner notched	Elko corner notched	tip & blade edges heavily worn, one base tang snapped	
20.5 2315	Ny920	>16.5 mm	>16.5 mm	5.8 mm	1.00	>13.5 mm	NM	NM (LMW=9.2 mm	13.4 mm	NM	10.4 mm	4.5 mm	178°	130°	48°	>1.05	Garfield Hills, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder snapped, remaining edges heavily worn	
20.5 555	Ny920	>27.8 mm	>22.5 mm	8.3 mm	0.81	>24.6 mm	NM	NM (LMW=14.8 mm)	>18.8 mm	NM	18.1 mm	5.1 mm	203°	130°	73°	>3.05	Montezuma Range, NV	Elko eared	Elko eared	distal end, blade edges, & one base tang snapped, heavily worn & reworked	based on wear patterns, probably a knife blade, not a point
20.4 6824	Ny920	>19.2 mm	>19.2 mm	6.5 mm	1.00	28.2 mm	NM	NM (LMW=7.2 mm)	6.2 mm	0.22	14.3 mm	5.1 mm	172°	45°	127°	>2.60	Montezuma Range, NV	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped at haft element	
20.4 7166	Ny920	27.2 mm	27.7 mm	4.4 mm	1.00	19.1 mm	1.42	29%	9.4 mm	0.49	10.3 mm	6.8 mm	146°	63°	83°	2.55	Obsidian Butte, NV, Variety 5 (Unknown C)	Gatecliff contracting stem	Gatecliff contracting stem	tip & one blade edge worn & reworked	based on wear patterns, may actually have been a knife/boring tool
20.5 780	Ny920	36.0 mm	35.5 mm	9.5 mm	0.99	26.2 mm	1.37	31%	11.1 mm	0.42	16.6 mm	7.5 mm	178°	63°	115°	5.40	Paradise Valley, NV	Gatecliff contracting stem	Gatecliff contracting stem	blade edges heavily worn & reworked, especially distal end	based on wear patterns, may actually have been used as a knife
20.5 2696	Ny920	28.7 mm	28.0 mm	6.0 mm	0.98	>13.9 mm	NM	29%	10.0 mm	NM	9.6 mm	5.5 mm	220°	94°	66°	>1.95	Tempiute Mountain, NV	Gatecliff contracting stem	Gatecliff contracting stem	tip worn, one shoulder & one base tang snapped, blade edges heavily worn	
20.4 159	Ny920	>29.3 mm	>28.1 mm	5.6 mm	0.96	19.4 mm	NM	NM (LMW=6.2 mm)	9.2 mm	0.47	9.7 mm	5.6 mm	163°	96°	67°	>2.60	Crow Spring, NV	Gatecliff split stem	Gatecliff split stem	tip snapped, blade edges damaged & reworked, one base tang chipped	based on wear patterns, may actually have been a knife
20.5 97	Ny920	>16.9 mm	>15.7 mm	N/A	0.93	13.4 mm	NM	NM (LMW=6.8 mm)	12.5 mm	0.93	N/A	5.2 mm	N/A	N/A	N/A	>1.40	Box Spring, NV	Humboldt	Humboldt	distal end snapped, edges worn, indentation at haft element	haft element indentation gives point appearance similar to a Pinto
20.4 7119	Ny920	>24.9 mm	>22.8 mm	N/A	0.92	20.7 mm	NM	NM (LMW=19.7 mm)	19.2 mm	0.93	N/A	7.5 mm	N/A	N/A	N/A	>4.00	Mount Hicks, NV	Humboldt	out-of-key	blade snapped at midpoint & worked/worn, edges worn, small notch on one edge	
20.4 7202	Ny920	>17.3 mm	>14.5 mm	N/A	0.84	14.6 mm	NM	NM (LMW=9.6 mm)	11.8 mm	0.81	N/A	4.1 mm	N/A	N/A	N/A	>1.10	Queen/Truman Meadows, CA/NV	Humboldt	Humboldt	distal end snapped & worn, edges worn	
20.4 7192	Ny920	>12.1 mm	>11.6 mm	N/A	0.96	10.5 mm	NM	NM (LMW=3.6 mm)	9.3 mm	0.89	N/A	4.4 mm	N/A	N/A	N/A	>0.65	Tempiute Mountain, NV	Humboldt	out-of-key	tip snapped, reworked, & worn	looks most like a tiny Humboldt
20.4 7148	Ny920	25.7 mm	24.9 mm	7.0 mm	0.97	18.6 mm	1.38	34%	13.2 mm	0.71	12.3 mm	4.7 mm	135°	92°	43°	2.10	Montezuma Range, NV	hafted knife blade	*?Gatecliff contracting stem?*	tip and blade edges heavily worn & reworked	based on wear patterns, probably a knife blade, not a point
20.4 171	Ny920	>20.0 mm	>19.2 mm	N/A	0.96	15.2 mm	NM	NM (LMW=5.7 mm)	14.3 mm	0.94	N/A	5.1 mm	N/A	N/A	N/A	>1.55	Montezuma Range, NV	hafted knife blade	out-of-key	distal end snapped & reworked, blade edges heavily worn one convex, one concave	based on wear patterns, probably a knife blade, not a point
Mount Jefferson Desert, Nye County, NV, n=23																					
20.5 3033	n/a	>14.0 mm	>12.8 mm	N/A	0.91	11.0 mm	NM	NM (LMW=6.6 mm)	8.9 mm	0.81	N/A	3.6 mm	N/A	N/A	N/A	>0.60	Box Spring, NV	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped , edges worn	barbed, very similar in appearance to 20.5 1223
20.5 1223	n/a	>17.5 mm	>14.0 mm	N/A	0.80	12.1 mm	NM	NM (LMW=15.5 mm)	10.4 mm	0.86	N/A	5.9 mm	N/A	N/A	N/A	>1.10	Unknown Variety G (Gatecliff shelter Group 1)	Cottonwood leaf shaped	*?Humboldt?*	distal end snapped, edges worn, large chip at haft element/blade juncture	barbed, red mineral paint?, similar to Utah small, thick, concave base, leaf shaped points
20.4 1107	n/a	>15.9 mm	>15.6 mm	N/A	0.98	12.2 mm	NM	NM (LMW=11.8 mm)	9.9 mm	0.81	N/A	2.5 mm	N/A	N/A	N/A	>0.55	Garfield Hills, NV	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	minimally pressure-flaked on one face
20.5 3286	n/a	13.9 mm	13.0 mm	N/A	0.94	10.8 mm	1.29	0%	10.8 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.35	Montezuma Range, NV	Cottonwood triangular	Cottonwood triangular	blade edges slightly worn	
20.4 1142	n/a	16.3 mm	15.9 mm	N/A	0.98	>12.0 mm	NM	0%	>12.0 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	>0.45	Montezuma Range, NV	Cottonwood triangular	Cottonwood triangular	blade edges worn & reworked, one corner of base snapped	
20.4 1144	n/a	11.9 mm	11.3 mm	N/A	0.95	10.6 mm	1.12	0%	10.6 mm	1.00	N/A	2.6 mm	N/A	N/A	N/A	0.25	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	all edges damaged/worn	mahogany obsidian
20.5 1789	n/a	12.4 mm	11.4 mm	4.3 mm	0.92	12.2 mm	1.02	0%	12.2 mm	1.00	8.7 mm	3.3 mm	236°	128°	108°	0.35	Paradise Valley, NV	Desert side notched	Desert side notched	blade edges worn	
20.5 3242	n/a	>11.5 mm	>11.5 mm	7.4 mm	1.00	14.2 mm	NM	0%	14.2 mm	1.00	5.3 mm	3.0 mm	214°	184°	30°	>0.40	Oak Spring Butte, NV	Desert side notched	Desert side notched	blade snapped above shoulders	
20.4 1145	n/a	>8.5 mm	>8.5 mm	6.9 mm	1.00	10.8 mm	NM	0%	10.8 mm	1.00	6.0 mm	2.3 mm	215°	150°	65°	>0.20	Garfield Hills, NV	Desert side notched	Desert side notched	blade snapped above shoulder notches	
20.5 3246	n/a	>24.0 mm	>22.4 mm	4.4 mm	0.93	22.0 mm	NM	NM (LMW=3.6 mm)	9.4 mm	0.43	8.6 mm	3.3 mm	127°	103°	24°	>1.55	Crow Spring, NV	Rosegate	Rosegate	distal end snapped, blade edges worn	large - Eastgate type
20.5 1129	n/a	18.9 mm	17.5 mm	6.3 mm	0.93	15.8 mm	1.20	36%	13.7 mm	0.87	9.2 mm	5.0 mm	203°	130°	73°	1.30	Box Spring, NV	Elko corner notched	Elko corner notched	blade edges heavily damaged & reworked	may have been barbed, looks eared but BIR too high, small enough to be an arrow point
20.5 3237	n/a	>19.3 mm	>18.3 mm	5.5 mm	0.95	14.0 mm	NM	NM (LMW=6.4 mm)	12.4 mm	0.89	7.9 mm	3.8 mm	138°	130°	8°	>0.85	Unknown 11	Elko corner notched	Elko corner notched	tip snapped, blade edges slightly worn	blade edges serrated, small enough to be an arrow point
20.5 1220	n/a	>22.9 mm	>22.9 mm	7.7 mm	1.00	16.8 mm	NM	NM (LMW=13.0 mm)	11.4 mm	0.68	8.1 mm	5.3 mm	175°	140°	35°	>2.00	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Elko corner notched	Elko corner notched	distal end smashed, shoulders chipped, blade edges worn	
20.5 2961	n/a	21.2 mm	19.6 mm	6.7 mm	0.92	>14.0 mm	NM	NM	>13.6 mm	NM	10.4 mm	4.9 mm	211°	134°	111°	>1.30	Mount Hicks, NV	Elko eared	Elko eared	one shoulder & one base tang snapped , blade edges heavily damaged & reworked	classification based on PSA & BIR but may have been side notched - too damaged
20.5 1839	n/a	>17.6 mm	>17.1 mm	3.4 mm	0.97	16.4 mm	NM	NM (LMW=5.7 mm)	7.4 mm	0.45	9.1 mm	4.3 mm	199°	86°	113°	>1.30	Box Spring, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, blade edges worn	within parameters of larger Parowan basal notched points
20.5 1424	n/a	>20.2 mm	>19.4 mm	5.5 mm	0.96	14.5 mm	NM	NM (LMW=10.4 mm)	12.1 mm	0.83	11.0 mm	5.2 mm	201°	100°	101°	>1.55	Unknown 11	Gatecliff split stem	Gatecliff split stem	tip snapped, blade edges heavily damaged/reworked	
20.5 1221	n/a	>12.6 mm	>11.5 mm	N/A	0.91	12.6 mm	NM	NM (LMW=10.5 mm)	11.3 mm	0.90	N/A	4.9 mm	N/A	N/A	N/A	>0.90	Unknown Variety G (Gatecliff shelter Group 1)	Humboldt	Humboldt	distal end snapped , edges worn	
20.5 3083	n/a	>25.1 mm	>24.7 mm	N/A	0.98	13.5 mm	NM	NM (LMW=8.5 mm)	10.1 mm	0.75	N/A	5.4 mm	N/A	N/A	N/A	>1.80	Box Spring, NV	Humboldt	Humboldt	tip snapped , blade edges heavily worn	
20.5 1800	n/a	24.1 mm	23.9 mm	N/A	0.99	11.7 mm	2.06	43%	8.5 mm	0.73	N/A	5.4 mm	N/A	N/A	N/A	1.40	Box Spring, NV	Humboldt	out-of-key	blade edges worn	shoulderless, flat-based point - looks like Humboldt w/o BI
20.4 7309	n/a	>34.0 mm	>31.9 mm	7.9 mm	0.94	≈20.5 mm	NM	0%	≈20.5 mm	1.00	13.5 mm	5.3 mm	159°	153°	6°	>3.20	Montezuma Range, NV	Large side notched, Sudden	Large side notched	tip snapped, one base tang snapped, blade edges heavily worn & reworked	MW estimated based on assumed relative symmetry of base, Sudden type
20.5 3123	n/a	>18.1 mm	>15.5 mm	7.3 mm	0.86	>12.5 mm	NM	NM	>9.7 mm	NM	8.8 mm	4.0 mm	213°	156°	57°	>1.00	Tempiute Mountain, NV	Large side notched, Northern	Large side notched	blade edges snapped from 4 directions, one base tang snapped, some edges reworked	Northern type
20.5 2902	n/a	>17.0 mm	>15.3 mm	9.2 mm	0.90	20.1 mm	NM	0%	20.1 mm	1.00	11.6 mm	4.1 mm	199°	153°	45°	>1.35	Montezuma Range, NV	Large side notched, Northern	Large side notched	tip snapped , blade edges heavily worn & reworked	based on wear patterns, possibly a scraping tool rather than a point, Northern type
WEST OF STUDY AREA (n=433)																					
Death Valley National Park, California, n=191																					
Grapevine Canyon rock shelter, Inyo County, CA (Iny378) (n=8)																					
DEVA 35505	Iny378	18.3 mm	16.2 mm	8.4 mm	0.88	14.1 mm	1.30	0%	14.1 mm	1.00	9.0 mm	3.1 mm	218°	150°	69°	0.55	Lookout Mountain, Casa Diablo, CA	Desert side notched	Desert side notched	complete	Sierra type
DEVA 35487	Iny378	16.0 mm	12.6 mm	7.4 mm	0.79	11.6 mm	1.38	0%	11.6 mm	1.00	7.5 mm	2.5 mm	224°	182°	42°	0.30	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Desert side notched	Desert side notched	complete	Sierra type
DEVA 35486	Iny378	18.7 mm	15.6 mm	7.2 mm	0.83	>13.2 mm	NM	0%	>13.2 mm	1.00	8.5 mm	3.9 mm	219°	145°	74°	>0.60	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	one base tang snapped	Sierra type
DEVA 35495	Iny378	>12.4 mm	>9.2 mm	7.8 mm	0.74	11.7 mm	NM	0%	11.7 mm	1.00	5.9 mm	2.2 mm	184°	168°	17°	>0.30	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	blade snapped	Sierra type
DEVA 35484	Iny378	>8.5 mm	>7.1 mm	6.5 mm	0.84	12.1 mm	NM	0%	12.1 mm	1.00	6.9 mm	2.5 mm	191°	177°	16°	>0.20	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade snapped at shoulders	Sierra type
DEVA 35481	Iny378	>16.3 mm	>14.8 mm	5.5 mm	0.91	11.6 mm	NM	0%	11.6 mm	1.00	7.9 mm	3.4 mm	214°	142°	72°	>0.50	Unknown Variety F?	Desert side notched	Desert side notched	one base tang reworked, tip snapped	Sierra type
DEVA 35508	Iny378	>14.2 mm	>10.4 mm	13.2 mm	0.73	14.0 mm	NM	0%	14.0 mm	1.00	7.4 mm	3.4 mm	198°	176°	19°	>0.60	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	blade snapped at shoulders	Sierra type
DEVA 35477	Iny378	51.1 mm	51.1 mm	N/A	1.00	26.5 mm	1.93	34%	20.2 mm	0.76	N/A	5.3 mm	N/A	N/A	N/A	>7.30	Shoshone Mountain, NV	hafted knife	out-of-key	corner of base chipped	wear patterns and shape suggest a hafted knife blade, not a point
Little Grapevine Creek, Inyo County, CA (n=3)																					
DEVA 34505 (sh)	Iny3019	>17.5 mm	>17.5 mm	N/A	1.00	13.2 mm	NM	0%	13.2 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	same spec. number as below, (sh) added to indicate shoulderless
DEVA 34534	Iny3021	>14.6 m	>12.5 mm	7.0 mm	0.86	12.9 mm	NM	0%	12.9 mm	1.00	8.1 mm	2.8 mm	192°	166°	26°	>0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	distal end snapped	Sierra type
DEVA 34505 (cn)	Iny3019	>21.2 mm	>21.2 mm	6.5 mm	1.00	>16.0 mm	NM	NM (LMW=7.2 mm)	10.3 mm	NM	6.3 mm	4.0 mm	165°	147°	19°	>1.40	Obsidian Butte, NV, Variety 5 (Unknown C)	Elko corner notched	Elko corner notched	distal end snapped, one shoulder tang snapped	same spec. number as above, (cn) added to indicate corner notched - looks more like Rosegate
Grapevine Mountains, Inyo County, CA (n=6)																					
7920	BRS 4	19.3 mm	19.3 mm	4.6 mm	1.00	9.9 mm	1.95	38%	>6.3 mm	NM	3.9 mm	1.7 mm	198°	153°	46°	>0.40	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Desert side notched	Desert side notched	one side of base snapped	Desert type - site near Briar Springs
7919	BRS 2	>19.0 mm	>16.5 mm	7.6 mm	0.87	27.7 mm	NM	NM (LMW=8.3 mm)	20.6 mm	0.74	18.7 mm	4.4 mm	197°	111°	87°	>2.80	Saline Range, CA, Variety 1 (Queen Impostor)	Elko corner notched	Elko corner notched	blade snapped above shoulders	site near Briar Springs
7574	GRV 6	>24.2 mm	>23.7 mm	7.5 mm	0.98	17.7 mm	NM	NM (LMW=9.8 mm)	15.1 mm	0.85	12.3 mm	6.1 mm	201°	133°	69°	>2.60	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	distal end snapped, one shoulder & base tang snapped & reworked	site in vicinity of Strozzi Ranch
7545	GRV 34	>29.6 mm	>29.6 mm	5.3 mm	1.00	17.8 mm	NM	NM (LMW=6.4 mm)	>6.7 mm	NM	7.8 mm	4.4 mm	185°	150°	35°	>2.20	Shoshone Mountain, NV	Elko corner notched	Elko corner notched	tip snapped one shoulder & base tang snapped & reworked	site in vicinity of Strozzi Ranch
7582	GRV 6	>16.6 mm	>14.6 mm	N/A	0.88	19.6 mm	NM	NM (LMW=16.6 mm)	13.6 mm	0.69	N/A	3.8 mm	N/A	N/A	N/A	>1.35	Obsidian Butte, NV, Variety 3	Humboldt	Humboldt	blade snapped above haft element	site in vicinity of Strozzi Ranch
7604	GRV 34	>17.7 mm	>14.6 mm	N/A	0.82	23.2 mm	NM	NM (LMW=13.1 mm)	18.1 mm	0.78	N/A	4.4 mm	N/A	N/A	N/A	>1.75	Saline Range, CA, Variety 1 (Queen Impostor)	Humboldt	Humboldt	blade snapped above haft element	site in vicinity of Strozzi Ranch
Furnace Creek fan, Inyo County, CA (n=5)																					
2730	Iny593	16.6 mm	16.2 mm	N/A	0.98	8.7 mm	1.91	0%	8.7 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.30	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	site in Furnace Creek fan
2644	Iny558	>15.5 mm	>15.2 mm	N/A	0.98	13.2 mm	NM	0%	13.2 mm	1.00	N/A	3.9 mm	N/A	N/A	N/A	>0.65	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	site in Furnace Creek fan
4198	Iny616	>9.6 mm	>8.7 mm	N/A	0.91	12.1 mm	NM	0%	12.1 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	>0.40	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	distal end & one edge snapped	site in Furnace Creek fan
4235	Iny639	18.2 mm	16.6 mm	N/A	0.91	9.5 mm	1.92	0%	9.5 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	0.30	Tempiute Mountain, NV	Cottonwood triangular	Cottonwood triangular	complete	site at Salt Creek
2443	Iny489	>23.4 mm	>17.2 mm	N/A	1.36	22.1 mm	NM	NM (LMW=11.4 mm)	18.6 mm	0.84	N/A	4.5 mm	N/A	N/A	N/A	>2.90	Shoshone Mountain, NV	Humboldt	Humboldt	distal end snapped	site in Grapevine Canyon 1/2 mile from Scotty's Castle
Eagle Borax mine, Inyo County, CA (n=1)																					
10692	Iny885	22.5 mm	19.4 mm	N/A	0.86	12.5 mm	1.80	0%	12.5 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	0.40	Joshua Ridge, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	
Grapevine Mountains, Nye County, NV (near Willow Spring) (n=10)																					
DEVA 44254	Ny1634	>23.4 mm	>22.0 mm	N/A	0.94	17.2 mm	NM	0%	17.2 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	>1.20	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Cottonwood triangular	Cottonwood triangular	distal end snapped diagonally, base tang chipped	
DEVA 44129	Ny1634	15.7 mm	15.7 mm	N/A	1.00	10.5 mm	1.50	0%	10.5 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.30	Obsidian Butte, NV, Variety 3	Cottonwood triangular	Cottonwood triangular	serrated edges - complete	
DEVA 44253	Ny1634	>16.2 mm	>16.0 mm	N/A	0.99	12.8 mm	NM	0%	12.8 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
DEVA 44147	Ny1634	>18.7 mm	>17.3 mm	6.4 mm	0.93	11.0 mm	NM	0%	11.0 mm	1.00	10.0 mm	3.6 mm	236°	141°	97°	>0.70	Montezuma Range, NV	Desert side notched	Desert side notched	distal blade edges reworked (notches very faint), tip snapped	Sierra type
DEVA 44270	Ny1641	14.0 mm	12.3 mm	5.3 mm	0.88	9.5 mm	1.47	0%	9.5 mm	1.00	5.2 mm	2.3 mm	222°	164°	60°	0.30	Oak Spring Butte, NV	Desert side notched	Desert side notched	complete	Sierra type
DEVA 44269	Ny1641	19.1 mm	16.1 mm	8 mm	0.84	13.6 mm	1.40	0%	13.6 mm	1.00	7.6 mm	2.7 mm	227°	176°	52°	0.50	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Desert side notched	Desert side notched	complete	Sierra type
DEVA 44265	Ny1640	16.4 mm	16.4 mm	3.3 mm	1.00	13.3 mm	1.23	35%	7.5 mm	0.56	6.9 mm	2.7 mm	228°	127°	100°	0.50	Obsidian Butte, NV, Variety 5 (Unknown C)	Rosegate	Rosegate	base & distal blade edges appear reworked	
DEVA 44271	Ny1641	>20.8 mm	>20.8 mm	7.4 mm	1.00	18.3 mm	NM	NM (LMW=8.1 mm)	15.3 mm	0.84	11.7 mm	4.4 mm	193°	130°	64°	>1.70	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Elko corner notched	Elko corner notched	distal end snapped	
DEVA 44272	isolate	41.5 mm	39.7 mm	N/A	0.96	17.3 mm	2.40	28%	13.8 mm	0.80	N/A	6.0 mm	N/A	N/A	N/A	3.90	Obsidian Butte, NV, Variety 3	Humboldt	Humboldt	complete - edges & base reworked	
DEVA 44133	Ny1634	19.6 mm	17.0 mm	8.5 mm	0.87	15.3 mm	1.28	44%	14.5 mm	0.95	13.9 mm	4.4 mm	223°	103°	122°	1.35	Obsidian Butte, NV, Variety 4	Humboldt	out-of-key	distal blade edges heavily reworked	appearance most like a heavily used & reworked Humboldt (shoulders are faint)
Mesquite Flat, Inyo County, CA (n=31)																					
6513	Iny1101	20.0 mm	20.0 mm	N/A	1.00	11.2 mm	0.56	25%	10.1 mm	0.90	N/A	3.4 mm	N/A	N/A	N/A	0.70	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
6596	Iny1258	>16.7 mm	>15.7 mm	N/A	0.93	15.6 mm	NM	0%	15.6 mm	1.00	N/A	3.8 mm	N/A	N/A	N/A	>1.10	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6610	Iny955	>17.6 mm	>16.7 mm	N/A	0.95	13.0 mm	NM	0%	13.0 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	>0.75	Obsidian Butte, NV, Variety 3	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6640	Iny955	≈20.0 mm	≈19.4 mm	N/A	0.97	11.5 mm	≈1.74	0%	11.5 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	≈0.45	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip chipped	
6580	Iny955	>22.7 mm	>19 mm	N/A	0.84	15.7 mm	NM	NM (LMW=3.3 mm)	14.7 mm	0.94	N/A	3.9 mm	N/A	N/A	N/A	>1.20	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6542	Iny1203	17.6 mm	17.6 mm	N/A	1.00	10.2 mm	1.73	0%	10.2 mm	1.00	N/A	2.6 mm	N/A	N/A	N/A	0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
6618	Iny1040	>17.5 mm	>16.4 mm	N/A	0.94	12.2 mm	NM	0%	12.2 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	>0.45	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6507	Iny1106	>17.2 mm	>16.7 mm	N/A	0.97	14.4 mm	NM	0%	14.4 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>0.8	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6631	Iny1293	>14.8 mm	>14.1 mm	N/A	0.95	14.1 mm	NM	0%	14.1 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>0.70	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6693	isolate	21.8 mm	21.2 mm	N/A	0.97	11.7 mm	1.86	0%	11.7 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.55	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	
6660	Iny1098	>16.2 mm	>15.0 mm	N/A	0.93	14.8 mm	NM	0%	14.8 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	>0.55	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped	
6664	Iny1198	20.4 mm	19.7 mm	N/A	0.97	8.8 mm	2.32	13%	8.1 mm	0.92	N/A	3.5 mm	N/A	N/A	N/A	0.50	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
6334	Iny1101	20.9 mm	19.6 mm	7.0 mm	0.94	12.7 mm	1.65	0%	12.7 mm	1.00	7.1 mm	3.0 mm	203°	133°	70°	0.50	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	complete	Sierra type
6389	Iny1274	>19.7 mm	>15.4 mm	11.6 mm	0.78	14.6 mm	NM	0%	14.6 mm	1.00	5.6 mm	2.5 mm	184°	161°	23°	>0.60	Oak Spring Butte, NV	Desert side notched	Desert side notched	distal end snapped	Sierra type
6383	Iny1201	≈19.0 mm	≈16.8 mm	6.5 mm	≈0.88	>10.3 mm	NM	0%	>10.3 mm	1.00	5.9 mm	2.3 mm	190°	162°	23°	>0.35	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	tip chipped, one base tang snapped	Sierra type
6581	Iny1107	21.5 mm	20.8 mm	N/A	0.97	12.4 mm	1.73	0%	12.4 mm	1.00	N/A	4.3 mm	N/A	N/A	N/A	0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	out-of-key	complete	too thick Cottonwood triangular, appears to be incomplete Dsn (some cortex, faint side notch)
6387	Iny1101	17.9 mm	16.1 mm	6.9 mm	0.90	11.5 mm	1.56	0%	11.5 mm	1.00	4.4 mm	2.0 mm	187°	159°	29°	0.25	Saline Range, CA, Variety 3	Desert side notched	Desert side notched	complete	Sierra type
6333	Iny1106	20.8 mm	19.3 mm	7.9 mm	0.93	≈10.5 mm	≈1.98	0%	≈10.5 mm	1.00	6.7 mm	2.6 mm	243°	135°	109°	≈0.50	Saline Range, CA, Variety 3	Desert side notched	Desert side notched	one base tang chipped	Sierra type
6395	Iny1295	18.7 mm	18.7 mm	6.5 mm	1.00	10.4 mm	1.80	0%	10.4 mm	1.00	6.9 mm	3.2 mm	231°	171°	62°	0.50	Saline Range, CA, Variety 3	Desert side notched	Desert side notched	complete	Desert type
6371	Iny1267	15.7 mm	14.9 mm	5.8 mm	0.95	11.0 mm	1.43	0%	11.0 mm	1.00	4.8 mm	2.5 mm	194°	162°	32°	0.30	Shoshone Mountain, NV	Desert side notched	Desert side notched	complete	Sierra type
6348	Iny1267	17.5 mm	14.6 mm	6.5 mm	0.83	10.3 mm	1.70	0%	10.3 mm	1.00	5.0 mm	2.6 mm	193°	191°	2°	0.30	Shoshone Mountain, NV	Desert side notched	Desert side notched	complete	Sierra type
6375	Iny1258	20.1 mm	18.0 mm	7.9 mm	0.90	14.5 mm	1.39	0%	14.5 mm	1.00	9.2 mm	2.5 mm	204°	160°	44°	0.60	Shoshone Mountain, NV	Desert side notched	Desert side notched	complete	Delta type
6332	Iny1201	19.7 mm	17.5 mm	9.2 mm	0.89	>11 mm	NM	0%	>11.0 mm	1.00	5.7 mm	2.6 mm	203°	163°	41°	>0.40	Shoshone Mountain, NV	Desert side notched	Desert side notched	one base tang snapped, one shoulder chipped	Delta type
6411	Iny1281	20.4 mm	17.8 mm	7.5 mm	0.87	>10.4 mm	NM	0%	>10.4 mm	1.00	4.7 mm	2.4 mm	202°	158°	44°	>0.35	Shoshone Mountain, NV	Desert side notched	Desert side notched	one base tang snapped at neck	Sierra type
6373	Iny1282	>13.2 mm	>12.7 mm	8.4 mm	0.96	12.1 mm	NM	0%	12.1 mm	1.00	6.0 mm	3.5 mm	188°	165°	23°	>0.40	Shoshone Mountain, NV	Desert side notched	Desert side notched	blade snapped	Desert type
6379	Iny1192	>15.6 mm	>15.4 mm	4.5 mm	0.99	11.5 mm	NM	0%	11.5 mm	1.00	6.6 mm	2.7 mm	186°	169°	17°	>0.50	Sugarloaf Mountain, Coso Volcanic Field, CA	Desert side notched	Desert side notched	distal end snapped	Sierra type
6366	Iny3306	15.6 mm	13.3 mm	6.2 mm	0.85	9.7 mm	1.37	0%	9.7 mm	1.00	6.4 mm	3.0 mm	233°	169°	66°	0.40	Tempiute Mountain, NV	Desert side notched	Desert side notched	tip and one base tang appear reworked	Sierra type
6406	Iny1251	15.3 mm	13.2 mm	6.8 mm	0.86	10 mm	1.53	0%	10.0 mm	1.00	5.6 mm	2.9 mm	218°	146°	72°	0.30	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	complete	Delta type
6380	Iny3303	19.7 mm	18.1 mm	7.7 mm	0.92	9.5 mm	2.07	0%	9.5 mm	1.00	6.6 mm	2.6 mm	230°	157°	76°	0.35	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	complete	Sierra type
6346	Iny3305	16.0 mm	15.5 mm	8.8 mm	0.97	12.1 mm	1.28	0%	12.1 mm	1.00	7.4 mm	2.6 mm	203°	158°	45°	0.50	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	distal blade edges appear reworked	Desert type
6041	Iny960	>11.9 mm	>11.9 mm	3.7 mm	1.00	19.0 mm	NM	NM (LMW=4.7 mm)	10.0 mm	0.53	9.4 mm	3.9 mm	169°	100°	69°	>0.70	Obsidian Butte, NV, Variety 3	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped	
Waucoba Spring, Saline Valley, Inyo County, CA (Iny441), n=127																					
961-47	Iny441	>17.6 mm	>17.6 mm	n/a	1.00	8.1 mm	NM	NM (LMW=2.8 mm)	7.2 mm	0.88	N/A	3.1 mm	N/A	N/A	N/A	>0.60	Fish Springs, Owens Valley, CA	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
961-60	Iny441	>22.0 mm	>18.5 mm	n/a	0.84	11.9 mm	NM	NM (LMW=4.5 mm)	.0 mm	0.84	N/A	2.7 mm	N/A	N/A	N/A	>0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	tip snapped	based on position of tip snap, point was≤26 mm, thus MWP would be ≥17%
961-59	Iny441	>11.0 mm	>9.5 mm	n/a	0.86	12.5 mm	NM	NM (LMW=3.5 mm)	10.5 mm	0.84	N/A	2.3 mm	N/A	N/A	N/A	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	blade snapped	
961-79	Iny441	29.7 mm	29.1 mm	n/a	0.98	13.5 mm	2.20	43%	8.3 mm	0.61	N/A	3.8 mm	N/A	N/A	N/A	1.15	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	based on asymmetrical mid-section, appears to have been a broken knife tip reworked into projectile point
961-308	Iny441	23.9 mm	23.9 mm	n/a	1.00	11.5 mm	2.08	19%	7.4 mm	0.64	N/A	2.4 mm	N/A	N/A	N/A	0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
961-	Iny441	22.6 mm	22.6 mm	n/a	1.00	13.0 mm	1.74	27%	≈11.1 mm	≈0.85	N/A	2.9 mm	N/A	N/A	N/A	>0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	one corner base chipped and reworked	base width estimated based on relative symmetry
961-45	Iny441	≈18.9 mm	≈18.9 mm	n/a	1.00	11.5 mm	1.64	38%	≈7.0 mm	0.61	N/A	2.7 mm	N/A	N/A	N/A	≈0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	one edge of base chipped, tip chipped	
961-152	Iny441	18.1 mm	18.1 mm	n/a	1.00	11.5 mm	1.57	29%	8.8 mm	0.77	N/A	2.1 mm	N/A	N/A	N/A	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	minimal pressure-flaking along margins only, very crude
961-527	Iny441	>20.6 mm	>20.6 mm	n/a	1.00	1.0 mm	NM	NM (LMW=7.1 mm)	7.6 mm	0.69	N/A	3.7 mm	N/A	N/A	N/A	>0.9	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
961-476	Iny441	22.2 mm	22.2 mm	n/a	1.00	10.6 mm	2.09	34%	7.0 mm	0.66	N/A	1.9 mm	N/A	N/A	N/A	0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	minimal pressure-flaking along margins only, very crude
961-475	Iny441	24.0 mm	24.0 mm	n/a	1.00	12.8 mm	1.88	42%	10.8 mm	0.84	N/A	3.3 mm	N/A	N/A	N/A	1.15	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	tip appears reworked
961-348	Iny441	>23.1 mm	>23.1 mm	n/a	1.00	11.6 mm	NM	NM (LMW=13.3 mm)	8.6 mm	0.74	N/A	2.5 mm	N/A	N/A	N/A	>0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
961-227	Iny441	>24.8 mm	>24.8 mm	n/a	1.00	13.9 mm	NM	NM (LMW=9.0 mm)	8.5 mm	0.61	N/A	2.5 mm	N/A	N/A	N/A	>0.9	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
961-134	Iny441	≈25.0 mm	≈25.0 mm	n/a	1.00	14.0 mm	≈1.79	≈49%	6.9 mm	0.49	N/A	3.4 mm	N/A	N/A	N/A	≈0.75	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	tip chipped	
961-167	Iny441	24.9 mm	24.9 mm	n/a	1.00	14.0 mm	1.78	41%	11.2 mm	0.80	N/A	3.2 mm	N/A	N/A	N/A	1.30	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	minimal pressure-flaking along margins only, very crude
961-56	Iny441	17.6 mm	16.0 mm	n/a	0.91	11.1 mm	1.59	0%	11.1 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	0.45	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	complete	
961-95	Iny441	23.8 mm	23.8 mm	n/a	1.00	11.0 mm	2.16	0%	11.0 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	0.55	Lookout Mountain, Casa Diablo, CA	Cottonwood triangular	Cottonwood triangular	complete	
961-93	Iny441	>19.5 mm	>18 mm	n/a	0.92	13.7 mm	NM	0%	13.7 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-8	Iny441	21.7 mm	21.0 mm	n/a	0.97	9.9 mm	2.19	0%	9.9 mm	1.00	N/A	2.3 mm	N/A	N/A	N/A	0.45	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-288	Iny441	20.0 mm	20.0 mm	n/a	1.00	16.3 mm	1.23	0%	16.3 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.75	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-391	Iny441	≈22.6 mm	≈22.2 mm	n/a	0.98	13.2 mm	≈1.71	0%	13.2 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	≈1.00	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip chipped	
961-369	Iny441	≈20.5 mm	≈20.5 mm	n/a	1.00	12.3 mm	≈1.66	≈11%	11.9 mm	0.97	N/A	1.8 mm	N/A	N/A	N/A	≈0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip chipped	
961-75	Iny441	>25.5 mm	>24.6 mm	n/a	0.96	13.3 mm	NM	0%	13.3 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>1.00	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped diagonally	
961-204	Iny441	21.3 mm	20.5 mm	n/a	0.96	11.2 mm	1.90	15%	10.3 mm	0.92	N/A	2.4 mm	N/A	N/A	N/A	0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-271	Iny441	>15.1 mm	>12.8 mm	n/a	0.85	12.3 mm	NM	0%	12.3 mm	1.00	N/A	2.1 mm	N/A	N/A	N/A	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped diagonally	
961-287	Iny441	>14.6 mm	>13.3 mm	n/a	0.91	14.6 mm	NM	0%	14.6 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	blade snapped	
961-38	Iny441	≈16.2 mm	≈14.4 mm	n/a	0.88	8.6 mm	≈1.88	≈14%	8.1 mm	0.94	N/A	2.7 mm	N/A	N/A	N/A	≈0.3	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip chipped	
961-262	Iny441	>12.5 mm	>10.9 mm	n/a	0.87	11.9 mm	NM	0%	11.9 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	>0.35	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	blade snapped	
961-507	Iny441	>20.2 mm	>19.5 mm	n/a	0.97	11.9 mm	NM	NM (LMW=3.4 mm)	11.7 mm	0.98	N/A	3.4 mm	N/A	N/A	N/A	>0.75	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-233	Iny441	23.3 mm	23.3 mm	n/a	1.00	12.3 mm	1.89	0%	12.3 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-540	Iny441	>20.1 mm	>18.2 mm	n/a	0.91	13.0 mm	NM	0%	13.0 mm	1.00	N/A	2.1 mm	N/A	N/A	N/A	>0.55	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-353	Iny441	20.8 mm	20 mm	n/a	0.96	8.4 mm	2.48	0%	8.4 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	0.30	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-309	Iny441	>21.1 mm	>21.1 mm	n/a	1.00	11.9 mm	NM	NM (LMW=5.3 mm)	11.1 mm	0.93	N/A	2.4 mm	N/A	N/A	N/A	>0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-20	Iny441	21.2 mm	21.2 mm	n/a	1.00	11.1 mm	1.91	30%	10.5 mm	0.95	N/A	2.8 mm	N/A	N/A	N/A	0.85	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-597	Iny441	19.0 mm	17.1 mm	n/a	0.90	14.2 mm	1.34	0%	14.2 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	0.85	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-28	Iny441	19.7 mm	19.7 mm	n/a	1.00	9.9 mm	1.99	0%	9.9 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-53	Iny441	15.8 mm	14.5 mm	n/a	0.92	14.5 mm	1.09	0%	14.5 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	
961-560	Iny441	>17.7 mm	>17.7 mm	n/a	1.00	12.4 mm	NM	0%	12.4 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	>0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
961-347	Iny441	>20.0 mm	>20.0 mm	n/a	1.00	8.9 mm	NM	NM (LMW=2.0 mm)	8.7 mm	0.98	N/A	2.0 mm	N/A	N/A	N/A	>0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-90	Iny441	≈23.5 mm	≈22.9 mm	n/a	0.97	11.7 mm	2.01	≈9%	11.3 mm	0.97	N/A	3.0 mm	N/A	N/A	N/A	≈0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip chipped	
961-584	Iny441	>20.5 mm	>19.8 mm	n/a	0.97	13.6 mm	NM	0%	13.6 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	>0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped diagonally	
961-506	Iny441	>16.2 mm	>14.9 mm	n/a	0.92	12.7 mm	NM	0%	12.7 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	>0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
961-219	Iny441	>18.5 mm	>18.5 mm	n/a	1.00	14.3 mm	NM	NM (LMW=3.7 mm)	13.9 mm	0.97	N/A	3.5 mm	N/A	N/A	N/A	>1.10	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-234	Iny441	>24.1 mm	>24.1 mm	n/a	1.00	11.8 mm	NM	NM (LMW=1.9 mm)	11.5 mm	0.97	N/A	2.8 mm	N/A	N/A	N/A	>0.95	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped diagonally	
961-231	Iny441	≈20.8 mm	≈20.8 mm	n/a	1.00	11.5 mm	≈1.81	0%	11.5 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	≈0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip chipped	
961-328	Iny441	>21.0 mm	>21.0 mm	n/a	1.00	10.9 mm	NM	0%	10.9 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	>0.95	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-263	Iny441	>19.3 mm	>19.3 mm	n/a	1.00	11.2 mm	NM	0%	11.2 mm	1.00	N/A	2.3 mm	N/A	N/A	N/A	>0.6	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-48	Iny441	>18.0 mm	>16.9 mm	n/a	0.94	9.7 mm	NM	NM (LMW=3.0 mm)	8.9 mm	0.92	N/A	2.2 mm	N/A	N/A	N/A	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped diagonally	
961-140	Iny441	19.8 mm	19.8 mm	n/a	1.00	13.9 mm	1.42	18%	13.2 mm	0.95	N/A	1.9 mm	N/A	N/A	N/A	0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	complete	minimal pressure-flaking along margins only, very crude
961-80	Iny441	>17.0 mm	>17.0 mm	n/a	1.00	11.6 mm	NM	NM (LMW=6.9 mm)	10.9 mm	0.94	N/A	3.2 mm	N/A	N/A	N/A	>0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
961-71	Iny441	>18.5 mm	>18.5 mm	n/a	1.00	11.9 mm	NM	NM (LMW=4.4 mm)	11.0 mm	0.92	N/A	3.5 mm	N/A	N/A	N/A	>0.90	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped diagonally	
961-604	Iny441	>16.9 mm	>16.9 mm	n/a	1.00	11.2 mm	NM	NM (LMW=3.1 mm)	10.7 mm	0.96	N/A	2.6 mm	N/A	N/A	N/A	>0.55	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end snapped diagonally	
961-235	Iny441	20.4 mm	18.8 mm	n/a	0.92	9.2 mm	2.22	0%	9.2 mm	1.00	N/A	2.9 mm	N/A	N/A	N/A	0.45	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	
961-350	Iny441	>14.4 mm	>13.7 mm	n/a	0.95	8.8 mm	NM	0%	8.8 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	>0.25	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	tip snapped	
961-37	Iny441	22.2 mm	20.0 mm	n/a	0.90	10.2 mm	2.18	0%	10.2 mm	1.00	5.3 mm	2.8 mm	188°	148°	42°	0.50	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	small snap on one shoulder	
961-7	Iny441	>24.5 mm	>23.9 mm	n/a	0.98	10.4 mm	NM	0%	10.4 mm	1.00	5.3 mm	3.7 mm	197°	145°	53°	>0.85	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	base chipped on one side, tip snapped	
961-344	Iny441	>18.0 mm	>14.9 mm	n/a	0.83	12.8 mm	NM	0%	12.8 mm	1.00	6.0 mm	2.5 mm	203°	165°	39°	>0.45	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	tip snapped	
961-315	Iny441	21.4 mm	20 mm	n/a	0.93	12.1 mm	1.77	0%	12.1 mm	1.00	6.5 mm	2.5 mm	191°	166°	25°	0.50	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	complete	
961-368	Iny441	24.9 mm	21.7 mm	n/a	0.87	≈12.9 mm	≈1.93	0%	≈12.9 mm	1.00	5.6 mm	3.0 mm	175°	161°	13°	>0.6	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	one base tang snapped	relative symmetry assumed for WB
961-467	Iny441	18.7 mm	16.5 mm	n/a	0.88	12.9 mm	1.45	0%	12.9 mm	1.00	7.5 mm	2.2 mm	202°	155°	52°	0.45	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	complete	
961-468	Iny441	15.7 mm	14.4 mm	n/a	0.92	≈11.7 mm	1.09	0%	≈11.7 mm	1.00	5.8 mm	2.5 mm	189°	172°	12°	>0.30	Lookout Mountain, Casa Diablo, CA	Desert side notched	Desert side notched	one base tang snapped	
961-107	Iny441	21.0 mm	18.3 mm	n/a	0.87	9.4 mm	2.23	0%	9.4 mm	1.00	5.4 mm	2.8 mm	203°	164°	44°	0.45	Lookout Mountain, Casa Diablo, CA	Desert side notched	Desert side notched	complete	
961-500	Iny441	>24.0 mm	>24.0 mm	n/a	1.00	11.5 mm	NM	0%	11.5 mm	1.00	6.7 mm	2.8 mm	188°	169°	18°	>0.75	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	tip snapped	
961-147	Iny441	23.8 mm	22.2 mm	n/a	0.93	9.0 mm	2.64	0%	9.0 mm	1.00	4.1 mm	2.7 mm	213°	186°	32°	0.45	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	tip chipped	
961-153	Iny441	19.1 mm	17.3 mm	n/a	0.91	15.1 mm	1.15	0%	15.1 mm	1.00	6.7 mm	3.0 mm	180°	170°	25°	0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-185	Iny441	17.2 mm	13.7 mm	n/a	0.80	13.8 mm	1.25	0%	13.8 mm	1.00	6.6 mm	2.2 mm	200°	163°	37°	0.35	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-179	Iny441	23.2 mm	20.6 mm	n/a	0.89	12.3 mm	1.89	0%	12.3 mm	1.00	6 mm	2.6 mm	187°	170°	16°	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-21	Iny441	19.2 mm	19.2 mm	n/a	1.00	12.9 mm	1.49	0%	12.9 mm	1.00	5.8 mm	2.8 mm	185°	156°	38°	0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-238	Iny441	>16.9 mm	>13.1 mm	n/a	0.78	13.5 mm	NM	0%	13.5 mm	1.00	6.6 mm	2.4 mm	185°	181°	4°	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip snapped	
961-139	Iny441	21.3 mm	19.4 mm	n/a	0.91	14.2 mm	1.50	0%	14.2 mm	1.00	7.8 mm	4.0 mm	240°	140°	105°	0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-470	Iny441	27.6 mm	25.5 mm	n/a	0.92	13.5 mm	2.04	0%	13.5 mm	1.00	6.4 mm	2.4 mm	186°	170°	17°	0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-509	Iny441	>17.2 mm	>14.1 mm	n/a	0.82	13.3 mm	NM	0%	13.3 mm	1.00	5.2 mm	2.0 mm	162°	157°	5°	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip snapped	
961-529	Iny441	19.5 mm	16.1 mm	n/a	0.83	13.5 mm	1.44	0%	13.5 mm	1.00	5.8 mm	2.8 mm	193°	171°	22°	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	xrf lists as 329
961-135	Iny441	>25.6 mm	>22.1 mm	n/a	0.86	>12.1 mm	NM	0%	>12.1 mm	1.00	7.8 mm	3.3 mm	200°	160°	40°	>0.90	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	portion of one base tang snapped, tip snapped	
961-539	Iny441	>18.2 mm	>15.8 mm	n/a	0.87	13.6 mm	NM	0%	13.6 mm	1.00	6.2 mm	3.1 mm	216°	167°	47°	>0.55	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip snapped	
961-343	Iny441	22.1 mm	19.5 mm	n/a	0.88	11.8 mm	1.87	0%	11.8 mm	1.00	6.4 mm	3.3 mm	185°	178°	5°	0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-258	Iny441	≈26.0 mm	≈21.0 mm	n/a	0.81	≈14.5 mm	1.79	0%	≈14.5 mm	1.00	7.4 mm	3.7 mm	211°	159°	53°	>0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	portion of one base tang snapped, tip chipped	
961-205	Iny441	>20.0 mm	>16.0 mm	n/a	0.80	14.8 mm	NM	0%	14.8 mm	1.00	7.9 mm	4.0 mm	174°	172°	2°	>0.90	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip snapped	
961-301	Iny441	19.9 mm	17.3 mm	n/a	0.87	11.0 mm	1.81	0%	11.0 mm	1.00	6.8 mm	2.5 mm	203°	140°	63°	0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-300	Iny441	≈16.0 mm	≈14.0 mm	n/a	0.88	12.2 mm	1.31	0%	12.2 mm	1.00	3.8 mm	1.7 mm	180°	177°	3°	≈0.30	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip chipped	
961-291	Iny441	24.9 mm	23.8 mm	n/a	0.96	10.3 mm	2.42	0%	10.3 mm	1.00	5.5 mm	2.7 mm	204°	168°	31°	0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-357	Iny441	29.1 mm	25.5 mm	n/a	0.88	≈14.6 mm	1.99	0%	≈14.6 mm	1.00	6.6 mm	2.6 mm	176°	177°	3°	>0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one base tang completely snapped	
961-12	Iny441	36.0 mm	36.0 mm	n/a	1.00	13.0 mm	2.78	0%	13.0 mm	1.00	6.0 mm	3.0 mm	178°	169°	9°	1.30	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one base tang chipped	
961-163	Iny441	20.6 mm	18.5 mm	n/a	0.90	12.3 mm	1.62	0%	12.3 mm	1.00	6.2 mm	1.9 mm	201°	178°	27°	0.45	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-182	Iny441	19.9 mm	16.8 mm	n/a	0.84	12.5 mm	0.63	0%	12.5 mm	1.00	7.8 mm	2.4 mm	174°	170°	3°	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-218	Iny441	20.6 mm	19.5 mm	n/a	0.95	10.4 mm	1.98	0%	10.4 mm	1.00	4.3 mm	2.8 mm	213°	175°	39°	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one side of base chipped	
961-466	Iny441	20.3 mm	17.4 mm	n/a	0.86	≈11.5 mm	≈1.77	0%	≈11.5 mm	1.00	7.2 mm	2.6 mm	203°	165°	35°	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one base tang snapped	relative symmetry assumed for WB
961-169	Iny441	21.1 mm	19.3 mm	n/a	0.91	13.1 mm	1.61	0%	13.1 mm	1.00	7.3 mm	3.8 mm	222°	194°	29°	0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-317	Iny441	20.8 mm	19.9 mm	n/a	0.96	10.8 mm	1.93	0%	10.8 mm	1.00	6.5 mm	3.2 mm	205°	162°	35°	0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-409	Iny441	25.7 mm	24.7 mm	n/a	0.96	≈15.8 mm	≈1.63	0%	≈15.8 mm	1.00	6.7 mm	2.6 mm	181°	170°	12°	>0.55	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one base tang snapped	relative symmetry assumed for WB
961-407	Iny441	22.7 mm	18.8 mm	n/a	0.83	≈11.5 mm	≈1.96	0%	≈11.5 mm	1.00	6.4 mm	1.8 mm	180°	140°	43°	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one base tang snapped	relative symmetry assumed for WB
961-290	Iny441	>17.0 mm	>15.0 mm	n/a	0.88	12.6 mm	NM	0%	12.6 mm	1.00	5.5 mm	2.4 mm	215°	175°	40°	>0.35	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip snapped	
961-292	Iny441	18.3 mm	16.9 mm	n/a	0.92	10.9 mm	1.68	0%	10.9 mm	1.00	5.8 mm	2.3 mm	211°	148°	61°	0.35	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	
961-250	Iny441	25.5 mm	25.5 mm	n/a	1.00	11.4 mm	2.24	0%	11.4 mm	1.00	6.8 mm	2.5 mm	198°	142°	56°	≈0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	one corner base chipped and reworked	relative symmetry assumed for WB
961-410	Iny441	>24.9 mm	>23.7 mm	n/a	0.95	13.6 mm	NM	0%	13.6 mm	1.00	7.4 mm	3.3 mm	210°	145°	65°	>0.90	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip snapped, one shoulder chipped and reworked	
961-401	Iny441	>14.5 mm	>10.5 mm	n/a	0.72	14.9 mm	NM	0%	14.9 mm	1.00	6.2 mm	2.4 mm	179°	151°	29°	>0.45	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	distal end snapped at mid-section	
961-22	Iny441	33.5 mm	32.4 mm	n/a	0.97	11.0 mm	3.05	0%	11.0 mm	1.00	7.1 mm	3.5 mm	209°	153°	55°	1.20	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	damage/reworking on one corner of base
961-514	Iny441	>13.9 mm	>12.5 mm	n/a	0.90	9.2 mm	NM	0%	9.2 mm	1.00	5.1 mm	2.5 mm	208°	154°	44°	>0.3	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	distal end snapped	
961-374	Iny441	≈22.3	≈22.3	n/a	1.00	≈12.6 mm	1.77	0%	≈12.6 mm	1.00	7.6 mm	3.0 mm	231°	162°	69°	≈0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	tip and one corner base chipped	
961-26	Iny441	26.9 mm	26.1 mm	n/a	0.97	13.3 mm	2.02	0%	13.3 mm	1.00	7.5 mm	3.0 mm	172°	160°	13°	0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	complete	one side corner notched, one side notched, thus WB/WM not DSN but corner notch appears to be a manufacture "mistake"
961-405	Iny441	>15.8 mm	>15.8 mm	n/a	1.00	14.1 mm	NM	NM (LMW=9.5 mm)	10.3 mm	0.73	7.5 mm	3.7 mm	176°	140°	36°	>0.80	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	out-of-key	distal end snapped at mid-section	extensive base damage and reworking, one side corner notched, one side notched, probably was a DSN
961-6	Iny441	>20.7 mm	>20 mm	n/a	0.97	≈12.5 mm	NM	0%	≈12.5 mm	1.00	6.5 mm	3.0 mm	168°	159°	10°	>0.75	Saline Range, CA, Variety 3	Desert side notched	Desert side notched	distal end snapped, one corner of base chipped	WB might have been slightly larger
961-237	Iny441	23.7 mm	20.6 mm	n/a	0.87	12.7 mm	1.87	0%	12.7 mm	1.00	8.2 mm	3.3 mm	202°	155°	63°	0.70	Sawmill Ridge, Casa Diablo, CA	Desert side notched	Desert side notched	complete	
961-5	Iny441	28.0 mm	28.0 mm	n/a	1.00	11 mm	2.55	38%	5.9 mm	0.54	3.9 mm	3.4 mm	200°	115°	85°	0.85	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	complete	
961-600	Iny441	>15.6 mm	>13.2 mm	n/a	0.85	18.4 mm	NM	NM (LMW=4.1 mm)	8.5 mm	0.46	7.6 mm	3.6 mm	134°	108°	27°	>0.70	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	distal end snapped at mid-section	
961-248	Iny441	30.9 mm	30.9 mm	n/a	1.00	10.8 mm	2.86	25%	7.0 mm	0.65	5.1 mm	3.1 mm	182°	130°	52°	1.00	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	one edge appears damaged and reworked	
961-549	Iny441	>16.0 mm	>16.0 mm	n/a	1.00	12.3 mm	NM	NM (LMW=7.3 mm)	>9.0 mm	NM	7.7 mm	3.5 mm	193°	110°	82°	>0.65	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	distal end snapped, base heavily damaged, both tangs snapped	likely was a DSN but base damage created corner notches

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
961-377	Iny441	>14.5 mm	>14.5 mm	n/a	1.00	16.9 mm	NM	NM (LMW=7.1 mm)	9.1 mm	0.54	8.1 mm	3.6 mm	128°	118°	10°	>1.00	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	distal end snapped at mid-section	
961-206	Iny441	>23.5 mm	>22.4 mm	n/a	0.95	13.2 mm	NM	NM (LMW=8.6 mm)	6.0 mm	0.45	5.4 mm	4.1 mm	143°	100°	42°	>1.30	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	distal end snapped , one shoulder tang snapped, base heavily damaged and reworked	
961-260	Iny441	>19.7 mm	>19.7 mm	n/a	1.00	>12 mm	NM	NM (LMW=5.2 mm)	10.0 mm	NM	9 mm	2.8 mm	185°	124°	62°	>0.70	West Sugarloaf, Coso Volcanic Field, CA	Rosegate	Rosegate	shoulder and edge snapped on one side, distal end snapped	
961-30	Iny441	>23.5 mm	>23.5 mm	n/a	1.00	16.4 mm	NM	NM (LMW=10.6 mm)	10.6 mm	0.65	8.2 mm	4.8 mm	161°	122°	44°	>1.90	West Sugarloaf, Coso Volcanic Field, CA	Elko corner notched	Elko corner notched	distal end snapped	
961-356	Iny441	>24.5 mm	>21.5 mm	n/a	0.88	>18.8 mm	NM	NM (LMW=3.5 mm)	13.9 mm	NM	12.3 mm	3 mm	122°	108°	14°	>1.50	Saline Range, CA, Variety 3	Elko eared	Elko eared	snapped at distal end and along one edge	
961-10	Iny441	27.2 mm	27.2 mm	n/a	1.00	13.5 mm	2.01	35%	6.5 mm	0.48	7.6 mm	4.1 mm	188°	81°	108°	>1.50	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end near tip fractured, one edge heavily damaged	
961-267	Iny441	>21.0 mm	>21.0 mm	n/a	1.00	17.4 mm	NM	NM (LMW=3.2 mm)	7.9 mm	0.45	7.7 mm	3.5 mm	155°	68°	89°	>1.20	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end shattered, base reworked	
961-418	Iny441	>19.0 mm	>19.0 mm	n/a	1.00	20.2 mm	NM	NM (LMW=2.0 mm)	6.6 mm	0.33	8.5 mm	3.1 mm	145°	62°	83°	>1.30	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, base damaged and reworked	
961-13	Iny441	26.6 mm	26.6 mm	n/a	1.00	14.2 mm	1.87	40%	6.7 mm	0.47	7.3 mm	3.3 mm	215°	78°	135°	1.20	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	tip and base heavily damaged and reworked	
961-19	Iny441	>31.7 mm	>31.7 mm	n/a	1.00	22 mm	NM	NM (LMW=2.3 mm)	9.1 mm	0.41	10.2 mm	4.3 mm	134°	85°	48°	>2.45	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, part of base snapped	
961-247	Iny441	>19.3 mm	>18.5 mm	n/a	0.96	>18.6 mm	NM	NM (LMW=2.5 mm)	9.6 mm	NM	10.9 mm	3.7 mm	164°	84°	80°	>1.50	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff split stem	Gatecliff split stem	distal end snapped, one shoulder tang snapped, base damaged	
961-68	Iny441	23.0 mm				18.1 mm						2.4 mm				0.80	Saline Range, CA, Variety 1 (Queen Impostor)	drill	N/A	complete	pressure flaked one side only, borer exhibits edge damage both sides, xrf lists as 8
961-64	Iny441	28.6 mm				11.1 mm						3.3 mm				0.85	Saline Range, CA, Variety 1 (Queen Impostor)	drill	N/A	complete	borer exhibits some edge damage
961-51	Iny441	30.2 mm				14.4 mm						3.0 mm				≈1.20	Saline Range, CA, Variety 1 (Queen Impostor)	drill	N/A	edge snapped off at base, end chipped	borer exhibits edge damage and reworking
961-105	Iny441					22.1 mm			18.5 mm		7.8 mm	5.2 mm				>2.80	Saline Range, CA, Variety 1 (Queen Impostor)	drill base	N/A	borer snapped at neck	
961-159	Iny441	>27.2				14.1 mm						4.2 mm				>1.50	Saline Range, CA, Variety 1 (Queen Impostor)	flake tool	N/A	end snapped	unifacially worked, edge damage on both lateral margins
961-18	Iny441	30.2 mm	26.3 mm			23.6 mm		35%	19.8 mm		17.3 mm	6.3 mm				4.20	Saline Range, CA, Variety 3	hafted knife or scraper	N/A	distal end heavily damaged and reworked	blade unifacially worked, haft element bifacially worked
961-385	Iny441					19.3 mm						3.9 mm				>3.10	Montezuma Range, NV	knife fragment	N/A	fine, parallel flake scars	
961-244	Iny441					24.7 mm						6.5 mm				>5.00	Saline Range, CA, Variety 1 (Queen Impostor)	knife fragment	N/A	heavily reworked	
961-436	Iny441								11.2 mm		15.8 mm	6.4 mm				>3.00	West Cactus Peak (Coso Volcanic Field, CA)	knife fragment	N/A	hafted agave knife blade, heavily damaged and reworked	
Joshua Tree National Park, California (Campbell collection), n=112																					
Sarcobatus Flat District, NV (n=5)																					
5190 498G3536 (E)	n/a	>14.7 mm	>14.1 mm	N/A	0.96	17.2 mm	NM	NM (LMW=10.8 mm)	12.6 mm	0.73	N/A	3.4 mm	N/A	N/A	N/A	>0.90	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Cottonwood leaf shaped	out-of-key	blade snapped	point appears to be too big for Cottonwood leaf shaped & too small for Humboldt
5190 498G3536 (D)	n/a	20.0 mm	18.9 mm	N/A	0.95	10.6 mm	1.89	0%	10.6 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	0.60	Obsidian Butte, NV, Variety 2 (Airfield Canyon)	Cottonwood triangular	Cottonwood triangular	edges appear reworked	
5190 498G3536 (C)	n/a	>20.6 mm	>20.6 mm	N/A	1.00	12.0 mm	NM	0%	12.0 mm	1.00	N/A	2.9 mm	N/A	N/A	N/A	>0.8	Obsidian Butte, NV, Variety 5 (Unknown C)	Cottonwood triangular	Cottonwood triangular	distal end snapped	
5190 498G3536 (A)	n/a	24.6 mm	24.6 mm	9.0 mm	1.00	12.7 mm	1.94	0%	12.7 mm	1.00	10.0 mm	3.3 mm	225°	142°	84°	1.00	Obsidian Butte, NV, Variety 3	Desert side notched	Desert side notched	distal blade edges appear reworked	Desert type
5190 498G3536 (B)	n/a	23.8 mm	23.8 mm	5.6 mm	1.00	13.6 mm	1.75	32%	9.7 mm	0.71	7.2 mm	2.4 mm	176°	157°	19°	0.55	Obsidian Butte, NV, Variety 3	Desert side notched	out-of-key	extremely asymmetric (tip forms 48° angle to base)	Desert type - appears that manufacturer's intent was Dsn, one base tang probably snapped during manufacture
Owens River Valley District, CA (n=107)																					
2798 498G3007 (N)	site 791	37.9 mm	37.9 mm	N/A	1.00	17.6 mm	2.15	27%	≈14.4	≈0.82	N/A	6.6 mm	N/A	N/A	N/A	>3.05	Fish Springs, Owens Valley, CA	Cottonwood leaf shaped	out-of-key	one basal corner snapped, distal blade edges worn & reworked	looks like large Cottonwood leaf shaped. Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (J)	site 791	21.6 mm	21.6 mm	N/A	1.00	9.8 mm	2.20	30%	6.1 mm	0.64	N/A	3.0 mm	N/A	N/A	N/A	0.70	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood leaf shaped	Cottonwood leaf shaped	distal blade edges reworked	Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
4707 498G3031 (A)	site 794	35.2 mm	33.4 mm	N/A	0.95	9.3 mm	3.78	19%	8.3 mm	0.89	N/A	2.6 mm	N/A	N/A	N/A	0.60	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood leaf shaped	out-of-key	complete	fits all discriminants for Cottonwood leaf shaped except too long
4708 498G3030 (C)	site 794	>15.5 mm	>15.5 mm	N/A	1.00	8.7 mm	NM	NM (LMW=6.7 mm)	6.5 mm	0.75	N/A	3.0 mm	N/A	N/A	N/A	>0.50	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood leaf shaped	Cottonwood leaf shaped	tip snapped	sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
4708 498G3030 (D)	site 794	>12.3 mm	>12.0 mm	N/A	0.98	14.5 mm	NM	0%	14.5 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	>0.65	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped	sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
5660 498G3019 (D)	site 792	19.2 mm	18.0 mm	N/A	0.94	≈11.5 mm	1.67	0%	≈11.5 mm	1.00	N/A	1.9 mm	N/A	N/A	N/A	≈0.3	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	one corner base chipped	Paiute camp near spring 5 miles E of Olancha (Campbell class. Paiute arrow point)
5660 498G3019 (E)	site 792	>20.4 mm	>18.9 mm	N/A	0.93	15.1 mm	NM	0%	15.1 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	>1.15	Sugarloaf Mountain, Coso Volcanic Field, CA	Cottonwood triangular	out-of-key	distal end snapped	looks like Cottonwood triangular but slightly too thick, Paiute camp near spring 5 miles E of Olancha (Campbell class. - Paiute arrow point)
6556 A535 (C)	n/a	24.3 mm	22.1 mm	N/A	0.91	12.5 mm	1.94	0%	12.5 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	0.50	West Cactus Peak, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	notch worn in from hafting visible on one edge
2798 498G3007 (F)	site 791	≈17.2 mm	≈15.7 mm	N/A	0.91	14.5 mm	≈1.19	0%	14.5 mm	1.00	N/A	2.9 mm	N/A	N/A	N/A	≈0.60	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	tip chipped	Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (L)	site 791	19.7 mm	19.7 mm	N/A	1.00	12.1 mm	1.63	0%	12.1 mm	1.00	N/A	2.6 mm	N/A	N/A	N/A	0.50	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
4707 498G3031 (B)	site 794	17.2 mm	16.3 mm	N/A	0.95	10.8 mm	1.59	0%	10.8 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	0.40	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	camps on sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
4707 498G3031 (C)	site 794	31.2 mm	28.4 mm	N/A	0.91	10.1 mm	3.09	0%	10.1 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	0.80	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	out-of-key	complete	fits all discriminants for Cottonwood triangular except too long, camps on sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
4708 498G3030 (A)	site 794	>22.7 mm	>22.7 mm	N/A	1.00	18.8 mm	NM	0%	18.8 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	>1.15	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	out-of-key	distal end snapped	thin, long, wide triangular point, (would be >30 mm if complete), camps on sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
4708 498G3030 (B)	site 794	>20.1 mm	>20.1 mm	N/A	1.00	15.9 mm	NM	0%	15.9 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	>1.2	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped	camps on sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
5660 498G3019 (A)	site 792	26.4 mm	26.4 mm	N/A	1.00	14.6 mm	1.81	0%	14.6 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	1.00	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	Paiute camp near spring 5 miles E of Olancha (Campbell class. - Paiute arrow point)
5660 498G3019 (C)	site 792	28.7 mm	28.7 mm	N/A	1.00	11.3 mm	2.54	0%	11.3 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.95	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	Paiute camp near spring 5 miles E of Olancha (Campbell class. - Paiute arrow point)
6556 A535 (A)	n/a	24.0 mm	24.0 mm	N/A	1.00	≈15.8 mm	0.66	0%	≈15.8 mm	1.00	N/A	3.9 mm	N/A	N/A	N/A	≈1.10	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	one corner base chipped	
6556 A535 (B)	n/a	24.7 mm	24.0 mm	N/A	0.97	14.9 mm	1.66	0%	14.9 mm	1.00	N/A	4.9 mm	N/A	N/A	N/A	1.60	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	out-of-key	complete	looks like Cottonwood triangular but slightly too thick and heavy
6556 A535 (D)	n/a	≈21.8 mm	≈20.3 mm	7.2 mm	0.93	11.7 mm	1.86	0%	11.7 mm	1.00	6.2 mm	2.8 mm	210°	143°	67°	0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	small chip on tip	Sierra side notched type
2798 498G3007 (B)	site 791	23.3 mm	20.7 mm	7.9 mm	0.89	≈12.7 mm	1.83	0%	≈12.7 mm	1.00	5.6 mm	2.9 mm	187°	149°	38°	>0.55	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	one base tang snapped in half	Sierra side notched type, Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (M)	site 791	>17.7 mm	>17.4 mm	>4.4 mm	NM	>8.0 mm	NM	0%	>8.0 mm	1.00	7.3 mm	2.8 mm	220°	147°	73°	>0.35	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	both base tangs snapped, tip reworked	Sierra side notched type, Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
5660 498G3019 (G)	site 792	19.3 mm	19.2 mm	6.6 mm	0.99	11.8 mm	1.64	0%	11.8 mm	1.00	6.9 mm	2.9 mm	228°	151°	77°	0.60	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	complete	most closely resembles Bear River side notched, Paiute camp near spring 5 miles E of Olancha (Campbell class. Paiute arrow point)
6556 A535 (E)		15.8 mm	14.8 mm	8.0 mm	0.94	10.6 mm	1.49	0%	10.6 mm	1.00	6.3 mm	2.6 mm	235°	139°	96°	0.30	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	complete	Sierra side notched type
4707 498G3031 (D)	site 794	20.3 mm	18.9 mm	7.0 mm	0.93	12.6 mm	1.61	0%	12.6 mm	1.00	6.5 mm	2.9 mm	232°	145°	97°	0.40	West Sugarloaf Mountain, Coso Volcanic Field, CA	Desert side notched	Desert side notched	complete	Delta side notched type, camps on sand dunes on sand bar S end Owens Lake, extending from Olancha E for 4 miles (Campbell class. - arrow point)
2798 498G3007 (H)	site 791	27.7 mm	27.7 mm	4.8 mm	1.00	16.0 mm	1.73	19%	6.4 mm	0.40	7.5 mm	4.2 mm	163°	75°	88°	1.80	Fish Springs, Owens Valley, CA	Parowan basal notched	*?Gatecliff contracting stem?*	reworked near tip	looks too small for dart point, similar to O'Malley/Conaway contracting stem arrow points - Parowan basal notched, Ash Creek Point 8 miles N of Olanch (Campbell class. - arrow point)
2798 498G3007 (I)	site 791	27.9 mm	27.9 mm	4.3 mm	1.00	12.4 mm	2.25	26%	4.1 mm	0.33	7.1 mm	4.3 mm	216°	65°	151°	1.30	Sugarloaf Mountain, Coso Volcanic Field, CA	Parowan basal notched	*?Gatecliff contracting stem?*	all edges appear reworked	looks too small for dart point, similar to O'Malley/Conaway contracting stem arrow points - Parowan basal notched, Ash Creek Point 8 miles N of Olanch (Campbell class. - arrow point)
2798 498G3007 (E)	site 791	22.0 mm	22.0 mm	5.8 mm	1.00	12.9 mm	1.71	36%	6.4 mm	0.50	7.5 mm	3.9 mm	206°	84°	122°	0.95	West Sugarloaf, Coso Volcanic Field, CA	Parowan basal notched	out-of-key	weathered, all edges appear reworked	looks like mini Gatecliff, very similar to O'Malley/Conaway contracting stem arrow points - Parowan basal notched, Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (K)	site 791	>28.0 mm	>27.6 mm	4.0 mm	0.99	19.0 mm	NM	NM (LMW=1.3 mm)	≈7.2	≈0.38	7.2 mm	3.2 mm	151°	104°	47°	>1.45	West Sugarloaf, Coso Volcanic Field, CA	Parowan basal notched	out-of-key	tip snapped, one base tang snapped	looks most like Rosegate but neck to base width too high (Parowan basal notched?), Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point
6556 A535 (F)	n/a	22.7 mm	22.7 mm	3.9 mm	1.00	13.4 mm	1.69	22%	5.7 mm	0.43	7.2 mm	4.2 mm	190°	64°	126°	1.00	West Sugarloaf, Coso Volcanic Field, CA	Parowan basal notched	out-of-key	complete	looks like mini Gatecliff (very similar to O'Malley/Conaway points)
2798 498G3007 (A)	site 791	22.6 mm	22.6 mm	6.3 mm	1.00	14.9 mm	1.52	33%	8.4 mm	0.56	7.2 mm	3.2 mm	175°	118°	57°	0.65	Sugarloaf Mountain, Coso Volcanic Field, CA	Rosegate	Rosegate	distal blade edges reworked	Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (C)	site 791	20.3 mm	19.8 mm	4.5 mm	0.98	19.2 mm	1.06	28%	≈8.7 mm	≈0.45	8.2 mm	4.6 mm	171°	105°	66°	0.95	West Sugarloaf, Coso Volcanic Field, CA	Rosegate	Rosegate	distal blade edges & one base tang reworked	Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (D)	site 791	25.0 mm	25.0 mm	5.1 mm	1.00	13.0 mm	1.92	28%	7.4 mm	0.57	7.2 mm	3.4 mm	217°	105°	112°	1.05	West Sugarloaf, Coso Volcanic Field, CA	Rosegate	out-of-key	distal blade edges (especially toward tip) reworked	looks like a cross between a Rosegate and Gunther, Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
2798 498G3007 (G)	site 791	>31.0 mm	>31.0 mm	4.5 mm	1.00	16.8 mm	NM	NM (LMW=4.6 mm)	7.5 mm	0.45	5.7 mm	4.3 mm	142°	126°	24°	>1.70	West Sugarloaf, Coso Volcanic Field, CA	Rosegate	Rosegate	tip snapped	Ash Creek Point 8 miles N of Olancha (Campbell class. - arrow point)
5660 498G3019 (B)	site 792	25.5 mm	25.5 mm	4.9 mm	1.00	11.6 mm	2.20	23%	4.2 mm	0.35	3.8 mm	2.5 mm	202°	95°	107°	0.65	West Sugarloaf, Coso Volcanic Field, CA	Rosegate	out-of-key	complete	looks like Rosegate with small base, Paiute camp near spring 5 miles E of Olancha (Campbell class. - Paiute arrow point)
5660 498G3019 (F)	site 792	26.2 mm	26.2 mm	5.7 mm	1.00	16.2 mm	1.62	27%	11.4 mm	0.70	9.9 mm	3.1 mm	191°	130°	61°	1.15	West Sugarloaf, Coso Volcanic Field, CA	Elko corner notched	Elko corner notched	complete	Paiute camp near spring 5 miles E of Olancha (Campbell class. - Paiute arrow point)
2661 498G3068	site 806	50.4 mm	48.5 mm	6.5 mm	0.96	29.9 mm	1.69	15%	>10.5 mm	NM	12.9 mm	4.9 mm	160°	57°	53°	>6.20	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	one base tang snapped, distal end damaged & reworked	3 notches along distal blade edges suggest point may have been barbed, 2.5 miles up Lone Pine Creek, 1 mile W of Alabama Hills, 2.5 miles W of Lone Pine (Campbell class. - dart point, knife, or reject)
5662 498G3018	site 792	45.6 mm	45.6 mm	5.3 mm	1.00	21.6 mm	2.11	19%	9.5 mm	0.44	10.2 mm	4.0 mm	157°	83°	74°	2.90	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end reworked	Paiute camp near spring, S shore Owens Lake 5 miles E of Olancha (Campbell class. - Paiute arrow point)
2842 498G3684 (A)	n/a	>31.5 mm	>30.3 mm	8.7 mm	0.96	20.5 mm	NM	NM (LMW=12.3 mm)	>18.0 mm	NM	15.3 mm	8.4 mm	150°	58°	91°	>4.90	West Cactus Peak, Coso Volcanic Field, CA	Gatecliff contracting stem	Gatecliff contracting stem	distal end crushed, one base tang snapped	
2633 498G2999	site 790	>26.0 mm	>26.0 mm	5.1 mm	1.00	18.4 mm	NM	NM (LMW=6.6 mm)	9.1 mm	0.49	9.0 mm	3.6 mm	149°	78°	71°	1.60	West Sugarloaf, Coso Volcanic Field, CA	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, edge reworked	Ash Creek point above old Owens Lake shoreline, 8 miles N of Olancha (Campbell class. - arrow point)
2664 498G3059	n/a	29.0 mm	25.2 mm	6.7 mm	0.87	18.8 mm	1.54	26%	13.2 mm	0.70	13.5 mm	6.3 mm	209°	83°	126°	2.80	Fish Springs, Owens Valley, CA	Gatecliff split stem	Gatecliff split stem	weathered	one shoulder very weak
2842 498G3684 (B)	n/a	>19.8	>16.9 mm	N/A	0.85	24.3 mm	NM	NM (LMW=17.1 mm)	15.6 mm	0.64	20.6 mm	N/A	N/A	N/A	N/A	>2.60	Saline Range, CA, Variety 1 (Queen Impostor)	Humboldt	Humboldt	blade snapped at shoulders	
6327 A414	n/a	>16.7 mm	>15.0 mm	N/A	0.90	21.0 mm	NM	NM (LMW=16.7 mm)	19.0 mm	0.90	N/A	4.7 mm	N/A	N/A	N/A	>2.00	Sugarloaf Mountain, Coso Volcanic Field, CA	Humboldt	Humboldt	weathered, blade snapped (stem only)	
6573 A485 (B)	n/a	28.3 mm	25.5 mm	9.8 mm	0.90	20.0 mm	1.42	42%	13.2 mm	0.66	13.0 mm	7.0 mm	232°	109°	123°	3.90	Saline Range, CA, Variety 3	Pinto	*?Elko eared?*	extremely weathered, one base tang snapped	fits Basgall & Hall (2000) discriminants for Pinto rather than Elko
2889 498G3255	site 841	27.5 mm	25.7 mm	6.0 mm	0.93	17.1 mm	1.61	25%	15.9 mm	0.93	15.7 mm	5.2 mm	245°	107°	138°	>2.50	West Sugarloaf, Coso Volcanic Field, CA	Pinto	*?Elko eared?*	weathered, snapped diagonally from tip to shoulder	fits Basgall & Hall (2000) discriminants for Pinto, old Owens River Delta 1.5 miles NW of Dolomite station (Campbell class. - Pinto)
6437 A369 (B)	n/a	22.5 mm	20.2 mm	9.1 mm	0.90	17.4 mm	1.29	0%	17.4 mm	1.00	15.0 mm	4.4 mm	243°	117°	126°	1.90	West Sugarloaf, Coso Volcanic Field, CA	Pinto	*?Elko eared?*	heavily weathered, distal blade edges reworked	fits Basgall & Hall (2000) discriminants for Pinto v. Elko eared
6568 A480 (D)	n/a	>19.1 mm	>15.7 mm	N/A	0.82	22.2 mm	NM	NM (LMW=13.8 mm)	17.3 mm	0.78	N/A	4.7 mm	N/A	N/A	N/A	>2.70	Joshua Ridge, Coso Volcanic Field, CA	Black Rock concave base	*?Humboldt?*	blade snapped (haft element only), heavily weathered	Black Rock concave base
6568 A480 (B)	n/a	>25.0 mm	>22.0 mm	N/A	0.88	26.3 mm	NM	NM (LMW=22.1 mm)	23.2 mm	0.88	N/A	5.6 mm	N/A	N/A	N/A	>4.70	Lookout Mountain, Casa Diablo, CA	Black Rock concave base	*?Humboldt?*	blade snapped (haft element only), weathered	Black Rock concave base
6568 A480 (A)	n/a	>25.7 mm	>24.1 mm	20.4 mm	0.94	21.2 mm	NM	NM	21.2 mm	1.00	14.8 mm	5.6 mm	N/A	N/A	N/A	>4.25	Sawmill Ridge, Casa Diablo, CA	Black Rock concave base	out-of-key	blade snapped (base only), heavily weathered	Black Rock concave base
6953 K603 (A)	n/a	>16.1 mm	>11.3 mm	N/A	0.70	23.4 mm	NM	0%	23.4 mm	1.00	N/A	5.4 mm	N/A	N/A	N/A	2.10	Sugarloaf Mountain, Coso Volcanic Field, CA	Black Rock concave base	out-of-key	blade snapped (stem only)	Black Rock concave base
6568 A480 (C)	n/a	>22.4 mm	>18.4 mm	N/A	0.82	27.0 mm	NM	NM (LMW=22.4 mm)	23.3 mm	0.86	N/A	6.9 mm	N/A	N/A	N/A	>5.15	West Sugarloaf, Coso Volcanic Field, CA	Black Rock concave base	*?Humboldt?*	blade snapped (haft element only), heavily weathered	Black Rock concave base
2867 498G3461 (A)	site 797	34.0 mm	34.0 mm	13.5 mm	1.00	27.4 mm	1.24	50%	21.9 mm	0.80	22.9 mm	6.7 mm	217°	79°	138°	5.70	Fish Springs, Owens Valley, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal blade edges reworked, weathered	Great Basin stemmed, Borax Lake, N shore Owens Lake near Dolomite station (Campbell class.- probable dart point)
6313 A451	n/a	31.4 mm	31.4 mm	9.2 mm	1.00	21.9 mm	1.43	33%	18.5 mm	0.84	18.2 mm	6.6 mm	210°	99°	111°	4.80	Fish Springs, Owens Valley, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	heavily weathered, chipped above one shoulder	Great Basin stemmed, Borax Lake
26614 498G3212	site 836	50.6 mm	50.6 mm	14.5 mm	1.00	34.0 mm	1.49	44%	21.0 mm	0.62	24.0 mm	9.3 mm	195°	85°	110°	12.85	Queen/Truman Meadows, CA/NV	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	complete	Great Basin stemmed, Borax Lake wide stem, NE Owens Lake, 0.25 miles W of Dolomite station (Campbell class. - Silver Lake)
6953 K603 (B)	n/a	26.2 mm	25.8 mm	8.1 mm	0.98	25.3 mm	1.04	30%	16.8 mm	0.66	16.4 mm	5.7 mm	186°	81°	105°	3.30	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	weathered, blade appears reworked	Great Basin stemmed, Borax Lake wide stem
6257 A338	n/a	21.8 mm	21.8 mm	9.1 mm	1.00	20.7 mm	1.05	47%	16.5 mm	0.80	15.4 mm	5.1 mm	221°	101°	120°	3.30	Saline Range, CA, Variety 2	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	blade heavily damaged & reworked, heavily weathered	Great Basin stemmed, Borax Lake
26616 498G3672	n/a	>34.1 mm	>34.1 mm	13.2 mm	1.00	25.8 mm	NM	NM (LMW=15.1 mm)	20.5 mm	0.79	18.8 mm	6.5 mm	209°	96°	113°	>5.40	Saline Range, CA, Variety 3	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end crushed & reworked, distal blade edges reworked	Great Basin stemmed, Borax Lake
6573 A485 (A)	n/a	>20.3 mm	>20.3 mm	8.3 mm	1.00	24.7 mm	NM	NM (LMW=10.1 mm)	17.7 mm	0.72	17.5 mm	7.7 mm	214°	112°	102°	>3.70	Saline Range, CA, Variety 3	Great Basin stemmed, Borax Lake	*?Elko corner notched?*	blade snapped & reworked	Great Basin stemmed, Borax Lake wide stem
6954 (A)	n/a	39.8 mm	39.8 mm	18.1 mm	1.00	21.1 mm	1.89	54%	15.7 mm	0.74	19.3 mm	8.5 mm	252°	101°	151°	8.00	Sugarloaf Mountain, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	blade heavily damaged & reworked, heavily weathered	Great Basin stemmed, Borax Lake wide stem
2717 498G3691	n/a	25.9 mm	25.9 mm	8.5 mm	1.00	16.8 mm	1.54	37%	10.7 mm	0.41	12.5 mm	4.1 mm	195°	79°	116°	1.75	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	weathered, distal blade edges damaged, heavily reworked	Great Basin stemmed, Borax Lake (very small in comparison to others)
6317 A455 (A)	n/a	>21.4 mm	>21.4 mm	N/A	1.00	21.0 mm	NM	NM (LMW=21.4 mm)	17.1 mm	0.81	N/A	6.0 mm	NM	93°	NM	>3.30	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	blade snapped	Great Basin stemmed, Borax Lake wide stem, stem fragment
6775 A393 (C)	n/a	34.2 mm	34.2 mm	13.4 mm	1.00	19.6 mm	1.74	53%	9.7 mm	0.49	15.0 mm	6.8 mm	212°	87°	125°	4.90	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	heavily weathered, damaged & reworked, 1 shoulder very weak	Great Basin stemmed, Borax Lake wide stem
6954 (B)	n/a	38.7 mm	38.7 mm	19.0 mm	1.00	26.4 mm	1.47	51%	16.9 mm	0.64	23.5 mm	9.6 mm	238°	74°	164°	8.40	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal blade edges reworked, weathered	Great Basin stemmed, Borax Lake wide stem
6778 A396 (C)	n/a	38.6 mm	38.6 mm	19.1 mm	1.00	31.9 mm	1.21	53%	14.7 mm	0.46	30.1 mm	6.4 mm	240°	60°	180°	8.00	Fish Springs, Owens Valley, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal blade edges heavily reworked	Great Basin stemmed, Lake Mohave
7080 K666	n/a	>29.9 mm	>29.9 mm	24.8 mm	1.00	>20 mm	NM	NM	>9.0 mm	NM	15.3 mm	5.2 mm	221°	93°	134°	>3.00	Fish Springs, Owens Valley, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	stem & remnant shoulders only, weathered	Great Basin stemmed, Lake Mohave
2634 498G3520	n/a	101.6 mm	101.6 mm	N/A	1.00	26.9 mm	3.78	45%	7.7 mm	0.29	N/A	9.6 mm	N/A	N/A	N/A	22.50	Sugarloaf Mountain, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	out-of-key	complete, tip appears resharpened	massive lanceolate spear point, GBS (Lake Mohave) with no shoulders - Haskett?
6356 A424 (A)	n/a	29.8 mm	29.8 mm	10.5 mm	1.00	22.2 mm	1.34	50%	14.6 mm	0.66	14.9 mm	7.3 mm	229°	88°	141°	4.50	Unknown Variety F	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	heavily weathered, edges and base appear reworked	Great Basin stemmed, Lake Mohave (Big Smoky on cat. sheet, Melanie, JTNP stated cat. sheet incorrect, actually Owens River Valley)
2967 498G3575	n/a	101.8 mm	101.8 mm	47.5 mm	1.00	27.8 mm	3.66	58%	9.2 mm	0.33	20.8 mm	10.0 mm	250°	84°	166°	24.70	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal blade edges worn, weathered	Great Basin stemmed, Lake Mohave
6545 A466	n/a	38.1 mm	38.1 mm	14.2 mm	1.00	20.9 mm	1.82	51%	13.0 mm	0.62	17.1 mm	7.1 mm	225°	90°	135°	5.90	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	heavily weathered, distal blade edges appear damaged & reworked	Great Basin stemmed, Lake Mohave
6778 A396 (A)	n/a	46.8 mm	46.8 mm	24.3 mm	1.00	30.8 mm	1.52	55%	14.7 mm	0.48	26.5 mm	8.9 mm	236°	75°	161°	9.90	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	complete	Great Basin stemmed, Lake Mohave
6778 A396 (B)	n/a	46.1 mm	46.1 mm	N/A	1.00	26.5 mm	1.74	40%	17.7 mm	0.67	N/A	8.1 mm	NM	82°	NM	9.15	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	out-of-key	distal blade edges reworked to a "stub"	Great Basin stemmed, Lake Mohave
6778 A396 (D)	n/a	72.0 mm	72.0 mm	30.9 mm	1.00	29.6 mm	2.43	45%	15.2 mm	0.51	26.5 mm	10.2 mm	221°	83°	138°	18.00	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	distal end reworked	Great Basin stemmed, Lake Mohave
26613 498G3239	n/a	39.9 mm	39.6 mm	9.1 mm	0.99	24.2 mm	1.65	31%	19.3 mm	0.80	18.9 mm	6.3 mm	201°	103°	98°	4.95	Fish Springs, Owens Valley, CA	Great Basin stemmed, Silver Lake	out-of-key	distal end heavily reworked	Great Basin stemmed, Silver Lake
26615 498G3645 (B)	n/a	34.0 mm	33.6 mm	11.5 mm	0.99	25.0 mm	1.36	44%	17.7 mm	0.71	19.8 mm	5.9 mm	198°	82°	116°	4.80	Fish Springs, Owens Valley, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	edges reworked	Great Basin stemmed, Silver Lake
2978 498G3479 (B)	n/a	34.3 mm	34.3 mm	16.3 mm	1.00	25.2 mm	1.36	52%	19.2 mm	0.76	17.1 mm	9.4 mm	210°	118°	92°	7.15	Fish Springs, Owens Valley, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal blade edges reworked	Great Basin stemmed, Silver Lake, N shore Owens Lake near Dolomite station (Campbell class.- Silver Lake)
2983 498G3574	n/a	47.6 mm	47.6 mm	26.3 mm	1.00	29.5 mm	1.61	69%	15.7 mm	0.53	26.4 mm	10.5 mm	248°	78°	170°	12.50	Fish Springs, Owens Valley, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal end heavily reworked	Great Basin stemmed, Silver Lake
6775 A393 (B)	n/a	30.2 mm	30.2 mm	12.4 mm	1.00	19.7 mm	1.53	57%	8.5 mm	0.43	15.4 mm	6.3 mm	211°	74°	137°	3.95	Fish Springs, Owens Valley, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, damaged & reworked, 1 shoulder very weak	Great Basin stemmed, Silver Lake
2978 498G3479 (A)	site 859	38.7 mm	38.7 mm	15.4 mm	1.00	22.6 mm	1.71	48%	15.1 mm	0.67	18.2 mm	6.7 mm	226°	86°	140°	5.30	Joshua Ridge, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal blade edges reworked	Great Basin stemmed, Silver Lake, N shore Owens Lake near Dolomite station (Campbell class.- Silver Lake)
6267 A347 (A)	n/a	41.4 mm	41.4 mm	16.8 mm	1.00	18.0 mm	2.30	49%	13.6 mm	0.76	15.4 mm	7.4 mm	227°	84°	143°	5.25	Lookout Mountain, Casa Diablo, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal blade edges reworked, weathered	Great Basin stemmed, Silver Lake
6938	n/a	26.6 mm	26.6 mm	7.1 mm	1.00	18.0 mm	1.48	35%	15.4 mm	0.58	14.9 mm	7.0 mm	223°	102°	120°	2.90	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	distal blade edges extensively reworked	Great Basin stemmed, Silver Lake
26615 498G3645 (C)	n/a	>57.1 mm	>57.1 mm	>12.3 mm	NM	29.0 mm	NM	NM	NM	NM	21.8 mm	9.6 mm	213°	82°	131°	15.10	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	tip appears unfinished, end of stem snapped (manufacture error?)	Great Basin stemmed, Silver Lake
6267 A347 (E)	n/a	>23.1 mm	>23.1 mm	9.1 mm	1.00	20.5 mm	NM	NM (LMW=13.6 mm)	16.0 mm	0.78	17.6 mm	7.1 mm	230°	86°	144°	>3.95	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	extremely weathered, blade snapped above shoulders	Great Basin stemmed, Silver Lake
6267 A347 (F)	n/a	>19.4 mm	>19.4 mm	12.3 mm	1.00	21.5 mm	NM	NM (LMW= 16.5 mm)	12.1 mm	0.56	16.3 mm	6.2 mm	207°	78°	129°	>3.00	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	weathered, blade snapped above shoulders	Great Basin stemmed, Silver Lake
6614 A509 (A)	n/a	25.6 mm	25.6 mm	6.5 mm	1.00	20.6 mm	1.24	55%	9.0 mm	0.44	11.3 mm	7.2 mm	206°	76°	130°	3.05	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	weathered, distal blade edges damaged & reworked	Great Basin stemmed, Silver Lake
6614 A509 (B)	n/a	>37.4 mm	>37.4 mm	>12.3 mm	NM	31.3 mm	NM	NM	>10.5 mm	NM	22.4 mm	10.0 mm	205°	73°	132°	9.80	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	weathered, stem snapped diagonally below shoulder, distal blade edges reworked	Great Basin stemmed, Silver Lake
6775 A393 (A)	n/a	33.1 mm	33.1 mm	10.3 mm	1.00	18.2 mm	1.82	49%	15.0 mm	0.82	14.2 mm	8.9 mm	218°	101°	117°	5.50	Saline Range, CA, Variety 1 (Queen Impostor)	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, all edges damaged & reworked	Great Basin stemmed, Silver Lake
2978 498G3479 (C)	site 859	30.1 mm	30.1 mm	17.9 mm	1.00	27.4 mm	1.10	67%	23.1 mm	0.84	21.4 mm	9.2 mm	225°	98°	127°	6.30	Sawmill Ridge, Casa Diablo, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade heavily reworked	Great Basin stemmed, Silver Lake, N shore Owens Lake near Dolomite station (Campbell class.- Silver Lake)
2713 498G3226B	n/a	24.5 mm	24.5 mm	8.7 mm	1.00	15.9 mm	1.54	42%	8.9 mm	0.56	10.6 mm	6.5 mm	221°	86°	135°	2.05	Sugarloaf Mountain, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered, heavily reworked	Great Basin stemmed, Silver Lake, NE Owens Lake 0.25 W of Dolomite station (Campbell class. - can't determine)
26615 498G3645 (A)	n/a	59.4 mm	59.4 mm	20.6 mm	1.00	28.8 mm	2.06	46%	>14.5 mm	NM	22.1 mm	6.5 mm	198°	82°	116°	>11.20	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	corner of base snapped	Great Basin stemmed, Silver Lake
2850 498G3679	n/a	>52.5 mm	>52.5 mm	29.7 mm	1.00	35.2 mm	NM	NM (LMW=40.5 mm)	17.9 mm	0.51	24.3 mm	6.5 mm	205°	85°	120°	13.00	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade snapped, cortex covers one face	massive point, Great Basin stemmed, Silver Lake
6267 A347 (B)	n/a	40.2 mm	40.0 mm	11.5 mm	1.00	26.8 mm	1.50	43%	21.4 mm	0.80	21.5 mm	7.4 mm	231°	87°	144°	8.50	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	stem damaged, distal blade edges reworked	Great Basin stemmed, Silver Lake
6267 A347 (C)	n/a	34.4 mm	34.1 mm	15.3 mm	0.99	22.2 mm	1.55	49%	11.8 mm	0.53	19.5 mm	6.4 mm	212°	71°	141°	5.20	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	stem damaged, distal blade edges reworked	Great Basin stemmed, Silver Lake
6572 A484 (B)	n/a	48.1 mm	48.1 mm	16.8 mm	1.00	25.8 mm	1.86	41%	19.4 mm	0.75	21.5 mm	6.9 mm	238°	89°	149°	9.00	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	weathered, distal blade edges damaged	Great Basin stemmed, Silver Lake

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
6614 A509 (D)	n/a	27.1 mm	27.1 mm	9.2 mm	1.00	30.0 mm	0.90	40%	20.6 mm	0.69	22.4 mm	7.2 mm	192°	81°	111°	5.15	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	blade heavily reworked, base damaged & reworked	Great Basin stemmed, Silver Lake
6614 A509 (E)	n/a	23.2 mm	23.0 mm	5.3 mm	0.99	18.1 mm	1.28	38%	15.8 mm	0.87	16.2 mm	5.6 mm	236°	98°	138°	2.55	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Silver Lake	*?Gatecliff contracting stem?*	heavily weathered blade appears reworked	Great Basin stemmed, Silver Lake
6437 A369 (A)	n/a	27.2 mm	26.6 mm	9.8 mm	0.98	18.3 mm	1.49	42%	17.7 mm	0.97	15.6 mm	6.1 mm	199°	117°	82°	3.10	Fish Springs, Owens Valley, CA	Great Basin stemmed, Stanislaus	*?Elko corner notched?*	heavily weathered, distal blade edges reworked, one base tang snapped	Great Basin stemmed, Stanislaus broad stem
6775 A393 (D)	n/a	32.1 mm	31.7 mm	9.7 mm	0.99	21.0 mm	1.53	33%	16.5 mm	0.79	16.0 mm	6.3 mm	230°	94°	136°	4.35	Joshua Ridge, Coso Volcanic Field, CA	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	heavily weathered, damaged & reworked, 1 shoulder very weak	Great Basin stemmed, Stanislaus broad stem
2867 498G3461 (B)	site 797	18.8 mm	18.3 mm	11.5 mm	0.97	15.7 mm	1.20	62%	13.9 mm	0.89	13.5 mm	6.0 mm	241°	97°	144°	1.70	Saline Range, CA, Variety 3	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	heavily weathered, blade heavily reworked	Great Basin stemmed, Stanislaus broad stem, N shore Owens Lake near Dolomite station (Campbell class.- don't know, Pinto-like)
6988 K606 (A)	n/a	>30.7 mm	>29.6 mm	13.1 mm	0.96	23.1 mm	NM	NM (LMW=23.0 mm)	15.2 mm	0.66	17.3 mm	8.8 mm	222°	76°	146°	>7.20	Sawmill Ridge, Casa Diablo, CA	Great Basin stemmed, Stanislaus	*?Gatecliff split stem?*	heavily weathered, blade heavily damaged & reworked	Great Basin stemmed, Stanislaus broad stem
6988 K606 (B)	n/a	22.9 mm	21.7 mm	9.7 mm	0.95	20.2 mm	1.13	46%	17.3 mm	0.86	17.4 mm	7.1 mm	217°	86°	131°	3.65	Unknown 16	Great Basin stemmed, Stanislaus	*?Gatecliff split stem?*	heavily weathered, appears distal end damaged & reworked	Great Basin stemmed, Stanislaus broad stem
2827	n/a	23.4 mm	22.5 mm	9.2 mm	0.96	18.7 mm	1.25	48%	17.9 mm	0.96	15.4 mm	5.7 mm	226°	125°	101°	2.50	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Stanislaus	*?Elko corner notched?*	distal blade edges reworked, heavily weathered	Great Basin stemmed, Stanislaus broad stem
2713 498G3226A	site 837	19.7 mm	19.0 mm	8.0 mm	0.96	17.8 mm	1.11	44%	13.9 mm	0.78	14.1 mm	5.7 mm	231°	87°	144°	1.90	West Sugarloaf, Coso Volcanic Field, CA	Great Basin stemmed, Stanislaus	*?Gatecliff contracting stem?*	heavily weathered, heavily reworked	Great Basin stemmed, Stanislaus broad stem, NE Owens Lake 0.25 W of Dolomite station (Campbell class. - can't determine)
6760 A539	n/a	38.7 mm	37.3 mm	12.9 mm	0.96	23.3 mm	1.66	37%	17.4 mm	0.75	16.2 mm	7.2 mm	224°	95°	129°	5.00	Mount Hicks, NV	Great Basin stemmed, Stanislaus	*?Gatecliff split stem?*	distal blade edges heavily reworked, weathered	Great Basin stemmed, Stanislaus broad stem
6267 A347 (D)	n/a	>28.9 mm	>26.3 mm	N/A	0.91	19.2 mm	NM	0%	19.2 mm	1.00	N/A	8.2 mm	N/A	N/A	N/A	6.15	Queen/Truman Meadows, CA/NV	Great Basin fluted	out-of-key	heavily weathered, distal end snapped	Great Basin fluted
6356 A424 (B)	n/a	>20.7 mm	>19.2 mm	N/A	0.93	≈27.4 mm	NM	NM	24.0 mm	0.88	N/A	6.9 mm	N/A	N/A	N/A	>5.15	Sawmill Ridge, Casa Diablo, CA	Great Basin fluted	*?Humboldt?*	snapped at haft element, base chipped, heavily weathered	Great Basin fluted point stem (Big Smoky on cat. sheet, Melanie, JTNP, stated cat. sheet incorrect, actually Owens River Valley)
6572 A484 (C)	n/a	42.4 mm	42.4 mm	N/A	1.00	25.2 mm	1.68	42%	10.1 mm	0.40	N/A	5.5 mm	N/A	N/A	N/A	6.60	Fish Springs, Owens Valley, CA	Unknown large leaf shaped	out-of-key	weathered, all edges exhibit wear & use damage	large, leaf shaped point (spear to large dart-sized)
6572 A484 (A)	n/a	49.7 mm	49.7 mm	N/A	1.00	24.7 mm	2.01	56%	14.0 mm	0.57	N/A	9.4 mm	N/A	N/A	N/A	10.10	West Sugarloaf, Coso Volcanic Field, CA	Unknown large leaf shaped	out-of-key	weathered, all edges exhibit wear & use damage	large, leaf shaped point (spear to large dart-sized)
8939 A414	n/a	42.6 mm	41.0 mm	N/A	0.96	21.1 mm	2.02	37%	>18.9 mm	NM	N/A	8.4 mm	N/A	N/A	N/A	6.40	Fish Springs, Owens Valley, CA	Unknown shoulderless concave-base	out-of-key	one base tang snapped, weathered	
6317 A455 (B)	n/a	24.9 mm	24.1 mm	N/A	0.97	16.2 mm	1.54	10%	14.1 mm	0.87	N/A	7.1 mm	N/A	N/A	N/A	2.25	Saline Range, CA, Variety 1 (Queen Impostor)	Unknown shoulderless concave-base	out-of-key	heavily weathered	either a very thick, shoulderless point or Great Basin stemmed stem fragment
6614 A509 (C)	n/a	27.1 mm	26.0 mm	N/A	0.96	15.3 mm	1.77	0%	15.3 mm	1.00	N/A	8.2 mm	N/A	N/A	N/A	3.50	Sugarloaf Mountain, Coso Volcanic Field, CA	Unknown shoulderless concave-base	out-of-key	heavily weathered, tip appears reworked	very thick, medium-sized, shoulderless, concave-base triangular point
University of California, Davis Anthropology Museum, Deep Springs Valley, CA collection, n=106																					
354-1052	n/a	>13.5 mm	>12.8 mm	N/A	0.95	13.7 mm	NM	0%	13.7 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.50	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped, large hydration analysis notch	
354-186	n/a	>19.7 mm	>19.7 mm	N/A	1.00	15.8 mm	NM	0%	15.8 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	>0.95	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	tip snapped, blade edges heavily worn	
354-264	n/a	>14.0 mm	>14.0 mm	N/A	1.00	18.4 mm	NM	0%	18.4 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	>0.70	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped	
354-582	n/a	21.3 mm	21.3 mm	N/A	1.00	9.8 mm	2.17	12%	8.0 mm	0.82	N/A	3.7 mm	N/A	N/A	N/A	0.50	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	blade edges slightly serrated & worn	
354-660	n/a	>17.5 mm	>17.5 mm	N/A	1.00	13.6 mm	NM	0%	13.6 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.60	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	tip snapped, blade edges slightly worn	
354-662	n/a	>17.2 mm	>16.7 mm	N/A	0.97	≈16.3 mm	NM	0%	≈16.3 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	>0.90	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped, one corner base chipped, blade edges heavily worn	
354-924	n/a	>9.2 mm	>9.2 mm	N/A	1.00	13.1 mm	NM	0%	13.1 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	>0.30	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped (haft element only), large hydration analysis notch	
354-979	n/a	>12.7 mm	>11.4 mm	N/A	0.90	10.7 mm	NM	0%	10.7 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	>0.35	Fish Springs, Owens Valley, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped, blade edges worn, large hydration analysis notch	
354-203	n/a	>13.5 mm	>12.3 mm	N/A	0.91	16.7 mm	NM	0%	16.7 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	>0.70	Joshua Ridge, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped, blade edges worn	
354-923	n/a	>16.0 mm	>15.2 mm	N/A	0.95	11.5 mm	NM	0%	11.5 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.60	Lookout Mountain, Casa Diablo, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped, blade edges worn, weak hafting notches	
354-1015	n/a	20.8 mm	19.5 mm	N/A	0.94	11.7 mm	1.78	0%	11.7 mm	1.00	N/A	2.6 mm	N/A	N/A	N/A	>0.40	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	blade edges slightly serrated, large hydration analysis notch	
354-522	n/a	>11.2 mm	>11.2 mm	N/A	1.00	13.1 mm	NM	0%	13.1 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	>0.30	Queen/Truman Meadows, CA/NV	Cottonwood triangular	Cottonwood triangular	distal end snapped diagonally	mahogany obsidian
354-263	n/a	>20.7 mm	>20.7 mm	N/A	1.00	16.6 mm	NM	0%	16.6 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>1.00	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped, blade edges worn	
354-609	n/a	18.1 mm	18.1 mm	N/A	1.00	10.2 mm	1.77	12%	8.6 mm	0.84	N/A	3.4 mm	N/A	N/A	N/A	0.60	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	edges worn, especially tip and at hafting points - weak hafting notches	
354-894	n/a	>16.3 mm	>16.0 mm	N/A	0.98	>10.0 mm	NM	0%	>10.0 mm	1.00	N/A	2.2 mm	N/A	N/A	N/A	>0.35	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	tip snapped, one corner base snapped, blade edges heavily worn	
354-991	n/a	>12.7 mm	>10.1 mm	N/A	0.80	10.4 mm	NM	0%	10.4 mm	1.00	N/A	2.4 mm	N/A	N/A	N/A	>0.25	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	Cottonwood triangular	distal end step-snapped	minimal pressure-flaking
354-92	n/a	20.3 mm	20.0 mm	N/A	0.99	9.8 mm	2.07	0%	9.8 mm	1.00	N/A	4.5 mm	N/A	N/A	N/A	0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Cottonwood triangular	out-of-key	blade edges slightly worn	looks like Cottonwood but too thick
354-111	n/a	>16.3 mm	>12.7 mm	5.4 mm	NM	>11.1 mm	NM	0%	>11.1 mm	1.00	7.7 mm	2.4 mm	218°	123°	95°	>0.25	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	blade edges worn, bottom of base snapped diagonally, large hydration analysis notch	sub-type indeterminable
354-1182	n/a	20.9 mm	19.1 mm	7.8 mm	0.91	11.2 mm	1.87	0%	11.2 mm	1.00	7.0 mm	2.8 mm	210°	151°	61°	0.50	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	blade edges worn, one base tang chipped	Delta side notched
354-201	n/a	>11.1 mm	>8.3 mm	9.0 mm	0.75	13.1 mm	NM	0%	13.1 mm	1.00	4.9 mm	2.9 mm	256°	172°	84°	>0.25	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	blade snapped above shoulders, shoulder tangs damaged, large hydration analysis notch	probably Sierra side notched
354-556	n/a	21.4 mm	17.6 mm	10.0 mm	0.82	18.3 mm	1.17	0%	18.3 mm	1.00	7.2 mm	2.6 mm	172°	161°	11°	0.60	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	blade edges worn, especially toward tip	Sierra side notched
354-922	n/a	26.4 mm	23.3 mm	7.5 mm	0.88	14.7 mm	1.80	0%	14.7 mm	1.00	9.5 mm	3.0 mm	220°	154°	64°	>0.80	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	blade edges worn, large hydration analysis notch	Delta side notched
354-93	n/a	>13.8 mm	>9.0 mm	5.8 mm	0.69	12.7 mm	NM	0%	12.7 mm	1.00	7.7 mm	3.0 mm	245°	135°	110°	>0.30	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	distal end snapped, blade edges worn, large hydration analysis notch snapped base tang	probably Delta side notched
354-990	n/a	>14.4 mm	>14.4 mm	>4.7 mm	NM	>13.7 mm	NM	0%	>13.7 mm	1.00	8.1 mm	3.0 mm	198°	145°	53°	>0.45	Fish Springs, Owens Valley, CA	Desert side notched	Desert side notched	blade edges worn, base edge snapped, large hydration analysis notch	indeterminable sub-type
354-557	n/a	22.4 mm	21.8 mm	7.2 mm	0.97	14.2 mm	1.58	0%	14.2 mm	1.00	6.3 mm	3.3 mm	168°	163°	5°	0.80	Mono Glass Mountain, CA	Desert side notched	Desert side notched	blade edges slightly worn, tip chipped	Redding side notched
354-659	n/a	14.9 mm	14.7 mm	3.8 mm	0.99	>10.2 mm	NM	0%	>10.2 mm	1.00	8.4 mm	2.5 mm	221°	162°	59°	>0.30	Montezuma Range, NV	Desert side notched	Desert side notched	blade edges worn, one base tang snapped	Desert side notched type
354-578	n/a	20.8 mm	18.8 mm	7.1 mm	0.90	14.4 mm	1.44	0%	14.4 mm	1.00	5.8 mm	2.5 mm	189°	187°	2°	0.50	Queen/Truman Meadows, CA/NV	Desert side notched	Desert side notched	tip & blade edges worn, one corner base chipped	Sierra side notched
354-1006	n/a	12.0 mm	NM	4.8 mm	NM	11.5 mm	1.04	0%	11.5 mm	1.00	7.2 mm	2.5 mm	228°	164°	64°	>0.25	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges & tip damaged/reworked, large hydration notch cut through base indentation	indeterminable sub-type
354-1051	n/a	20.4 mm	18.5 mm	6.0 mm	0.91	10.5 mm	1.94	0%	10.5 mm	1.00	7.7 mm	2.6 mm	219°	155°	64°	0.30	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges worn & reworked	unknown sub-type - small base tangs, proportionately wide neck, & wide, rounded basal indentation
354-1123	n/a	13.0 mm	11.8 mm	4.5 mm	0.91	11.3 mm	1.15	0%	11.3 mm	1.00	8.4 mm	2.3 mm	209°	133°	76°	>0.30	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges damaged & reworked, bottom edge of half of base snapped	probably Delta side notched
354-1131	n/a	>13.5 mm	>10.7 mm	7.2 mm	0.79	14.6 mm	NM	0%	14.6 mm	1.00	7.0 mm	2.8 mm	221°	172°	49°	>0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges & tip snapped, one corner of base tang snapped	Sierra side notched
354-1249	n/a	17.0 mm	14.0 mm	7.4 mm	0.82	11.5 mm	1.48	0%	11.5 mm	1.00	8.2 mm	2.7 mm	213°	136°	77°	0.40	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edge near tip damaged & partly reworked, blade edges worn	Delta side notched
354-130	n/a	9.6 mm	6.0 mm	8.0 mm	0.63	11.8 mm	0.81	0%	11.8 mm	1.00	5.7 mm	2.0 mm	242°	170°	72°	>0.15	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade apparently snapped above shoulders & reworked to form point, hydration notch	Sierra side notched
354-202	n/a	>16.7 mm	>12.8 mm	5.3 mm	0.77	>11.8 mm	NM	0%	>11.8 mm	1.00	9.2 mm	2.1 mm	198°	145°	53°	>0.30	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges damaged, distal end snapped, one base tang snapped	probably Delta side notched
354-519	n/a	26.8 mm	22.5 mm	7.7 mm	0.84	14.3 mm	1.87	0%	14.3 mm	1.00	8.6 mm	3.1 mm	236°	157°	79°	0.70	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges worn	Delta side notched
354-921	n/a	15.5 mm	12.7 mm	4.1 mm	0.82	11.4 mm	1.36	0%	11.4 mm	1.00	8.8 mm	2.1 mm	220°	152°	68°	0.30	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edges worn	unknown sub-type - small base tangs, proportionately wide neck, & wide, rounded basal indentation
354-973	n/a	18.6 mm	16.4 mm	7.0 mm	0.88	>11.0 mm	NM	0%	>11.0 mm	1.00	7.2 mm	3.1 mm	192°	164°	28°	>0.50	Saline Range, CA, Variety 1 (Queen Impostor)	Desert side notched	Desert side notched	blade edge heavily worn, especially toward tip, one base tang snapped	Sierra side notched
354-429	n/a	31.0 mm	31.0 mm	2.9 mm	1.00	18.7 mm	1.66	12%	8.4 mm	0.45	9.9 mm	3.8 mm	151°	47°	104°	>1.70	Fish Springs, Owens Valley, CA	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn, especially tip, large hydration analysis notch	looks most similar to contracting stem Eastgate - possibly Parowan basal notched??
354-1162	n/a	>19.3 mm	>19.3 mm	2.3 mm	1.00	>15.9 mm	NM	NM (LMW=1.8 mm)	>6.4 mm	NM	>7.9 mm	3.1 mm	116°	74°	42°	>0.95	Lookout Mountain, Casa Diablo, CA	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped in 2 directions, one shoulder tang snapped, blade edges worn	looks most similar to contracting stem Eastgate - possibly Parowan basal notched??
354-308	n/a	>17.7 mm	>17.7 mm	5.0 mm	1.00	21.8 mm	NM	NM (LMW=6.8 mm)	12.4 mm	0.57	10.5 mm	4.1 mm	133°	110°	23°	>1.40	Fish Springs, Owens Valley, CA	Rosegate	*?Elko corner notched?*	distal end snapped, one shoulder tang snapped, large hydration analysis notch	based on thickness, looks more like a large-based Rosegate, Rose Springs type
354-841	n/a	>15.7 mm	>15.7 mm	3.9 mm	1.00	>14.2 mm	NM	NM (LMW=4.4 mm)	10.5 mm	NM	9.7 mm	3.0 mm	165°	107°	58°	>0.65	Fish Springs, Owens Valley, CA	Rosegate	*?Elko corner notched?*	distal end snapped, one shoulder snapped, large hydration analysis notch	based on thickness, LS, looks more like a large-based Rosegate, Rose Springs type
354-229	n/a	>21.8 mm	>21.5 mm	4.8 mm	0.99	19.2 mm	NM	NM (LMW=4.8 mm)	10.3 mm	0.54	9.1 mm	3.4 mm	122°	92°	30°	>1.35	Fish Springs, Owens Valley, CA	Rosegate	*?Gatecliff contracting stem?*	distal end & 1 blade edge snapped, 1 shoulder tang reworked, large hydration notch	looks most like a Rosegate (Eastgate type) with slightly large base
354-611	n/a	>21.4 mm	>21.4 mm	3.5 mm	1.00	13.6 mm	NM	NM (LMW=5.1 mm)	7.3 mm	0.54	7.0 mm	4.3 mm	164°	98°	66°	>1.30	Fish Springs, Owens Valley, CA	Rosegate	out-of-key	distal end snapped, blade edges heavily worn	looks like Rosegate - Rose Springs type
354-1130	n/a	>11.3 mm	>11.3 mm	4.9 mm	1.00	>12.6 mm	NM	NM (LMW=2.0 mm)	7.0 mm	NM	>6.3 mm	3.4 mm	112°	101°	11°	>0.35	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	blade snapped above neck, one shoulder tang snapped	Eastgate type
354-453	n/a	>22.7 mm	>22.7 mm	3.9 mm	1.00	16.4 mm	NM	NM (LMW=3.0 mm)	8.0 mm	0.49	7.5 mm	3.8 mm	145°	121°	24°	>1.25	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	distal end snapped, blade edges worn, base corners chipped, large hydration notch	appearance in between Rose Springs and Eastgate types
354-610	n/a	26.2 mm	25.5 mm	4.7 mm	0.97	14.0 mm	1.91	24%	9.5 mm	0.68	8.7 mm	3.9 mm	178°	99°	79°	1.55	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	blade edges worn & reworked	Rose Springs type
354-963	n/a	>20.2 mm	>19.3 mm	4.3 mm	0.96	16.5 mm	NM	NM (LMW=7.0 mm)	>8.5 mm	NM	8.6 mm	4.0 mm	112°	110°	2°	>1.20	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	distal end snapped, bottom edge & 1 corner of base snapped, 1 blade edge reworked, large hydration analysis notch	Rose Springs type - base would be more than 0.5 > neck if corner was intact
354-967	n/a	>23.2 mm	>23.2 mm	2.8 mm	1.00	>17.9 mm	NM	NM (LMW=4.5 mm)	9.1 mm	NM	8.6 mm	3.5 mm	149°	107°	42°	>1.20	Fish Springs, Owens Valley, CA	Rosegate	Rosegate	tip snapped, one shoulder tang snapped, large hydration analysis notch	Eastgate type
354-1198	n/a	30.2 mm	28.3 mm	5.4 mm	0.94	>17.0 mm	NM	NM	>7.3 mm	NM	NM	3.3 mm	NM	118°	NM	>1.10	Lookout Mountain, Casa Diablo, CA	Rosegate	Rosegate	shoulder tangs snapped, half of base snapped, blade edges worn, especially tip	based on position of shoulder breaks, probably Eastgate type
354-199	n/a	>14.6 mm	>13.7 mm	4.3 mm	1.00	18.3 mm	NM	NM (LMW=4.4 mm)	9.7 mm	0.53	9.2 mm	3.2 mm	125°	105°	20°	>0.80	Lookout Mountain, Casa Diablo, CA	Rosegate	Rosegate	distal end snapped	Rose Springs type
354-310	n/a	>17.8 mm	>17.8 mm	4.4 mm	1.00	>18.1 mm	NM	NM (LMW=5.7 mm)	10.6 mm	NM	10.1 mm	3.6 mm	118°	97°	21°	>1.05	Mono Glass Mountain, CA	Rosegate	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang snapped, blade edge worn	looks most like a slightly large Rosegate (Eastgate type)
354-309	n/a	>15.6 mm	>15.6 mm	3.8 mm	1.00	>19.5 mm	NM	NM	11.8 mm	NM	11.2 mm	3.5 mm	129°	102°	27°	>0.90	Mono Glass Mountain, CA	Rosegate	out-of-key	blade snapped above neck, one shoulder tang snapped	looks most like a slightly large Rosegate (Eastgate type) with pointed, rather than rounded, shoulder barbs
354-1245	n/a	>18.0 mm	>18.0 mm	4.7 mm	1.00	>21.6 mm	NM	NM (LMW=8.4 mm)	>6.5 mm	NM	>9.6 mm	3.2 mm	129°	73°	56°	>1.10	Montezuma Range, NV	Rosegate	*?Gatecliff contracting stem?*	blade snapped above neck, one shoulder tang snapped, blade edge worn, base reworked	looks most like a slightly large Rosegate (Eastgate type)
354-1166	n/a	>18.7 mm	>18.7 mm	>2.4 mm	NM	25.4 mm	NM	NM	>8.9 mm	NM	9.0 mm	3.5 mm	118°	104°	14°	>1.70	Montezuma Range, NV	Rosegate	Rosegate	distal end snapped, base edge snapped, blade edges worn, one shoulder tang reworked	Eastgate type
354-418	n/a	>20.7 mm	>20.7 mm	6.5 mm	1.00	>14.4 mm	NM	NM (LMW=1.7 mm)	7.4 mm	NM	6.9 mm	4.3 mm	130°	98°	32°	>1.05	Obsidian Butte, NV, Variety 4	Rosegate	Rosegate	distal end snapped, blade edges worn, large hydration analysis notch	exceptionally deep shoulder notch
354-365	n/a	>16.4 mm	>16.4 mm	5.9 mm	1.00	>19.4 mm	NM	NM (LMW=5.1 mm)	14.0 mm	NM	10.6 mm	3.0 mm	147°	133°	14°	>0.90	Queen/Truman Meadows, CA/NV	Rosegate	*?Elko corner notched?*	distal end snapped, one shoulder snapped, large hydration analysis notch	looks most like a slightly large Rosegate (Eastgate type)
354-1190	n/a	>18.4 mm	>18.4 mm	4.2 mm	1.00	15.8 mm	NM	NM (LMW=5.9 mm)	9.8 mm	0.62	8.8 mm	3.8 mm	137°	113°	24°	>1.15	Queen/Truman Meadows, CA/NV	Rosegate	Rosegate	distal end snapped, blade edges heavily worn, one shoulder reworked	
354-1191	n/a	>11.0 mm	>11.0 mm	4.5 mm	1.00	>10.3 mm	NM	NM (LMW=5.4 mm)	>8.0 mm	NM	>7.0 mm	2.6 mm	172°	127°	45°	>0.35	Queen/Truman Meadows, CA/NV	Rosegate	Rosegate	blade snapped above shoulder, 1 shoulder snapped	Rose Springs type - possibly pitch on base
354-61	n/a	>14.9 mm	>14.9 mm	5.9 mm	1.00	19.8 mm	NM	NM (LMW=6.9 mm)	13.4 mm	0.68	12.0 mm	3.7 mm	140°	137°	3°	>0.90	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	*?Elko corner notched?*	blade snapped above shoulders, blade edges damaged, large hydration analysis notch	based on thickness, looks more like a large base Rose Springs type
354-62	n/a	22.0 mm	20.9 mm	6.4 mm	0.95	>18.8 mm	>1.17	15%	11.9 mm	0.63	10.2 mm	3.8 mm	154°	127°	27°	>1.05	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	*?Elko corner notched?*	blade edges worn , 1 shoulder tang snapped	definitely arrow point size, most similar to Rosegate cluster, Eastgate split stem
354-558	n/a	27.7 mm	27.7 mm	6.7 mm	1.00	15.8 mm	1.75	28%	>8.3 mm	NM	7.4 mm	4.4 mm	148°	130°	18°	>1.60	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	blade edges heavily reworked/damaged, base tangs chipped	Rose Springs type
354-96	n/a	>19.0 mm	>19.0 mm	4.2 mm	1.00	>12.8 mm	NM	NM (LMW=5.0 mm)	9.1 mm	NM	6.5 mm	3.9 mm	148°	117°	31°	>0.95	Saline Range, CA, Variety 1 (Queen Impostor)	Rosegate	Rosegate	distal end snapped, blade edges heavily damaged, one shoulder tang snapped	Rose Springs type
354-66	n/a	>16.5 mm	>15.1 mm	6.6 mm	0.92	>21.5 mm	NM	NM (LMW=4.7 mm)	12.9 mm	NM	11.3 mm	2.9 mm	138°	121°	17°	>0.90	Sawmill Ridge, Casa Diablo, CA	Rosegate	*?Elko eared?*	blade snapped diagonally above neck, one shoulder tang snapped	looks most like a slightly large Rosegate (Eastgate type)
354-261	n/a	>13.5 mm	>13.5 mm	4.6 mm	1.00	>19.2 mm	NM	NM (LMW=1.6 mm)	12.2 mm	NM	10.3 mm	3.7 mm	121°	101°	20°	>0.65	Sawmill Ridge, Casa Diablo, CA	Rosegate	*?Gatecliff contracting stem?*	blade snapped above neck, one shoulder tang snapped, blade edge worn	looks most like a slightly large Rosegate (Eastgate type)
354-97	n/a	>18.5 mm	>18.5 mm	4.6 mm	1.00	14.7 mm	NM	NM (LMW=6.6 mm)	>7.4 mm	NM	7.8 mm	3.9 mm	151°	114°	47°	>0.95	Silver Peak/Fish Lake Valley, NV	Rosegate	Rosegate	distal end snapped, one shoulder tang chipped, one corner of base snapped	Rose Springs type
354-1291	n/a	>16.4 mm	>16.4 mm	6.5 mm	1.00	>21.0 mm	NM	NM (LMW=6.5 mm)	15.3 mm	NM	13.4 mm	5.4 mm	178°	115°	63°	>1.80	Fish Springs, Owens Valley, CA	Elko corner notched	Elko corner notched	distal end snapped, 1 shoulder snapped	
354-489	n/a	>17.6 mm	>17.6 mm	4.9 mm	1.00	23.3 mm	NM	NM (LMW=8.1 mm)	15.2 mm	0.65	13.7 mm	5.3 mm	148°	135°	13°	>1.65	Fish Springs, Owens Valley, CA	Elko corner notched	Elko corner notched	blade snapped above shoulders, 1 shoulder tang snapped, large hydration analysis notch	
354-580	n/a	>20.6 mm	>20.5 mm	4.9 mm	0.995	17.8 mm	NM	NM (LMW=6.9 mm)	11.2 mm	0.63	10.2 mm	5.4 mm	156°	123°	92°	>1.65	Fish Springs, Owens Valley, CA	Elko corner notched	Elko corner notched	distal end snapped, blade edges heavily damaged, one corner of base chipped	
354-654	n/a	>25.2 mm	>23.8 mm	7.4 mm	0.94	24.2 mm	NM	NM (LMW=7.8 mm)	>11.4 mm	NM	11.1 mm	6.8 mm	148°	140°	8°	>3.60	Fish Springs, Owens Valley, CA	Elko corner notched	Elko corner notched	distal end snapped, 1 base tang snapped, blade edges worn	
354-1155	n/a	>45.4 mm	>44.8 mm	6.7 mm	0.99	26.5 mm	NM	NM (LMW=13.1 mm)	13.0 mm	0.49	12.7 mm	4.9 mm	135°	127°	28°	>7.15	Obsidian Butte, NV, Variety 3	Elko corner notched	Elko corner notched	distal end snapped, 1 base & shoulder tang chipped, blade edges worn	based on wear patterns & size, possibly a hafted knife blade rather than a point
354-718	n/a	>19.0 mm	>19.0 mm	8.8 mm	1.00	27.4 mm	NM	NM (LMW=7.7 mm)	18.9 mm	0.69	12.9 mm	4.8 mm	139°	135°	4°	>2.05	Queen/Truman Meadows, CA/NV	Elko corner notched	Elko corner notched	blade snapped at haft element	Fish Slough side notched according to Delacorte but appears corner notched - PSA 135°
354-783	n/a	>18.2 mm	>18.2 mm	9.5 mm	1.00	>19.2 mm	NM	NM (LMW=11.7 mm)	18.1 mm	NM	9.5 mm	5.3 mm	140°	136°	4°	>1.65	Queen/Truman Meadows, CA/NV	Elko corner notched	Elko corner notched	blade snapped above 1 shoulder, 1 shoulder tang snapped	Fish Slough side notched according to Delacorte but appears corner notched - PSA 136°
354-16	n/a	>17.2 mm	>17.2 mm	9.3 mm	1.00	>24.8 mm	NM	NM	23.5 mm	NM	15.9 mm	6.2 mm	175°	149°	26°	>1.95	Saline Range, CA, Variety 1 (Queen Impostor)	Elko corner notched	Elko corner notched	blade snapped diagonally from above 1 shoulder to below opposing shoulder	Fish Slough side notched according to Delacorte
354-34	n/a	>21.0 mm	>21.0 mm	9.4 mm	1.00	32.4 mm	NM	NM (LMW=12.2 mm)	>19.6 mm	NM	17.7 mm	5.8 mm	157°	143°	14°	>3.95	Saline Range, CA, Variety 1 (Queen Impostor)	Elko corner notched	Elko corner notched	blade snapped above haft element, 1 base tang chipped, other tang appears snapped	Fish Slough side notched according to Delacorte but appears corner notched - PSA 143°, WM well above & >WB
354-47	n/a	>26.3 mm	>26.3 mm	9.0 mm	1.00	22.1 mm	NM	NM (LMW=8.5 mm)	15.2 mm	0.69	9.0 mm	5.1 mm	152°	139°	13°	>2.60	Saline Range, CA, Variety 1 (Queen Impostor)	Elko corner notched	Elko corner notched	distal end snapped, blade edges worn	
354-7	n/a	>18.8 mm	>18.8 mm	8.7 mm	1.00	>23.3 mm	NM	NM (LMW=12.8 mm)	23.3 mm	NM	12.7 mm	5.6 mm	196°	136°	60°	>2.20	Saline Range, CA, Variety 1 (Queen Impostor)	Elko corner notched	Elko corner notched	blade snapped diagonally through 1 shoulder, other shoulder chipped, hydration notch	Fish Slough side notched according to Delacorte appears corner notched point - PSA 136°
354-917	n/a	>19.9 mm	>19.9 mm	7.0 mm	1.00	>16.1 mm	NM	NM (LMW=7.7 mm)	12.5 mm	NM	8.8 mm	3.7 mm	151°	139°	12°	>0.85	Saline Range, CA, Variety 1 (Queen Impostor)	Elko corner notched	Elko corner notched	blade snapped diagonally from below tip to neck, large hydration analysis notch	
354-748	n/a	>20.5 mm	>20.5 mm	8.0 mm	1.00	>22.3 mm	NM	NM	>17.5 mm	NM	15.6 mm	6.7 mm	147°	127°	20°	>2.80	Sawmill Ridge, Casa Diablo, CA	Elko corner notched	Elko corner notched	blade snapped above shoulders, base tangs chipped, blade edge heavily worn	Fish Slough side notched according to Delacorte but appears corner notched - PSA 127°
354-774	n/a	>27.9 mm	>27.9 mm	10.5 mm	1.00	>26.0 mm	NM	NM (LMW=12.6 mm)	22.5 mm	NM	15.4 mm	7.7 mm	173°	141°	32°	>4.75	Silver Peak/Fish Lake Valley, NV	Elko corner notched	Elko corner notched	distal end snapped & reworked, 1 shoulder snapped, base edge chipped	Fish Slough side notched according to Delacorte but appears corner notched - PSA 141°
354-1073	n/a	>26.2 mm	>26.2 mm	6.5 mm	1.00	18.4 mm	NM	NM (LMW=9.2 mm	16.5 mm	0.90	11.3 mm	6.2 mm	157°	144°	13°	>2.70	Wildhorse Canyon, Mineral Mountains, UT	Elko corner notched	Elko corner notched	tip snapped, 1 corner notch reworked, blade edges heavily worn	
354-1013	n/a	>17.1 mm	>13.7 mm	7.2 mm	0.80	>23.2 mm	NM	NM (LMW=7.0 mm)	17.0 mm	NM	12.6 mm	4.1 mm	149°	140°	9°	>1.25	Fish Springs, Owens Valley, CA	Elko eared	Elko eared	blade snapped diagonally above haft element, large hydration analysis notch	
354-1199	n/a	>26.8 mm	>21.7 mm	8.1 mm	0.81	24.9 mm	NM	NM (LMW=11.4 mm)	>20.7 mm	NM	16.5 mm	5.4 mm	195°	144°	51°	>3.60	Lookout Mountain, Casa Diablo, CA	Elko eared	Elko eared	distal end snapped, 1 base tang snapped, blade edges heavily worn/damaged	
354-450	n/a	>18.0 mm	>14.2 mm	5.8 mm	0.79	>18.2 mm	NM	NM (LMW=8.2 mm)	16.1 mm	NM	15.3 mm	4.3 mm	192°	132°	60°	>1.20	Saline Range, CA, Variety 1 (Queen Impostor)	Elko eared	Elko eared	blade snapped diagonally above shoulder to neck, 1 base tang chipped, hydration notch	
354-1179	n/a	>25.6 mm	>19.6 mm	8.4 mm	0.77	30.1 mm	NM	NM (LMW=10.6 mm)	>18.8 mm	NM	>18.1 mm	6.8 mm	155°	127°	28°	>4.85	Sawmill Ridge, Casa Diablo, CA	Elko eared	Elko eared	blade snapped above haft element, 1 base tang snapped, 1 shoulder chipped	
354-1002	n/a	>22.2 mm	>19.2 mm	7.6 mm	0.86	30.2 mm	NM	NM (LMW=7.2 mm)	16.3 mm	0.54	14.9 mm	6.6 mm	141°	108°	33°	>3.85	West Sugarloaf, Coso Volcanic Field, CA	Elko eared	Elko eared	blade snapped above haft element	imperfection (bubble) in obsidian at snap
354-1218	n/a	45.6 mm	45.3 mm	5.5 mm	0.996	24.2 mm	1.87	11%	10.2 mm	0.42	10.4 mm	4.4 mm	106°	85°	21°	4.55	Fish Springs, Owens Valley, CA	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped diagonally through 1 base notch (both pieces collected), side notch from hafting worn into blade edge, blade edges worn, especially at tip	
354-1080	n/a	>25.2 mm	>25.2 mm	4.3 mm	1.00	22.7 mm	NM	NM (LMW=7.0 mm)	11.5 mm	0.51	13.3 mm	6.8 mm	177°	81°	96°	>3.60	Lookout Mountain, Casa Diablo, CA	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped & reworked, bottom edge base chipped, blade edges heavily worn	based on usewear patterns, may have been used as a scraping tool
354-1175	n/a	34.9 mm	34.9 mm	5.2 mm	1.00	17.5 mm	1.99	23%	6.0 mm	0.34	6.0 mm	5.1 mm	177°	78°	99°	2.50	Lookout Mountain, Casa Diablo, CA	Gatecliff contracting stem	Gatecliff contracting stem	blade edges heavily worn/damaged	
354-750	n/a	>16.6 mm	>15.4 mm	3.7 mm	0.93	22.9 mm	NM	NM (LMW=6.9 mm)	8.7 mm	0.38	10.5 mm	6.0 mm	164°	79°	85°	>1.90	Mono Glass Mountain, CA	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped above haft element, 1 corner base chipped	
354-495	n/a	33.0 mm	33.0 mm	8.2 mm	1.00	21.9 mm	1.51	29%	9.9 mm	0.45	11.8 mm	5.5 mm	170°	74°	96°	2.70	Queen/Truman Meadows, CA/NV	Gatecliff contracting stem	Gatecliff contracting stem	tip & blade edges slightly worn	blade edges barbed
354-705	n/a	>28.1 mm	>28.1 mm	6.8 mm	1.00	≈25.8 mm	NM	NM (LMW=10.5 mm)	>9.0 mm	NM	>13.3 mm	6.4 mm	132°	69°	63°	>4.90	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, 1 shoulder snapped, both sides base chipped, blade reworked	
354-884	n/a	>27.9 mm	>27.9 mm	6.0 mm	1.00	21.1 mm	NM	NM (LMW=6.7 mm)	6.8 mm	0.32	11.7 mm	4.6 mm	149°	61°	88°	>2.35	Saline Range, CA, Variety 1 (Queen Impostor)	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped diagonally, blade edges worn	
354-1090	n/a	>16.4 mm	>13.3 mm	N/A	0.81	>21.0 mm	NM	NM	15.5 mm	NM	N/A	4.5 mm	N/A	N/A	N/A	>1.20	Montezuma Range, NV	Humboldt	Humboldt	snapped at haft element	weight, WB/WM, & LM would be within Thomas Humboldt discriminants if complete
354-651	n/a	>20.6 mm	>18.6 mm	N/A	0.90	15.0 mm	NM	NM (LMW=16.6 mm)	11.0 mm	0.73	N/A	5.6 mm	N/A	N/A	N/A	>1.75	Queen/Truman Meadows, CA/NV	Humboldt	Humboldt	distal end snapped, blade edges worn, one side haft element reworked	
354-1158	n/a	30.0 mm	28.0 mm	N/A	0.93	19.2 mm	1.56	48%	15.4 mm	0.80	N/A	7.5 mm	N/A	N/A	N/A	>4.05	Saline Range, CA, Variety 1 (Queen Impostor)	Humboldt	Humboldt	tip damaged & reworked, blade edges worn	
354-1170	n/a	>44.0 mm	>38.0 mm	N/A	0.86	27.7 mm	NM	NM (LMW=13.2 mm)	≈23.6 mm	≈0.85	N/A	6.2 mm	N/A	N/A	N/A	>8.20	Saline Range, CA, Variety 1 (Queen Impostor)	Humboldt	Humboldt	1 base tang snapped, distal end snapped & reworked, blade edges heavily damaged, slight notches worn into haft element	based on wear patterns & size, possibly a hafted knife blade rather than a point
354-1171	n/a	47.4 mm	41.0 mm	N/A	0.86	24.9 mm	1.90	28%	20.9 mm	0.84	N/A	5.6 mm	N/A	N/A	N/A	6.45	Sawmill Ridge, Casa Diablo, CA	Humboldt	Humboldt	blade edges heavily worn, tip reworked, slight notch worn into haft element	based on wear patterns & size, possibly a hafted knife blade rather than a point
354-827	n/a	>16.4 mm	>13.6 mm	11.3 mm	0.83	NM	NM	NM	22.3 mm	NM	15.7 mm	5.6 mm	184°	169°	15°	>1.50	Fish Springs, Owens Valley, CA	Large side notched, Northern	Large side notched	blade snapped above neck	Northern side notched - Fish Slough side notched according to Delacorte, but concave base does not fit Basgall et al (1995) definition of type
354-749	n/a	26.5 mm	25.4 mm	10.2 mm	0.96	>21.1 mm	NM	0%	>21.1 mm	1.00	14.7 mm	4.8 mm	161°	164°	3°	>2.70	Silver Peak/Fish Lake Valley, NV	Large side notched, Northern	Large side notched	blade edges heavily reworked, especially tip, one edge 0f base snapped	Northern side notched - Fish Slough side notched according to Delacorte, but concave base does not fit Basgall et al (1995) definition of type
354-1	n/a	>22.1 mm	>22.1 mm	9.7 mm	1.00	21.7 mm	NM	NM (LMW=12.1 mm)	18.9 mm	0.87	17.5 mm	4.7 mm	156°	154°	7°	>2.00	Montezuma Range, NV	Large side notched, Fish Slough	Large side notched	distal end snapped, shoulder tangs worn, blade edges worn/possibly reworked	looks like Elko side notched - Fish Slough side notched according to Delacorte
354-2	n/a	>24.0 mm	>24.0 mm	10.0 mm	1.00	>19.3 mm	NM	NM	>19.3 mm	NM	11.4 mm	5.2 mm	193°	167°	34°	>1.85	Sawmill Ridge, Casa Diablo, CA	Large side notched, Fish Slough	Large side notched	blade heavily damaged & extensively reworked, 1 base tang chipped	looks like Elko side notched - Fish Slough side notched according to Delacorte
354-794	n/a	>29.0 mm	>23.0 mm	9.7 mm	0.79	28.4 mm	NM	NM (LMW=10.8 mm)	25.5 mm	0.90	23.5 mm	7.7 mm	195°	120°	75°	>6.30	Lookout Mountain, Casa Diablo, CA	Pinto	*?Elko eared?*	distal end snapped, blade partly reworked	WB, WN, & thickness seem exceptionally large for Elko. LS/LM and WB/WM in Basgall & Hall (2000) Pinto range
354-695	n/a	>29.4 mm	>25.3 mm	10.2 mm	0.86	23.2 mm	NM	NM (LMW=12.2 mm)	17.9 mm	0.77	15.8 mm	5.6 mm	163°	100°	30°	>3.55	Obsidian Butte, NV, Variety 5 (Unknown C)	Pinto	*?Gatecliff split stem?*	tip snapped, blade edges heavily worn	Pinto - meets Basgall & Hall (2000) discriminants except DSA
354-877	n/a	41.0 mm	38.5 mm	18.2 mm	0.94	22.3 mm	1.84	49%	16.6 mm	0.74	16.5 mm	7.9 mm	227°	96°	131°	>5.90	Queen/Truman Meadows, CA/NV	Pinto	*?Gatecliff split stem?*	blade reworked, especially toward tip, large hydration analysis notch	looks like a long-stemmed Pinto (cross between GBS & Pinto). LS/LM=0.44 (too high), WB/WM=0.74 (slightly low), DSA about right for Basgall& Hall (2000) Pinto definition
354-448	n/a	40.4 mm	36.5 mm	10.4 mm	0.90	28.5 mm	1.42	28%	26.7 mm	0.94	22.4 mm	5.6 mm	170°	147°	23°	5.35	Saline Range, CA, Variety 1 (Queen Impostor)	Pinto	*?Elko eared?*	blade edges heavily reworked, 1 base tang chipped	WB & WN seem exceptionally large for Elko. LS/LM=0.26, Basgall & Hall (2000) Pinto range

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
354-699	n/a	>49.2 mm	>41.8 mm	10.5 mm	0.85	30.2 mm	NM	NM (LMW=12.3 mm)	NM	NM	22.6 mm	6.9 mm	197°	113°	84°	>9.85	Lookout Mountain, Casa Diablo, CA	hafted knife blade	*?Elko eared?*	distal end snapped, one base tang snapped, blade edges heavily worn	based on usewear patterns, probably a hafted knife, not a point
SOUTH OF STUDY AREA (n=64)																					
Death Valley National Park, California, n=15																					
Ash Meadows/Amargosa Desert, NV/CA (n=10)																					
4585 111-57	Iny669	19.7 mm	18.2 mm	N/A	0.92	10.7 mm	1.84	0%	10.7 mm	1.00	N/A	2.8 mm	N/A	N/A	N/A	0.45	Oak Spring Butte, NV	Cottonwood triangular	Cottonwood triangular	complete	site located near west base, Funeral Mtns., Nevares Spring
9577	123-57	>11.2 mm	>10.8 mm	N/A	0.96	11.5 mm	NM	0%	11.5 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	>0.45	Obsidian Butte, NV, Variety 3	Cottonwood triangular	Cottonwood triangular	blade snapped	collected from Ash Meadows, NV
9578	123-57	>9.8 mm	>8.5 mm	N/A	0.87	11.8 mm	NM	0%	11.8 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.30	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	blade snapped	collected from Ash Meadows, NV
10824	164-56	>20.4 mm	>18.3 mm	N/A	0.90	16.7 mm	NM	0%	16.7 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	>1.40	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	collected from Ash Meadows, NV
9537	244-56	>17.0 mm	>15.3 mm	N/A	0.90	>12 mm	NM	0%	>12.0 mm	1.00	N/A	3.1 mm	N/A	N/A	N/A	>0.50	Shoshone Mountain, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped, one base tang snapped	collected from Franklin Well vicinity, Amargosa Desert, CA
9532	244-56	>16.7 mm	>15.0 mm	6.7 mm	0.90	10 mm	NM	0%	10.0 mm	1.00	4.2 mm	2.1 mm	196°	174°	23°	>0.30	Kane Springs Wash Caldera Variety 1, NV	Desert side notched	Desert side notched	tip snapped	Sierra type - collected from Franklin Well vicinity, Amargosa Desert, CA
9472	243-56	26.0 mm	26.0 mm	7.8 mm	1.00	14.7 mm	1.77	35%	12.6 mm	0.88	10.6 mm	4.9 mm	167°	136°	70°	1.60	Shoshone Mountain, NV	Desert side notched	Desert side notched	distal blade edges appear reworked	unknown type - collected from Franklin Well vicinity, Amargosa Desert, CA
9531	244-56	>19.2 mm	>16.5 mm	9.2 mm	0.86	14.1 mm	NM	0%	14.1 mm	1.00	8.3 mm	2.7 mm	188°	146°	53°	>0.70	Shoshone Mountain, NV	Desert side notched	Desert side notched	distal end snapped	Sierra type - collected from Franklin Well vicinity, Amargosa Desert, CA
9500	242-56	>18.2 mm	>18.2 mm	7.3 mm	1.00	22.4 mm	NM	NM (LMW=8.0 mm)	15.3 mm	0.68	11.3 mm	6.0 mm	164°	134°	32°	>2.20	Montezuma Range, NV	Elko corner notched	Elko corner notched	blade snapped	collected from Franklin Well vicinity, Amargosa Desert, CA
9667	148-57	36.5 mm	34.8 mm	8.0 mm	0.95	21.1 mm	1.73	38%	15.0 mm	0.71	11.2 mm	5.2 mm	227°	119°	107°	3.00	Obsidian Butte, NV, Variety 5 (Unknown C)	Elko corner notched	Elko corner notched	complete	collected from Rock Valley Wash, Ash Meadows, NV
Panamint Range, CA (Iny3044) (n=5)																					
8283	Iny3044	21.5 mm	21.5 mm	N/A	1.00	10.2 mm	2.11	0%	10.2 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.40	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	complete	
8277	Iny3044	>13.0 mm	>12.0 mm	N/A	0.92	13.7 mm	NM	0%	13.7 mm	1.00	N/A	2.6 mm	N/A	N/A	N/A	>0.40	Oak Spring Butte, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
8275	Iny3044	>11.4 mm	>11.4 mm	N/A	1.00	8.5 mm	NM	0%	8.5 mm	1.00	N/A	2.0 mm	N/A	N/A	N/A	>0.20	West Sugarloaf, Coso Volcanic Field, CA	Cottonwood triangular	Cottonwood triangular	distal end snapped	
8266	Iny3044	>11.5 mm	>8.8 mm	7.4 mm	0.77	10.4 mm	NM	0%	10.4 mm	1.00	5.9 mm	2.8 mm	219°	133°	87°	>0.30	Unknown 5	Desert side notched	Desert side notched	distal end snapped	Delta type
8268	Iny3044	>16.0 mm	>12.7 mm	11.8 mm	0.79	13.5 mm	NM	0%	13.5 mm	1.00	7.5 mm	2.9 mm	198°	145°	54°	>0.60	West Sugarloaf, Coso Volcanic Field, CA	Desert side notched	Desert side notched	distal end snapped	Delta type
Joshua Tree National Park, California (Campbell collection), n=51																					
Tule Spring District, NV (n=1)																					
5273 498G3795	n/a	>24.6 mm	>20.6 mm	9.7 mm	0.84	18.9 mm	NM	0%	18.9 mm	1.00	15.8 mm	5.4 mm	252°	108°	144°	>2.35	Kane Springs Wash Caldera Variety 1, NV	Pinto	*?Elko eared?*	distal end snapped, distal blade edges reworked	NO = Pinto, Basgall & Hall (2000)
Paradise River Valley District (n=7)																					
26610 498G3186	n/a	36.0 mm	31.6 mm	10.1 mm	0.88	26.3 mm	1.37	35%	22.8 mm	0.87	19.5 mm	7.7 mm	199°	108°	91°	5.20	West Sugarloaf, Coso Volcanic Field, CA	Pinto	*?Elko eared?*	tip appears reworked	NO = Pinto (Basgall & Hall 2000), distal blade edges appear barbed toward shoulders
26611 498G3183 (B)	n/a	32.6 mm	32.6 mm	11.3 mm	1.00	27.2 mm	1.20	37%	20.1 mm	0.74	20.9 mm	6.0 mm	135°	94°	41°	4.95	Joshua Ridge, Coso Volcanic Field, CA	Great Basin stemmed, Borax Lake	*?Gatecliff contracting stem?*	distal end reworked	Great Basin stemmed, Borax Lake widestem
26611 498G3183 (A)	n/a	36.7 mm	36.7 mm	14.3 mm	1.00	23.7 mm	1.55	46%	8.8 mm	0.37	18.8 mm	6.9 mm	223°	71°	151°	4.70	Sugarloaf Mountain, Coso Volcanic Field, CA	Great Basin stemmed, Lake Mohave	*?Gatecliff contracting stem?*	stem heavily damaged & reworked, distal end reworked	Great Basin stemmed, Lake Mohave
4952 498G2213 (B)	n/a	>38.1 mm	>35.0 mm	N/A	0.92	27.1 mm	NM	NM (LMW=33.7 mm)	24.0 mm	0.89	N/A	7.5 mm	N/A	N/A	N/A	>9.00	Mount Hicks, NV	Unknown shoulderless concave-base	*?Humboldt?*	distal end snapped, base tangs chipped	large, unshouldered, concave-base, lanceolate point - huge compared to other Humboldts
26612 498G3181 (B)	n/a	>37.3 mm	>34.9 mm	N/A	0.94	22.9 mm	NM	NM (LMW=8.7 mm)	22.3 mm	0.97	N/A	8.8 mm	N/A	N/A	N/A	>8.00	West Sugarloaf, Coso Volcanic Field, CA	Unknown shoulderless concave-base	out-of-key	distal end damaged, edges reworked	large, unshouldered, concave-base, triangular point
4952 498G2213 (A)	n/a	>32.4 mm	>27.2 mm	N/A	0.84	23.9 mm	NM	0%	23.9 mm	1.00	N/A	9.9 mm	N/A	N/A	N/A	>8.30	West Sugarloaf, Coso Volcanic Field, CA	Unknown shoulderless concave-base	out-of-key	distal end snapped, weathered	large, unshouldered, concave-base, triangular point, xrf lists as 4552a
Mesquite Valley District, CA (n=26)																					
2460 498G1644	n/a	14.7 mm	12.3 mm	N/A	0.84	11.3 mm	1.30	0%	11.3 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.30	Bristol Mountains, CA (Baghdad)	Cottonwood triangular	Cottonwood triangular	complete	
2626 4986169	n/a	21.9 mm	21.9 mm	N/A	1.00	16.0 mm	1.37	0%	16.0 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	0.95	Devil Peak West, NV (Umpire)	Cottonwood triangular	Cottonwood triangular	complete	
2451 498G1634	n/a	14.7 mm	13.7 mm	N/A	0.93	7.0 mm	2.10	0%	7.0 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	0.45	Devil Peak West, NV (Umpire)	Cottonwood triangular	Cottonwood triangular	one side distal edge damaged & reworked	
2459 498G1643	n/a	>18.5 mm	>17.4 mm	N/A	0.94	16.9 mm	NM	0%	16.9 mm	1.00	N/A	4.7 mm	N/A	N/A	N/A	>1.30	Devil Peak West, NV (Umpire)	Cottonwood triangular	out-of-key	distal end snapped	looks like a thick Cottonwood triangular
2461 498G1645	n/a	11.4 mm	11.0 mm	N/A	0.96	12.3 mm	0.93	0%	12.3 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.25	Devil Peak West, NV (Umpire)	Cottonwood triangular	Cottonwood triangular	edges damaged & reworked	
7902	n/a	31.7 mm	29.5 mm	N/A	0.93	12.9 mm	2.46	0%	12.9 mm	1.00	N/A	4.3 mm	N/A	N/A	N/A	1.10	Shoshone Mountain, NV	Cottonwood triangular	out-of-key	complete, edges slightly serrated	long, triangular point (too long & thick for Thomas 1981 Cottonwood)
26619 498G1686 (A)	n/a	>14.9 mm	>13.5 mm	N/A	0.91	14.1 mm	NM	0%	14.1 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.50	Unknown 12	Cottonwood triangular	Cottonwood triangular	tip snapped	
2452 498G1635	n/a	13.0 mm	12.5 mm	N/A	0.96	15.4 mm	0.84	0%	15.4 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.40	Unknown 12	Cottonwood triangular	Cottonwood triangular	distal end damaged & reworked	
26619 498G1686 (B)	n/a	>9.4 mm	>6.7 mm	9.0 mm	0.71	12.5 mm	NM	0%	12.5 mm	1.00	5.7 mm	2.3 mm	217°	182°	38°	>0.30	Bristol Mountains, CA (Baghdad)	Desert side notched	Desert side notched	blade snapped at shoulders	Sierra type
26619 498G1686 (J)	n/a	>9.1 mm	>5.8 mm	9.1 mm	0.64	13.2 mm	NM	0%	13.2 mm	1.00	4.7 mm	2.7 mm	NM	187°	NM	>0.20	Bristol Mountains, CA (Baghdad)	Desert side notched	Desert side notched	blade snapped below shoulders	Sierra type
2458 498G1642	n/a	15.7 mm	15.2 mm	8.7 mm	0.97	11.2 mm	1.40	0%	11.2 mm	1.00	6.9 mm	2.7 mm	197°	152°	45°	0.40	Bristol Mountains, CA (Baghdad)	Desert side notched	Desert side notched	distal blade edges & base damaged & reworked	Desert type
2625 G1669	n/a	>16.3 mm	>16.3 mm	8.6 mm	1.00	14.7 mm	NM	0%	14.7 mm	1.00	6.7 mm	3.6 mm	226°	134°	74°	>0.60	Devil Peak East, NV?	Desert side notched	Desert side notched	tip snapped	Desert type
26619 498G1686 (C)	n/a	>11.0 mm	>11.0 mm	8.3 mm	1.00	15.2 mm	NM	0%	15.2 mm	1.00	5.3 mm	3.7 mm	218°	185°	33°	>0.40	Devil Peak West, NV (Umpire)	Desert side notched	Desert side notched	blade snapped at shoulders	Desert type
26619 498G1686 (E)	n/a	≈17.5 mm	≈13.7 mm	6.4 mm	0.78	>9.4 mm	NM	0%	>9.4 mm	1.00	5.7 mm	2.6 mm	194°	140°	54°	>0.35	Devil Peak West, NV (Umpire)	Desert side notched	Desert side notched	one base tang snapped, distal end near tip chipped	Sierra type
2454 498G1638	n/a	19.4 mm	17.4 mm	8.3 mm	0.90	13.1 mm	1.48	0%	13.1 mm	1.00	5.7 mm	2.5 mm	213°	186°	27°	0.40	Devil Peak West, NV (Umpire)	Desert side notched	Desert side notched	complete	Sierra type
2455 498G1639	n/a	>16.6 mm	>13.9 mm	9.5 mm	0.84	11.1 mm	NM	0%	11.1 mm	1.00	4.3 mm	2.4 mm	226°	190°	35°	>0.30	Devil Peak West, NV (Umpire)	Desert side notched	Desert side notched	distal end snapped	Sierra type
2457 498G1641	n/a	17.6 mm	15.3 mm	6.3 mm	0.87	13.1 mm	1.34	0%	13.1 mm	1.00	6.6 mm	1.8 mm	213°	149°	64°	0.30	Devil Peak West, NV (Umpire)	Desert side notched	Desert side notched	complete	Sierra type
2461 498G1645	n/a	12.6 mm	11.9 mm	6.5 mm	0.94	12.6 mm	1.00	0%	12.6 mm	1.00	7.9 mm	3.3 mm	193°	152°	41°	0.40	Devil Peak West, NV (Umpire)	Desert side notched	Desert side notched	distal blade edges damaged & reworked	Sierra type
26619 498G1686 (H)	n/a	>14.4 mm	>11.1 mm	9.1 mm	0.77	13.8 mm	NM	0%	13.8 mm	1.00	6.6 mm	2.4 mm	207°	171°	36°	>0.40	Hackberry Mountain, CA	Desert side notched	Desert side notched	distal end snapped	Sierra type
26619 498G1686 (D)	n/a	18.1 mm	14.9 mm	7.2 mm	0.82	>14.1 mm	NM	0%	>14.1 mm	1.00	6.6 mm	2.4 mm	201°	165°	41°	>0.40	Shoshone Mountain, NV	Desert side notched	Desert side notched	one base tang snapped	Sierra type
26619 498G1686 (G)	n/a	>20.4 mm	>16.3 mm	10.1 mm	0.80	>12.9 mm	NM	0%	>12.9 mm	1.00	7.0 mm	3.3 mm	209°	193°	16°	>0.70	Shoshone Mountain, NV	Desert side notched	Desert side notched	one base tang snapped, tip snapped, one distal edge reworked	Sierra type
26619 498G1686 (F)	n/a	>10.3 mm	>8.7 mm	6.9 mm	0.84	11.6 mm	NM	0%	11.6 mm	1.00	4.4 mm	2.5 mm	208°	202°	6°	>0.25	Unknown 13	Desert side notched	Desert side notched	tip snapped	Sierra type
26619 498G1686 (I)	n/a	>12.3mm	>10.3 mm	6.4 mm	0.84	10.4 mm	NM	0%	10.4 mm	1.00	4.5 mm	2.2 mm	211°	158°	53°	>0.25	Unknown 9	Desert side notched	Desert side notched	distal end snapped	Sierra type
2627 61637	n/a	23.6 mm	23.6 mm	3.8 mm	1.00	15.6 mm	1.51	15%	7.8 mm	0.50	6.8 mm	3.4 mm	161°	115°	53°	0.80	Devil Peak West, NV (Umpire)	Rosegate	Rosegate	complete	Sierra type
2453 498G1639	n/a	18.9 mm	18.9 mm	4.8 mm	1.00	10.0 mm	1.89	34%	7.6 mm	0.76	5.4 mm	3.7 mm	201°	133°	73°	0.60	Unknown 16	Rosegate	out-of-key	complete	looks like Rosegate but PSA too large(144° for 2nd angle) - in between Rosegate and Dsn
2456 498G1640	n/a	25.3 mm	25.3 mm	5.1 mm	1.00	16.4 mm	1.54	45%	6.9 mm	0.42	7.6 mm	5.6 mm	169°	79°	90°	1.60	Unknown 10	Gatecliff contracting stem	Gatecliff contracting stem	distal blade edges barbed	
Mesquite Spring, CA (n=2)																					
1391	n/a	14.1 mm	12.4 mm	N/A	0.88	9.8 mm	1.44	0%	9.8 mm	1.00	N/A	2.1 mm	N/A	N/A	N/A	0.15	Obsidian Butte, CA	Cottonwood triangular	Cottonwood triangular	distal blade edges reworked	
26624 498G443	n/a	39.6 mm	39.6 mm	8.8 mm	1.00	21.2 mm	1.87	46%	20.6 mm	0.97	12.9 mm	4.8 mm	188°	162°	26°	4.10	Big Southern Butte, ID	Large side notched, Northern	Large side notched	distal blade edges worn/reworked	Northern type
Crucero District, CA (n=2)																					
9021 498G295	n/a	29.5 mm	29.5 mm	N/A	1.00	11.7 mm	2.52	15%	11.0 mm	0.94	N/A	3.3 mm	N/A	N/A	N/A	0.70	Bristol Mountains, CA (Baghdad)	Cottonwood triangular	Cottonwood triangular	small chip on base	
9036 498G295	n/a	20.3 mm	20.3 mm	4.2 mm	1.00	14.3 mm	1.42	24%	10.6 mm	0.74	8.6 mm	2.8 mm	211°	124°	87°	0.65	Devil Peak West, NV (Umpire)	Rosegate	*?Elko corner notched?*	complete	much too small for "dart point" - looks more like a Rosegate
Newberry Spring District, CA (n=1)																					
7977 498G798	n/a	>22.4 mm	>19.6 mm	N/A	0.88	21.2 mm	NM	NM (LMW=8.2 mm)	16.9 mm	0.80	N/A	8.7 mm	N/A	N/A	N/A	>4.60	West Sugarloaf, Coso Volcanic Field, CA	Humboldt	Humboldt	distal end snapped, weathered	
Joshua Tree National Park District, CA (n=5)																					
7833 (A)	n/a	16.5 mm	16.5 mm	3.4 mm	1.00	10.7 mm	1.54	25%	4.4 mm	0.41	5.6 mm	2.7 mm	197°	73°	123°	0.40	Unknown 1, possibly Obsidian Ridge, NM	Parowan basal notched	out-of-key	damaged & reworked	looks like "arrow point" sized Gatecliff, similar to O'Malley & Conaway points - Parowan basal notched)
7833 (C)	n/a	>23.4 mm	>22.6 mm	8.3 mm	0.97	>22.4 mm	NM	NM (LMW=7.4 mm)	13.4 mm	NM	9.6 mm	4.6 mm	133°	113°	20°	>2.30	Cerro del Medio, NM	Elko corner notched	Elko corner notched	distal end snapped, one shoulder tang snapped	
7833 (B)	n/a	>47.2 mm	>47.2 mm	4.6 mm	1.00	27.7 mm	NM	NM (LMW=6.3 mm)	10.5 mm	0.38	17.3 mm	7.2 mm	190°	87°	104°	>10.20	Mount Hicks, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, one corner base chipped	extremely large, doubtful it was a dart point
245	n/a	>29.1 mm	>29.1 mm	N/A	1.00	17.1 mm	NM	NM (LMW=19.0 mm)	15.5 mm	0.91	N/A	6.1 mm	N/A	N/A	N/A	>2.60	Obsidian Butte, CA	drill	out-of-key	tip snapped	not a point, probably an unhafted drill/borer
Oasis of Mara, CA (n=1)																					
24772	n/a	17.9 mm	16.5 mm	6.2 mm	0.92	13.4 mm	1.34	55%	10.0 mm	0.75	8.4 mm	3.9 mm	222°	110°	112°	0.75	Cerro del Medio, NM	Desert side notched	out-of-key	distal blade edges appear reworked	Desert type, crude
Desert Queen Ranch, CA (n=1)																					
19675	n/a	24.2 mm	23.8 mm	N/A	0.98	10.2 mm	2.37	0%	10.2 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	0.40	Obsidian Butte, CA	Cottonwood triangular	Cottonwood triangular	distal end appears reworked	
Hinkley District, CA (n=1)																					
26617 498G1778B	n/a	20.9 mm	18.8 mm	N/A	0.90	13.2 mm	1.58	0%	13.2 mm	1.00	N/A	4.3 mm	N/A	N/A	N/A	0.80	Unknown 8	Cottonwood triangular	out-of-key	complete	looks exactly like Cottonwood triangular (too thick)
Surprise Spring District, CA (n=2)																					
5236 498G1823	n/a	22.9 mm	22.2 mm	N/A	0.97	10.6 mm	2.16	0%	10.6 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	0.60	Obsidian Butte, NV, Variety 5 (Unknown C)	Cottonwood triangular	Cottonwood triangular	complete	
5236 498G1823 glass	n/a	15.4 mm	15.1 mm	N/A	0.98	10.9 mm	1.41	0%	10.9 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	0.50	bottle glass	Cottonwood triangular	Cottonwood triangular	complete	manufactured from bottle glass with slight amber tint (Se)?
Saratoga Springs District, CA (n=1)																					
26621 498G2092	n/a	>27.0 mm	>27.0 mm	4.4 mm	1.00	18.6 mm	NM	NM (LMW=4.2 mm)	7.6 mm	0.41	7.2 mm	4.1 mm	143°	97°	46°	>1.60	West Sugarloaf, Coso Volcanic Field, CA	Rosegate	out-of-key	tip snapped, one shoulder tang chipped	neck 0.1 mm too large for Rosegate, but looks like Rosegate
Chiriaco Summit, CA (n=1)																					
25178	n/a	>15.6 mm	>14.7 mm	N/A	0.94	10.9 mm	NM	0%	10.9 mm	1.00	N/A	3.9 mm	N/A	N/A	N/A	>0.65	Obsidian Butte, CA	Cottonwood triangular	Cottonwood triangular	distal end & one shoulder tang snapped	
EAST OF STUDY AREA (n=740)																					
Desert Research Institute, Reno, NV, n=380																					
Conaway Shelter, Meadow Valley Wash, Lincoln County, Nevada (26Ln126) n=48																					
Stratum II (post-AD 900 to pre-AD 1720)																					
FS 18/6	Ln126	19.7 mm	18.0 mm	8.3 mm	0.91	11.4 mm	1.73	0%	11.4 mm	1.00	6.9 mm	3.2 mm	221°	140°	81°	0.55	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	complete	Desert type
FS 10/5	Ln126	20.5 mm	20.5 mm	3.5 mm	1.00	≈13.5 mm	≈1.52	12%	3.2 mm	≈0.24	5.4 mm	3.6 mm	152°	59°	98°	≈0.70	South Pahroc Range, NV	Parowan basal notched	out-of-key	base appears reworked	looks like "arrow point-size" Gatecliff - Parowan basal notched
Stratum IV (AD 900)																					
FS 58/33	Ln126	≈19.2 mm	≈19.2 mm	N/A	1.00	>13.8 mm	NM	0%	>13.8 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	≈ 0.80	Kane Springs Wash Caldera Variety 2, NV	Cottonwood triangular	Cottonwood triangular	tip and one side of base chipped	
FS 56/1	Ln126	27.2 mm	27.2 mm	N/A	1.00	14.1 mm	1.93	0%	14.1 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	1.00	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	complete	
FS 69/301	Ln126	24.4 mm	24.4 mm	N/A	1.00	18.7 mm	1.30	0%	18.7 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	1.40	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	complete	xrf data lists as 69/30
FS 79/3	Ln126	>11.2 mm	>11.2 mm	3.2 mm	1.00	16.0 mm	NM	NM (LMW=1.8 mm)	5.2 mm	0.33	5.4 mm	2.7 mm	136°	92°	44°	>0.40	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	out-of-key	about half of distal end snapped off	looks like Rosegate category - Parowan basal notched
FS 46/77	Ln126	>28.1 mm	>27.1 mm	4.0 mm	0.96	>20.1 mm	NM	NM (LMW=2.1 mm)	7.9 mm	NM	7.2 mm	4.0 mm	135°	100°	34°	>1.60	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff split stem?*	tip snapped, one tang snapped, base chipped	too small for "dart point" category - Parowan basal notched
FS 61/37	Ln126	27.3 mm	27.3 mm	2.4 mm	1.00	14.9 mm	1.83	7%	6.4 mm	0.43	7.1 mm	3.7 mm	146°	71°	77°	1.10	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	too small for "dart point" category - Parowan basal notched
Stratum V (AD 1010)																					
FS 106/129	Ln126	≈23.5 mm	≈23.5 mm	N/A	1.00	11.7 mm	≈2.0	16%	10.5 mm	0.90	N/A	4.2 mm	N/A	N/A	N/A	0.90	Kane Springs Wash Caldera Variety 1, NV	Cottonwood leaf shaped	Cottonwood leaf shaped	tip chipped	
FS 124/85	Ln126	25.9 mm	25.9 mm	N/A	1.00	17.4 mm	1.49	28%	15.0 mm	0.86	N/A	4.2 mm	N/A	N/A	N/A	>1.60	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	out-of-key	proximal end chipped on one side	looks like Cottonwood leaf shaped
FS 98/252	Ln126	18.7 mm	18.7 mm	N/A	1.00	16.1 mm	1.16	21%	13.5 mm	0.84	N/A	3.0 mm	N/A	N/A	N/A	0.80	Unknown Variety A	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
FS 120/1	Ln126	32.3 mm	32.3 mm	N/A	1.00	12.9 mm	2.50	17%	11.6 mm	0.90	N/A	3.6 mm	N/A	N/A	N/A	1.20	Unknown Variety A	Cottonwood leaf shaped	out-of-key	complete	looks like Cottonwood leaf shaped
FS 124/88	Ln126	25.0 mm	25.0 mm	N/A	1.00	15.2 mm	1.64	16%	11.4 mm	0.75	N/A	4.5 mm	N/A	N/A	N/A	1.30	Unknown Variety B	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
FS 106/132	Ln126	23.2 mm	23.2 mm	N/A	1.00	16.0 mm	1.45	0%	16.0 mm	1.00	N/A	5.6 mm	N/A	N/A	N/A	1.50	Kane Springs Wash Caldera Variety 1, NV	Cottonwood triangular	Cottonwood triangular	complete	
FS 98/260	Ln126	21.9 mm	21.9 mm	N/A	1.00	14.5 mm	1.51	28%	13.2 mm	0.91	N/A	3.3 mm	N/A	N/A	N/A	0.90	Kane Springs Wash Caldera Variety 2, NV	Cottonwood triangular	Cottonwood triangular	complete	
FS 108/29	Ln126	>21.5 mm	>21.5 mm	N/A	1.00	19.8 mm	NM	NM (LMW=2.6 mm)	16.4 mm	0.83	N/A	4.7 mm	N/A	N/A	N/A	>1.50	Kane Springs Wash Caldera Variety 2, NV	Cottonwood triangular	out-of-key	distal end snapped diagonally	looks like Cottonwood triangular
FS 98/253	Ln126	>21.5 mm	>21.5 mm	4.3 mm	1.00	17.8 mm	NM	NM (LMW=3.3 mm)	6.3 mm	0.35	7.6 mm	4.0 mm	137°	80°	57°	>1.20	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	too small for "dart point" category - Parowan basal notched
FS 98/254	Ln126	>18.2 mm	>18.2 mm	>2.7 mm	1.00	17.2 mm	NM	NM (LMW=1.0 mm)	>4.8 mm	NM	6.7 mm	3.2 mm	139°	94°	39°	>0.70	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	out-of-key	distal end snapped, base chipped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 106/126	Ln126	27.8 mm	27.8 mm	2.0 mm	1.00	15.5 mm	1.79	3%	>2.7 mm	NM	5.0 mm	3.8 mm	132°	72°	62°	≈1.40	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	*?Gatecliff contracting stem?*	base chipped on one side	too small for "dart point" category - Parowan basal notched
FS 124/83	Ln126	>19.2 mm	>19.2 mm	2.6 mm	1.00	15 mm	NM	NM (LMW=2.2 mm)	7.7. mm	0.51	9.2 mm	4.3 mm	200°	82°	120°	>1.20	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	too small for "dart point" category - Parowan basal notched
FS 124/86	Ln126	25.0 mm	25.0 mm	3.0 mm	1.00	13.0 mm	1.92	7%	5.0 mm	0.38	6.0 mm	2.9 mm	182°	78°	105°	0.60	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 124/87	Ln126	30.0 mm	3.0 mm	2.3 mm	1.00	17 mm	1.76	7%	6.6 mm	0.39	8.3 mm	3.7 mm	139°	58°	83°	1.30	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	*?Gatecliff contracting stem?*	small basal chip	too small for "dart point" category - Parowan basal notched
FS 125/220	Ln126	>30.7 mm	>29.9 mm	>2.5 mm	NM	19.2 mm	NM	NM (LMW=30.7 mm)	>5.5 mm	NM	6.7 mm	3.9 mm	145°	62°	85°	≈1.40	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	*?Gatecliff contracting stem?*	tip of base snapped	too small for "dart point" category - Parowan basal notched, xrf lists 125/270
FS 125/271	Ln126	24.2 mm	24.2 mm	3.6 mm	1.00	17.9 mm	1.35	12%	5.3 mm	0.30	7.4 mm	3.9 mm	148°	78°	71°	1.40	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	*?Gatecliff contracting stem?*	complete	too small for "dart point" category - Parowan basal notched
FS 106/130	Ln126	>9.7 mm	>9.7 mm	2.1 mm	1.00	18.9 mm	NM	NM (LMW=1.0 mm)	9.7 mm	0.51	9.9 mm	3.8 mm	147°	84°	64°	>0.60	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	out-of-key	most of distal end snapped off	Parowan basal notched
FS 96/61	Ln126	>13.7 mm	>13.7 mm	3.3 mm	1.00	18.8 mm	NM	NM (LMW=2.1 mm)	6.5 mm	0.35	8.5 mm	3.9 mm	151°	94°	74°	>0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	most of distal end snapped off	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 125/272	Ln126	>17.6 mm	>17.6 mm	2.8 mm	1.00	20.3 mm	NM	NM (LMW=1.0 mm)	6.8 mm	0.33	8.2 mm	4.2 mm	144°	82°	61°	>1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	too small for "dart point" category - Parowan basal notched
FS 98/250	Ln126	>22.3 mm	>22.3 mm	3.2 mm	1.00	16.7 mm	NM	NM (LMW=2.6 mm)	6.0 mm	0.36	7.4 mm	3.8 mm	143°	80°	66°	≈1.10	Unknown Variety A	Parowan basal notched	*?Gatecliff contracting stem?*	tip and base chipped	too small for "dart point" category - Parowan basal notched
FS 106/127	Ln126	20.7 mm	20.7 mm	2.5 mm	1.00	14.5 mm	1.43	6%	5.4 mm	0.37	6 mm	3.9 mm	135°	70°	68°	0.90	Unknown Variety A	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 114/158	Ln126	>18.8 mm	>18.8 mm	3.2 mm	1.00	17.6 mm	NM	NM (LMW=2.3 mm)	7.0 mm	0.40	9.0 mm	4.0 mm	148°	80°	69°	≈1.00	Unknown 15	Parowan basal notched	out-of-key	tip snapped, basal chip	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 114/161	Ln126	23.2 mm	23.2 mm	6.4 mm	1.00	>11.8 mm	NM	34%	4.9 mm	NM	6.7 mm	2.7 mm	149°	90°	60°	>0.60	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	blade snapped in half vertically	Parowan basal notched
FS 114/157	Ln126	15.7 mm	15.7 mm	3.8 mm	1.00	18.0 mm	0.87	16%	5.5 mm	0.31	9.4 mm	3.5 mm	128°	77°	52°	0.80	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	heavily reworked	Parowan basal notched
FS 114/159	Ln126	23.1 mm	23.1 mm	4.8 mm	1.00	>15 mm	NM	≈39%	8.4 mm	NM	7.8 mm	3.3 mm	128°	109°	32°	>1.00	Kane Springs Wash Caldera Variety 1, NV	Rosegate	Rosegate	one shoulder tang snapped vertically	
FS 125/268	Ln126	>14.5 mm	>14.5 mm	3.8 mm	1.00	19.4 mm	NM	NM (LMW=4.1 mm)	9.1 mm	0.47	8.5 mm	3.0 mm	148°	94°	56°	>0.60	Kane Springs Wash Caldera Variety 1, NV	Rosegate	Rosegate	most of distal end snapped off	
FS 130	Ln126	>12.1 mm	>12.1 mm	4.0 mm	1.00	>13.3 mm	NM	NM (LMW=3.3 mm)	7.0 mm	NM	6.5 mm	3.4 mm	148°	110°	45°	>0.40	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	most of distal end snapped off (base and one shoulder tang only)	mahogany obsidian
FS 114/156	Ln126	>16.1 mm	>16.1 mm	6.3 mm	1.00	22.5 mm	NM	NM (LMW=16.1 mm)	15.0 mm	0.66	14.1 mm	3.7 mm	169°	130°	39°	>1.20	Kane Springs Wash Caldera Variety 2, NV	Elko corner notched	Elko corner notched	base and shoulders only, snapped diagonally	
FS 124/93	Ln126	>13.0 mm	>13.0 mm	8.1 mm	1.00	>19 mm	NM	NM	18.8 mm	NM	14.8 mm	5.3 mm	162°	131°	33°	>1.30	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched		
FS 114/160	Ln126	32.5 mm	28.6 mm	8.8 mm	0.88	20.9 mm	1.56	32%	12.3 mm	0.59	11.6 mm	6.3 mm	196°	117°	79°	3.40	Kane Springs Wash Caldera Variety 2, NV	Elko eared	Elko eared	crude	looks "beat-up", possibly by use but more probably crudely and incompletely manufactured

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
Stratum VI (100 BC)																					
FS 142/5	Ln126	36.7 mm	34.9 mm	7.0 mm	0.95	19.7 mm	1.86	25%	15.7 mm	0.80	11.9 mm	3.8 mm	211°	122°	89°	2.40	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	complete, small amount of cortex on base	
FS 152/1	Ln126	35.2 mm	34.2 mm	6.6 mm	0.97	23.4 mm	1.50	21%	17.5 mm	0.75	12.4 mm	4.8 mm	156°	128°	28°	3.40	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	complete	
FS 144/7	Ln126	23.7 mm	23.7 mm	6.2 mm	1.00	24.2 mm	0.98	8%	13.2 mm	0.55	13.1 mm	5.9 mm	147°	110°	43°	2.80	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	complete	asymmetrical and very crude in appearance, xrf lists as 144/8
FS 152/3	Ln126	>30.4 mm	>28.3 mm	7.2 mm	0.93	20.6 mm	NM	NM (LMW=15.2 mm)	14.6 mm	0.71	12.2 mm	4.6 mm	189°	134°	55°	>3.20	Kane Springs Wash Caldera Variety 2, NV	Elko eared	Elko eared	distal end snapped diagonally	
FS 156/2	Ln126	32.1 mm	32.1 mm	N/A	1.00	15.8 mm	2.08	50%	7.2 mm	0.46	N/A	5.4 mm	N/A	N/A	N/A	3.00	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
Stratum VII (140 BC)																					
FS 160/121	Ln126	>35.4 mm	>35.4 mm	6.9 mm	1.00	23.5 mm	NM	NM (LMW=13.8 mm)	16.0 mm	0.68	12.4 mm	5.9 mm	158°	133°	25°	>4.20	Kane Springs Wash Caldera Variety 2, NV	Elko corner notched	Elko corner notched	distal end snapped	
FS 170/1	Ln126	39.0 mm	37.8 mm	7.0 mm	0.97	>36.6 mm	NM	21%	>8.1 mm	NM	>10.6 mm	7.0 mm	138°	113°	32°	>4.80	Kane Springs Wash Caldera Variety 2, NV	Elko corner notched	Elko corner notched	snapped diagonally from above one shoulder through half of base	
FS 166/3	Ln126	>18.9 mm	>18.0 mm	5.8 mm	0.95	24.2 mm	NM	NM (LMW=3.1 mm)	11.6 mm	0.48	11 mm	4.5 mm	135°	111°	26°	>1.80	Kane Springs Wash Caldera Variety 1, NV	Elko eared	Elko eared	most of distal end snapped off diagonally (base and shoulders only)	
FS 166/2	Ln126	>30.0 mm	>27.0 mm	6.5 mm	0.90	24.5 mm	NM	NM (LMW=9.0 mm)	5.1 mm	0.21	12.3 mm	4.1 mm	166°	135°	30°	>2.70	Kane Springs Wash Caldera Variety 2, NV	Elko eared	Elko eared	distal end snapped	
FS 170/5	Ln126	>13.0 mm	>12.5 mm	6.8 mm	0.96	>20.5 MM	NM	NM	6.7 mm	NM	14.4 mm	4.9 mm	151°	114°	45°	>1.70	not obsidian	Elko eared	Elko eared	stem and one shoulder only	mahogany obsidian
O'Malley Shelter, Clover Valley, Lincoln County, Nevada, (26Ln418), n=332																					
Cultural Unit VII (Surface - Historic, post-AD 1080)																					
FS 208/10	Ln418	>15.2 mm	>15.2 mm	N/A	1.00	17.5 mm	NM	NM (LMW=7.4 mm)	9.0 mm	0.51	N/A	3.0 mm	N/A	N/A	N/A	>1.00	Kane Springs Wash Caldera Variety 2, NV	Cottonwood leaf shaped	Cottonwood leaf shaped	blade snapped	
FS 37/8	Ln418	>18.5 mm	>18.5 mm	N/A	1.00	15.2 mm	NM	0%	15.2 mm	1.00	N/A	3.5 mm	N/A	N/A	N/A	>1.20	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
FS 44/93	Ln418	23.6 mm	23.6 mm	N/A	1.00	13.3 mm	1.77	36%	11.5 mm	0.86	N/A	3.6 mm	N/A	N/A	N/A	0.90	Unknown Variety C	Cottonwood leaf shaped	Cottonwood leaf shaped	one edge of base appears reworked	may have originally been a Cottonwood triangular
FS 145/2	Ln418	30.4 mm	30.4 mm	N/A	1.00	13.2 mm	2.30	14%	6.3 mm	0.48	N/A	3.7 mm	N/A	N/A	N/A	1.20	Unknown Variety C	Cottonwood leaf shaped	out-of-key	complete	looks like long Cottonwood leaf shaped at Utah sites
FS 452/24	Ln418	>17.0 mm	>16.5 mm	N/A	0.97	16.5 mm	NM	0%	16.5 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.80	Kane Springs Wash Caldera Variety 1, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 24/36	Ln418	21.2 mm	21.2 mm	N/A	1.00	12.0 mm	1.77	0%	12.0 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	0.90	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	complete	minimally pressure-flaked on both sides
FS 45/55	Ln418	>14.4 mm	>13.7 mm	N/A	0.95	12.1 mm	NM	NM (LMW=1.6 mm)	11.6 mm	0.96	N/A	3.0 mm	N/A	N/A	N/A	>0.60	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 208/4	Ln418	20.5 mm	20.5 mm	N/A	1.00	14.9 mm	1.38	0%	14.9 mm	1.00	N/A	3.4 mm	N/A	N/A	N/A	0.80	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	complete	
FS 42/1	Ln418	>23.5 mm	>22.7 mm	N/A	0.97	12.3 mm	NM	NM (LMW=10.0 mm)	11.8 mm	0.96	N/A	3.9 mm	N/A	N/A	N/A	>1.20	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 24/31a	Ln418	23.6 mm	23.6 mm	N/A	1.00	17.2 mm	1.37	14%	16.7 mm	0.97	N/A	4.0 mm	N/A	N/A	N/A	1.50	Unknown Variety C	Cottonwood triangular	Cottonwood triangular	complete	
FS 145/1	Ln418	18.8 mm	18.8 mm	6.3 mm	1.00	9.9 mm	1.90	0%	9.9 mm	1.00	7.1 mm	2.7 mm	179°	160°	10°	0.50	Unknown Variety B	Desert side notched	Desert side notched	complete	Desert type, minimally pressure-flaked on one side
FS 32/111	Ln418	19.7 mm	19.4 mm	4.1 mm	0.98	11.4 mm	1.73	29%	7.0 mm	0.61	7.3 mm	3.3 mm	170°	125°	43°	0.60	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 13/58	Ln418	24.2 mm	23.7 mm	3.8 mm	0.98	16.0 mm	1.51	13%	5.8 mm	0.36	7.4 mm	3.0 mm	153°	75°	76°	0.80	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched, xrf lists as 13/38
FS 143/2	Ln418	>23.2 mm	>23.2 mm	4.9 mm	1.00	≈15.4 mm	NM	NM (LMW=6.5 mm)	6.2 mm	0.40	8.0 mm	4.2 mm	170°	65°	104°	>1.20	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	too small for "dart point" category - Parowan basal notched
FS 208/2	Ln418	22.4 mm	22.4 mm	2.3 mm	1.00	10.4 mm	2.15	16%	2.4 mm	0.23	3.8 mm	2.1 mm	148°	85°	67°	0.50	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 143/3	Ln418	>26.5 mm	>26.5 mm	3.6 mm	1.00	>14.0 mm	NM	NM	6.5 mm	NM	6.6 mm	3.5 mm	173°	100°	69°	>1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	too small for "dart point" category - Parowan basal notched
FS 206/1	Ln418	>16.3 mm	>16.3 mm	1.9 mm	1.00	14.0 mm	NM	NM (LMW=2.4 mm)	6.2 mm	0.44	7.4 mm	3.1 mm	150°	75°	104°	>0.70	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	distal end snapped, base appears reworked	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 40/6	Ln418	>23.9 mm	>23.8 mm	5.6 mm	1.00	≈17.8 mm	NM	NM (LMW=8.5 mm)	6.1 mm	≈0.34	6.0 mm	4.9 mm	154°	97°	58°	>1.70	Unknown Variety B	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder chipped	too small for "dart point" category - Parowan basal notched
FS 45/65	Ln418	>12.9 mm	>12.9 mm	4.3 mm	1.00	16.3 mm	NM	NM (LMW=3.6 mm)	6.4 mm	0.39	7.2 mm	3.8 mm	122°	93°	30°	>0.70	Unknown Variety B	Parowan basal notched	out-of-key	distal end snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 333/1	Ln418	20.9 mm	20.9 mm	4.4 mm	1.00	16.0 mm	1.30	5.6 mm	7.1 mm	0.44	8.0 mm	3.5 mm	160°	107°	56°	0.90	Unknown Variety C	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff, cortex remaining on one surface - Parowan basal notched
FS 40/2	Ln418	>9.3 mm	>9.3 mm	2.9 mm	1.00	12.5 mm	NM	NM (LMW=3.1 mm)	5.2 mm	0.42	6.0 mm	2.7 mm	172°	83°	96°	>0.30	Unknown Variety D	Parowan basal notched	out-of-key	blade snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 46/12	Ln418	>33.1 mm	> 33.1 mm	5.6 mm	1.00	18.4 mm	NM	NM (LMW=7.8 mm)	6.7 mm	0.36	8.3 mm	5.4 mm	159°	69°	89°	>3.10	Unknown Variety E	Parowan basal notched	Gatecliff contracting stem	distal end snapped and reworked	
FS 267/6	Ln418	25.8 mm	25.8 mm	6.2 mm	1.00	12.7 mm	2.03	26%	5.9 mm	0.44	5.4 mm	3.4 mm	154°	109°	45°	0.70	Kane Springs Wash Caldera Variety 1, NV?	Rosegate	Rosegate	one shoulder tang snapped	sloppy fit for Kane Springs variety
FS 24/39	Ln418	>16.2 mm	>16.2 mm	3.3 mm	1.00	14.2 mm	NM	NM (LMW=7.2 mm)	8.2 mm	0.58	7.7 mm	2.1 mm	168°	114°	54°	>0.70	~~Kane Springs Wash Caldera Variety 2, NV~~	Rosegate	Rosegate	distal end snapped	source deleted from xrf final - Sr wrong for Kane Springs
FS 29/12	Ln418	>15.5 mm	>15.5 mm	6.1 mm	1.00	10.2 mm	NM	NM (LMW=7.2 mm)	7.6 mm	0.75	6.3 mm	3.2 mm	218°	128°	92°	>0.40	Kane Springs Wash Caldera Variety 2, NV	Rosegate	Rosegate	tip chipped, one edge appears reworked	
FS 24/34	Ln418	>20.2 mm	>20.2 mm	5.4 mm	1.00	13 mm	NM	NM (LMW=7.0 mm)	5.5 mm	0.42	3.7 mm	4.4 mm	175°	113°	62°	>1.00	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end snapped	
FS 32/109	Ln418	>14.2 mm	>14.2 mm	6.6 mm	1.00	>11.8 mm	NM	NM (LMW=8.1 mm)	8.5 mm	NM	6.2 mm	3.7 mm	185°	108°	78°	>0.60	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end crushed, one shoulder tang snapped	
FS 32/112	Ln418	>15.5 mm	>15.5 mm	5.7 mm	1.00	≈16.2 mm	NM	NM (LMW=8.2 mm)	8.7 mm	≈0.54	6.5 mm	3.1 mm	149°	101°	49°	>0.70	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end and one shoulder tang snapped	
FS 32/113	Ln418	24.1 mm	23.5 mm	3.9 mm	0.98	9.5 mm	2.54	29%	5.9 mm	0.62	5.2 mm	2.8 mm	201°	116°	90°	0.60	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 35/1	Ln418	>34.7 mm	>34.7 mm	4.7 mm	1.00	17.7 mm	NM	NM (LMW=5.9 mm)	8.3 mm	0.47	7.2 mm	4.0 mm	155°	110°	47°	>2.30	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	tip snapped	mahogany obsidian, quite large in comparison to other Rosegates in sample
FS 40/1	Ln418	30.5 mm	30.0 mm	7.0 mm	0.98	17.1 mm	1.78	22%	9.5 mm	0.55	5.7 mm	2.6 mm	174°	130°	46°	1.10	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	small chip at tip	minimally pressure-flaked on one side
FS 45/60	Ln418	30.1 mm	30.1 mm	5.4 mm	1.00	13 mm	2.32	27%	10.5 mm	0.35	7.1 mm	3.4 mm	161°	125°	42°	1.20	Panaca Summit (Modena area), NV/UT	Rosegate	*?Elko corner notched?*	complete	*manufacture defects on both base and blade - looks more like a Rosegate
FS 333/4	Ln418	>24 mm	>24 mm	7.1 mm	1.00	19.6 mm	NM	NM (LMW=9.3 mm)	9.8 mm	0.50	8.3 mm	4.0 mm	153°	103°	50°	1.30	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end snapped and partly reworked	
FS 333/5	Ln418	34.0 mm	34.0 mm	5.4 mm	1.00	13.6 mm	2.50	17%	7.7 mm	0.57	6.2 mm	3.4 mm	170°	108°	61°	1.30	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 24/31b	Ln418	≈23.5 mm	≈23.5 mm	5.5 mm	1.00	13.1 mm	≈1.79	≈30%	7.6 mm	0.58	6.6 mm	3.5 mm	181°	118°	63°	0.80	Unknown Variety B	Rosegate	Rosegate	small chip at tip	
FS 32/119	Ln418	≈26.0 mm	≈26.0 mm	5 mm	1.00	14.3mm	≈1.82	≈26%	≈6.0 mm	≈0.42	4.9 mm	3.7 mm	150°	118°	34°	≈0.90	Unknown Variety B	Rosegate	Rosegate	tip chipped, one side of base chipped	
FS 37/6	Ln418	18.7 mm	18.7 mm	5.7 mm	1.00	12.5 mm	1.50	43%	7.1 mm	0.57	6.1 mm	3.4 mm	169°	130°	39°	0.80	Unknown Variety B	Rosegate	Rosegate	tip appears reworked	
FS 11/8	Ln418	22.4 mm	22.4 mm	6.8 mm	1.00	15.5 mm	1.45	36%	>8.3 mm	NM	6.3 mm	3.2 mm	172°	122°	50°	>0.70	Unknown Variety C	Rosegate	Rosegate	one base tang chipped	crude, probably manufacture defects
FS 208/3	Ln418	25.6 mm	25.6 mm	4.9 mm	1.00	15.0 mm	1.71	22%	7.2 mm	0.48	5.7 mm	2.9 mm	155°	109°	46°	0.80	Unknown Variety C	Rosegate	Rosegate	complete	
FS 14/10	Ln418	>24.3 mm	>24.3 mm	3.2 mm	1.00	12.3 mm	NM	NM (LMW=4.5 mm)	8.3 mm	0.67	7.5 mm	3.1 mm	184°	113°	72°	>0.85	Unknown Variety D	Rosegate	Rosegate	tip snapped	
FS 41/9	Ln418	28.7 mm	28.2 mm	8.0 mm	0.98	>22.5 mm	NM	33%	7.2 mm	NM	12.2 mm	4.6 mm	146°	122°	25°	>2.40	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	one shoulder tang snapped	
FS 15/8	Ln418	>24.1 mm	>24.1 mm	11.2 mm	1.00	>18.8 mm	NM	NM (LMW=13.2 mm)	>10.7 mm	NM	>8.1 mm	6.1 mm	162°	117°	45°	>2.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	most of blade, half of base, & one shoulder snapped	
FS 24/40	Ln418	>38.9 mm	>37.7 mm	7.8 mm	0.97	27.1 mm	NM	NM (LMW=8.7 mm)	15 mm	0.55	13.1 mm	4.5 mm	152°	118°	35°	>4.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped	
FS 269/3	Ln418	29.6 mm	29.6 mm	8.0 mm	1.00	21.2 mm	1.40	31%	14.4 mm	0.68	9.2 mm	3.8 mm	192°	131°	65°	1.85	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	complete	
FS 452/11	Ln418	25.6 mm	25.6 mm	7.0 mm	1.00	21.5 mm	1.19	37%	14.2 mm	0.66	9.9 mm	5.7 mm	152°	129°	24°	2.40	Unknown Variety C	Elko corner notched	Elko corner notched	complete	
FS 423/3	Ln418	30.5 mm	28.1 mm	7.2 mm	0.92	24.8 mm	1.23	33%	≈12.1 mm	≈0.49	13.4 mm	5.4 mm	169°	114°	62°	≈3.00	Kane Springs Wash Caldera Variety 2, NV	Elko eared	Elko eared	small chip one edge of base	
FS 32/106	Ln418	36.9 mm	34.3 mm	7.6 mm	0.93	>20.5 mm	NM	22%	>14.6 mm	NM	12.5 mm	4.7 mm	150°	115°	37°	>3.40	Unknown Variety C	Elko eared	Elko eared	one shoulder and one base tang snapped	
FS 45/53	Ln418	37.5 mm	>34.7 mm	6.1 mm	NM	27.1 mm	1.38	15%	≈12.2 mm	0.45	14.8 mm	5.3 mm	164°	77°	87°	>3.90	Panaca Summit (Modena area), NV/UT	Gatecliff	Gatecliff	snapped diagonally near tip, base snapped diagonally	
FS 254/2	Ln418	34.8 mm	34.8 mm	5.0 mm	1.00	23.9 mm	1.46	22%	9.5 mm	0.40	11.3 mm	4.6 mm	189°	78°	69°	3.00	Kane Springs Wash Caldera Variety 1, NV	Gatecliff contracting stem	Gatecliff contracting stem	distal blade edges serrated, complete	
FS 333/6	Ln418	>24.9 mm	>24.9 mm	5.5 mm	1.00	22.7 mm	NM	NM (LMW=7.4 mm)	10.9 mm	0.48	12.6 mm	4.4 mm	160°	76°	85°	>2.40	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 423/1	Ln418	44.4 mm	44.4 mm	5.4 mm	1.00	26.4 mm	1.68	13%	8.8 mm	0.33	12.1 mm	5.7 mm	171°	84°	88°	4.30	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 257/6	Ln418	35.5 mm	34.0 mm	10.1 mm	0.96	22.8 mm	1.56	37%	11.3 mm	0.50	12.5 mm	5.9 mm	204°	92°	116°	3.30	Kane Springs Wash Caldera Variety 2, NV	Gatecliff split stem	Gatecliff split stem	complete	
FS 208/6	Ln418	>22.0 mm	>21.0 mm	5.6 mm	0.95	≈18.0 mm	NM	NM (LMW=7.3 mm)	≈10.8 mm	≈0.6	9.6 mm	4.0 mm	193°	100°	94°	>1.80	Panaca Summit (Modena area), NV/UT	Gatecliff split stem	Gatecliff split stem	distal end and one shoulder snapped, base chipped	
FS 42/1	Ln418	>25.5 mm	>20.2 mm	N/A	0.79	17.5 mm	NM	NM (LMW=7.1 mm)	15.0 mm	0.86	N/A	6.0 mm	N/A	N/A	N/A	>2.50	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end snapped and reworked	
FS 333/3	Ln418	36.0 mm	35.3 mm	N/A	0.98	14.4 mm	2.50	36%	11.5 mm	0.80	N/A	4.5 mm	N/A	N/A	N/A	2.30	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 452/5	Ln418	>24.9 mm	>24.6 mm	10.5 mm	0.99	23.4 mm	NM	0%	23.4 mm	1.00	14.9 mm	6.0 mm	205°	139°	66°	>3.20	Panaca Summit (Modena area), NV/UT	Large side notched, Sudden	out-of-key	distal end snapped, shoulders damaged	large, side notched point, but PSA too small for Thomas type - looks most like Sudden type
Cultural Unit VI (post-AD 1080 to Historic)																					
FS 25/83	Ln418	>18.0 mm	>18.0 mm	N/A	1.00	12.8 mm	NM	NM (LMW=15.4 mm)	12.3 mm	0.96	N/A	2.5 mm	N/A	N/A	N/A	>0.70	Unknown Variety E	Cottonwood leaf shaped	out-of-key	distal end snapped	WB/WM of Cottonwood triangular and MWP of leaf shaped
FS 65/1	Ln418	29.4 mm	29.1 mm	N/A	0.99	14.3 mm	2.06	26%	11.4 mm	0.79	N/A	5.0 mm	N/A	N/A	N/A	1.85	Kane Springs Wash Caldera Variety 2, NV	Cottonwood leaf shaped	out-of-key	complete	looks like large Cottonwood leaf shaped
FS 21/78	Ln418	22.8 mm	22.8 mm	N/A	1.00	15.1 mm	1.51	36%	13.0 mm	0.86	N/A	4.0 mm	N/A	N/A	N/A	1.20	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
FS 22/45	Ln418	>16.7 mm	>16.7 mm	N/A	1.00	10.2 mm	NM	NM (LMW=6.5 mm)	9.3 mm	0.91	N/A	2.5 mm	N/A	N/A	N/A	>0.40	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	tip chipped from two directions	
FS 191/3	Ln418	≈24.0 mm	≈24.0 mm	N/A	1.00	18.3 mm	1.31	44%	15.8 mm	0.86	N/A	5.7 mm	N/A	N/A	N/A	≈2.25	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	out-of-key	tip chipped	looks like large Cottonwood leaf shaped
FS 191/2	Ln418	28.2 mm	28.2 mm	N/A	1.00	17.3 mm	1.63	23%	15.8 mm	0.91	N/A	4.7 mm	N/A	N/A	N/A	1.60	Unknown Variety B	Cottonwood leaf shaped	out-of-key	complete	looks like large Cottonwood leaf shaped
FS 258/2	Ln418	22.2 mm	22.2 mm	N/A	1.00	11.2 mm	1.98	37%	8.0 mm	0.71	N/A	3.1 mm	N/A	N/A	N/A	0.70	Unknown Variety C	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
FS 117/2	Ln418	>22.2 mm	>22.2 mm	N/A	1.00	13.7 mm	NM	NM (LMW=12.2 mm)	10.3 mm	0.75	N/A	3.8 mm	N/A	N/A	N/A	>1.30	Unknown Variety D	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
FS 188/2	Ln418	≈22 mm	≈20.5 mm	N/A	0.93	14.2 mm	≈1.55	0%	14.2 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	≈0.70	Kane Springs Wash Caldera Variety 1, NV	Cottonwood triangular	Cottonwood triangular	tip chipped	
FS 22/38	Ln418	27.3 mm	26.6 mm	N/A	0.97	14.7 mm	1.86	42%	13.0 mm	0.88	N/A	4.6 mm	N/A	N/A	N/A	1.80	Kane Springs Wash Caldera Variety 2, NV	Cottonwood triangular	out-of-key	distal end damaged and reworked	thick for Cottonwood, too short for Humboldt, similar to Utah "Cottonwoods"
FS 6/15	Ln418	16.8 mm	15.6 mm	N/A	0.93	14.9 mm	1.13	0%	14.9 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	0.70	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	distal blade edges reworked, one base tang chipped	thick for Cottonwood triangular (appearance), similar to Utah "Cottonwoods" in association with Parowan basal notched
FS 5/17	Ln418	>14.0 mm	>13.0 mm	N/A	0.93	14.1 mm	NM	0%	14.1 mm	1.00	N/A	2.9 mm	N/A	N/A	N/A	>0.40	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 22/40	Ln418	>16.3 mm	>15.7 mm	N/A	0.96	15.1 mm	NM	0%	15.1 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.70	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 120/6	Ln418	>20.4 mm	>20.4 mm	N/A	1.00	17.3 mm	NM	0%	17.3 mm	1.00	N/A	3.6 mm	N/A	N/A	N/A	>1.10	Unknown Variety C	Cottonwood triangular	Cottonwood triangular	distal end snapped	xrf lists as 120/6
FS 21/62	Ln418	>22.5 mm	>22.5 mm	N/A	1.00	15.6 mm	NM	0%	15.6 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>1.35	Unknown Variety E	Cottonwood triangular	Cottonwood triangular	distal end snapped	xrf lists as 27/62 - either way, same unit
FS 188/1	Ln418	13.5 mm	12.1 mm	5.8 mm	0.90	≈10.3 mm	0.76	0%	≈10.3 mm	1.00	6.0 mm	2.8 mm	184°	176°	8°	>0.25	Kane Springs Wash Caldera Variety 2, NV	Desert side notched	Desert side notched	one base tang snapped	Sierra type
FS 25/79	Ln418	>21.0 mm	>18.2 mm	9.9 mm	0.87	13.6 mm	NM	0%	13.6 mm	1.00	7.0 mm	3.0 mm	195°	192°	4°	>0.75	Obsidian Butte, NV, Variety 5 (Unknown C)	Desert side notched	Desert side notched	distal end snapped	Sierra type
FS 7/17	Ln418	>12.3 mm	>9.4 mm	7.4 mm	0.76	>10.1 mm	NM	0%	>10.1 mm	1.00	5.4 mm	2.3 mm	194°	173°	23°	>0.25	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	distal end snapped, one base tang snapped	Sierra type
FS 7/19	Ln418	24.7 mm	21.0 mm	9.0 mm	0.85	>11 mm	NM	0%	>11 mm	1.00	7.9 mm	4.0 mm	210°	166°	45°	>0.60	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	one base tang snapped	Sierra type
FS 27/61	Ln418	≈18.0 mm	≈17.3 mm	5.6 mm	0.96	9.8 mm	1.84	0%	9.8 mm	1.00	5.5 mm	2.3 mm	221°	161°	60°	≈0.30	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	tip chipped	Sierra type
FS 27/63	Ln418	27.7 mm	27.7 mm	5.9 mm	1.00	10.3 mm	2.69	29%	8.8 mm	0.85	5.6 mm	3.9 mm	228°	157°	73°	0.90	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	complete	Desert type
FS 27/64	Ln418	16.2 mm	14.2 mm	8.2 mm	0.88	12.8 mm	1.27	16%	10.3 mm	0.80	7.1 mm	3.4 mm	245°	150°	84°	0.50	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	complete	Sierra type, worn appearance
FS 131/4	Ln418	>10.4 mm	>7.4 mm	8.2 mm	0.71	12.8 mm	NM	0%	12.8 mm	1.00	7.7 mm	2.5 mm	199°	185°	15°	>0.25	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	blade snapped vertically above shoulder	Sierra type
FS 22/44	Ln418	21.1 mm	21.1 mm	2.1 mm	1.00	17 mm	1.24	14%	5.2 mm	0.31	7.6 mm	3.7 mm	171°	78°	93°	0.90	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 7/21	Ln418	>19.6 mm	>19.6 mm	1.9 mm	1.00	15.0 mm	NM	NM (LMW=2.2 mm)	5.9 mm	0.39	6.9 mm	3.6 mm	144°	75°	69°	>1.10	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 22/39	Ln418	26.2 mm	25.9 mm	3.5 mm	0.99	15.7 mm	1.67	11%	5.1 mm	0.32	5.7 mm	.0 mm	170°	73°	99°	0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 66/1	Ln418	33.1 mm	31.9 mm	4.7 mm	0.96	18.2 mm	1.82	12%	5.9 mm	0.32	6.9 mm	4.1 mm	133°	85°	50°	>1.40	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff split stem?*	base chipped	looks more like a Rosegate with contracting stem - Parowan basal notched
FS 108/6	Ln418	26.3 mm	26.3 mm	4.5 mm	1.00	13.4 mm	1.96	19%	8.5 mm	0.63	9.0 mm	4.3 mm	164°	88°	76°	0.95	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 113/1	Ln418	17.4 mm	17.4 mm	1.2 mm	1.00	≈17.7 mm	≈0.98	13%	6.0 mm	≈0.34	9.9 mm	2.9 mm	143°	54°	91°	≈0.80	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of key	one shoulder tang chipped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 59/3	Ln418	>24.4 mm	>24.4 mm	3.4 mm	1.00	18.5 mm	NM	NM (LMW=3.9 mm)	9.1 mm	0.49	10.0 mm	3.6 mm	144°	70°	104°	>1.20	Unknown Variety B	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	too small for "dart point" category - Parowan basal notched
FS 78/1	Ln418	18.0 mm	18.0 mm	3.5 mm	1.00	15.8 mm	1.14	25%	7.0 mm	0.44	8.2 mm	3.8 mm	188°	69°	119°	0.80	Unknown Variety B	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 113/2	Ln418	>20.9 mm	>20.9 mm	4.2 mm	1.00	14.9 mm	NM	NM (LMW=5.2 mm)	6.1 mm	0.41	7.4 mm	3.6 mm	169°	78°	91°	>0.90	Unknown Variety B	Parowan basal notched	out-of-key	tip snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 78/2	Ln418	26.6 mm	26.6 mm	3.5 mm	1.00	≈13.8 mm	≈1.93	≈15%	6.2 mm	≈0.46	6.5 mm	3.0 mm	153°	92°	60°	≈0.85	Unknown Variety C	Parowan basal notched	out-of-key	one shoulder chipped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 113/5	Ln418	21.0 mm	1.0 mm	1.8 mm	1.00	12.1 mm	1.74	26%	5.4 mm	0.45	6.2 mm	3.3 mm	145°	60°	95°	0.80	Unknown Variety C	Parowan basal notched	out-of-key	tip and distal blade edges worn & reworked, tip chipped, one tang snapped	looks like "arrow point-size" Gatecliff
FS 131/3	Ln418	21.3 mm	21.3 mm	3.9 mm	1.00	18.3 mm	0.86	24%	6.9 mm	0.38	8.3 mm	3 mm	148°	77°	73°	0.80	Unknown Variety C	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 54/2	Ln418	>10.6 mm	>10.6 mm	4.1 mm	1.00	13.1 mm	NM	NM (LMW=5.2 mm)	6.2 mm	0.47	6.3 mm	3.2 mm	199°	77°	122°	>0.50	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	blade snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 107/1	Ln418	>13.6 mm	>13.6 mm	7.3 mm	1.00	≈13.2 mm	NM	NM (LMW=10.3 mm)	9.6 mm	≈0.73	6.8 mm	3.3 mm	216°	115°	101°	>0.60	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	blade and one shoulder snapped	
FS 108/5	Ln418	30.5 mm	30.5 mm	5.6 mm	1.00	10.8 mm	2.82	22%	5.9 mm	0.55	5.3 mm	3.7 mm	183°	109°	75°	0.80	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 83/1	Ln418	>17.5 mm	>17.5 mm	5.2 mm	1.00	14.9 mm	NM	NM (LMW=7.9 mm)	7.8 mm	0.52	5.9 mm	3.7 mm	181°	117°	66°	>0.75	Unknown Variety B	Rosegate	Rosegate	distal end smashed	
FS 60/3	Ln418	>28 mm	>28 mm	7.6 mm	1.00	>23.4 mm	NM	NM (LMW=9.4 mm)	15.7 mm	NM	12.4 mm	5.3 mm	157°	115°	41°	>3.70	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped & reworked, one shoulder snapped	
FS 83/4	Ln418	>35.7 mm	>34.3 mm	9.3 mm	0.96	27.9 mm	NM	NM (LMW=12.0 mm)	≈13.3 mm	≈0.48	12.1 mm	4.9 mm	172°	127°	45°	>5.20	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped, one base tang chipped	minimally pressure-flaked on one surface, may have broken during manufacture
FS 83/7	Ln418	>32.3 mm	>31.2 mm	8.0 mm	0.97	24.1 mm	NM	NM (LMW=9.1 mm)	18.3 mm	0.76	16.7 mm	5.2 mm	186°	110°	78°	>4.70	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped in two directions	
FS 108/27	Ln418	>20.3 mm	>20.3 mm	5.9 mm	1.00	22.5 mm	NM	NM (LMW=8.1 mm)	15.4 mm	0.68	14.1 mm	3.4 mm	202°	122°	75°	>2.00	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped	
FS 74/6	Ln418	>25.1 mm	>22.2 mm	8.5 mm	0.88	21.3 mm	NM	NM (LMW=10.2 mm)	17.0 mm	0.80	13.0 mm	5.0 mm	178°	130°	45°	>2.80	Panaca Summit (Modena area), NV/UT	Elko eared	Elko eared	distal end snapped, edges reworked	mahogany obsidian
FS 7/20	Ln418	38.2 mm	38.2 mm	5.7 mm	1.00	24.3 mm	1.57	21%	10.3 mm	0.42	13.5 mm	4.6 mm	186°	63°	123°	3.40	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	serrated on distal edges, serration on 1 side worn (across shoulder tang), base damage	wear pattern more consistent with knife blade wear
FS 54/1	Ln418	31.3 mm	31.3 mm	5.4 mm	1.00	25.7 mm	1.22	25%	4.5 mm	0.18	10.9 mm	5.1 mm	163°	55°	109°	2.80	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal blade edges appear reworked	
FS 89/5	Ln418	>24 mm	>23.7 mm	4.6 mm	0.99	26.1 mm	NM	NM (LMW=5.8 mm)	13.0 mm	0.50	15.4 mm	5.5 mm	165°	75°	92°	>4.00	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 108/4	Ln418	>19.2 mm	>19.2 mm	6.7 mm	1.00	>19.4 mm	NM	NM (LMW=7.4 mm)	11.0 mm	NM	11.8 mm	3.7 mm	174°	74°	101°	>1.30	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end smashed	
FS 117/5	Ln418	>29.6 mm	>29.6 mm	6.4 mm	1.00	22.1 mm	NM	NM (LMW=7.8 mm)	>10.2 mm	NM	15.6 mm	5.2 mm	164°	80°	85°	>3.10	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, one base corner snapped, one distal edge snapped	
FS 121/1	Ln418	29.0 mm	29.0 mm	5.2 mm	1.00	17.1 mm	1.70	30%	7.6 mm	0.44	9.7 mm	4.9 mm	168°	73°	67°	2.35	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end and one shoulder appear reworked	
FS 22/36	Ln418	30.0 mm	30.0 mm	6.1 mm	1.00	20.5 mm	1.46	27%	8.1 mm	0.40	10.4 mm	5.2 mm	171°	70°	102°	2.70	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	tip appears damaged and reworked	
FS 64/1	Ln418	25.7 mm	25.4 mm	3.7 mm	0.99	21.1 mm	1.22	17%	6.0 mm	0.28	8.9 mm	4.8 mm	131°	52°	80°	2.10	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	serrated on distal blade edges - complete	serrated: very short barbs, evenly spaced, appearance similar to steak knife
FS 108/3	Ln418	31.7 mm	30.7 mm	5.8 mm	0.97	18.7 mm	1.70	26%	6.6 mm	0.35	8.5 mm	5.5 mm	174°	86°	89°	2.70	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 27/60	Ln418	>27.4 mm	>27.4 mm	6.3 mm	1.00	25.6 mm	NM	NM (LMW=8.6 mm)	11.5 mm	0.45	15.3 mm	5.0 mm	135°	57°	79°	2.30	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	blade heavily damaged, some reworked	
FS 505/3	Ln418	41.5 mm	40.4 mm	5.1 mm	0.97	27.1 mm	1.53	43%	9.4 mm	0.35	11.5 mm	5.1 mm	186°	54°	132°	5.30	Kane Springs Wash Caldera Variety 2, NV	Gatecliff split stem	Gatecliff split stem	complete	very wide, rounded , with somewhat serrated edges - looks like *Populus* ssp. leaf
FS 27/54	Ln418	>26.8 mm	>26.0 mm	8.3 mm	0.97	≈22.6 mm	NM	NM (LMW=17.2 mm)	15.6 mm	≈0.69	15.1 mm	6.8 mm	197°	94°	103°	>4.30	Panaca Summit (Modena area), NV/UT	Gatecliff split stem	Gatecliff split stem	distal end snapped, distal blade edges damaged & reworked, one shoulder snapped	

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
FS 117/1	Ln418	43.3 mm	42.1 mm	N/A	0.97	17.3 mm	2.50	24%	13.8 mm	0.80	N/A	5.6 mm	N/A	N/A	N/A	3.75	Kane Springs Wash Caldera Variety 2, NV	Humboldt	Humboldt	complete	
FS 89/3	Ln418	33.3 mm	32.0 mm	N/A	0.96	13.0 mm	2.56	42%	7.5 mm	0.58	N/A	5.0 mm	N/A	N/A	N/A	>2.00	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	large chip on one edge at hafting element, one large chip on distal edge	
Cultural Unit V (AD 1060, AD 1080)																					
FS 26/87	Ln418	17.3 mm	16.2 mm	N/A	0.94	≈12 mm	≈1.44	15%	≈9.9 mm	≈0.83	N/A	2.4 mm	N/A	N/A	N/A	>0.40	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	one side of base appears snapped and reworked	xrf lists as 25/87
FS 82/7	Ln418	>26.3 mm	>25.8 mm	N/A	0.98	13.1 mm	NM	NM (LMW=10.4 mm)	8.7 mm	0.66	N/A	3.5 mm	N/A	N/A	N/A	>1.50	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	out-of-key	distal end snapped	looks most like a Cottonwood series point but large like UT types
FS 85/2	Ln418	>24.8 mm	>24.8 mm	N/A	1.00	14.5 mm	NM	NM (LMW=7.6 mm)	10.0 mm	0.69	N/A	3.1 mm	N/A	N/A	N/A	>1.30	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	out-of-key	distal end snapped	looks like large Cottonwood leaf shaped - like UT points
FS 132/1	Ln418	>19.8 mm	>19.8 mm	N/A	1.00	16.5 mm	NM	NM (LMW=6.3 mm)	14.8 mm	0.90	N/A	3.9 mm	N/A	N/A	N/A	>1.30	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	distal end snapped	
FS 146/2	Ln418	21.3 mm	21.3 mm	N/A	1.00	10.7 mm	1.99	27%	9.1 mm	0.85	N/A	2.8 mm	N/A	N/A	N/A	0.50	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	complete	
FS 209/1	Ln418	>24.7 mm	>24.4 mm	N/A	0.99	13.5 mm	NM	NM (LMW=10.8 mm)	9.3 mm	0.69	N/A	3.5 mm	N/A	N/A	N/A	>1.40	Unknown Variety C	Cottonwood leaf shaped	out-of-key	distal end snapped	looks most like a Cottonwood series point but large like UT types
FS 391/18	Ln418	32.0 mm	32.0 mm	N/A	1.00	14.7 mm	2.18	47%	5.0 mm	0.34	N/A	4.6 mm	N/A	N/A	N/A	1.80	Unknown Variety C	Cottonwood leaf shaped	out-of-key	complete	looks like large Cottonwood leaf shaped
FS 153/12	Ln418	>21.2 mm	>20.7 mm	N/A	0.98	15.3 mm	NM	NM (LMW=1.7 mm)	14.8 mm	0.97	N/A	2.6 mm	N/A	N/A	N/A	>1.00	Kane Springs Wash Caldera Variety 1, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 135/3	Ln418	>20.3 mm	>20.3 mm	N/A	1.00	17.4 mm	NM	0%	17.4 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	>1.10	Kane Springs Wash Caldera Variety 2, NV	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 200/2	Ln418	>20.0 mm	>20.0 mm	N/A	1.00	14.0 mm	NM	NM (LMW=5.1 mm)	13.7 mm	0.98	N/A	2.6 mm	N/A	N/A	N/A	>0.90	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 200/5	Ln418	>32.0 mm	>3.0 mm	N/A	1.00	16.8 mm	NM	0%	16.8 mm	1.00	N/A	4.4 mm	N/A	N/A	N/A	>1.70	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	tip snapped, one edge appears reworked	long, triangular shape, slightly large Cottonwood (UT)
FS 391/15	Ln418	36.3 mm	36.3 mm	N/A	1.00	16.6 mm	2.19	32%	12.9 mm	0.78	N/A	5.2 mm	N/A	N/A	N/A	3.10	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	edges reworked, especially hafting element	looks like large Cottonwood triangular
FS 26/33	Ln418	20.3 mm	19.3 mm	N/A	0.95	11.7 mm	1.74	8%	10.7 mm	0.91	N/A	3.0mm	N/A	N/A	N/A	0.60	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood triangular	Cottonwood triangular	complete	
FS 216/1	Ln418	20.0 mm	18.3 mm	5.3 mm	0.92	10.0 mm	0.50	30%	≈7.1 mm	≈0.71	6.4 mm	2.7 mm	208°	144°	68°	>0.30	Kane Springs Wash Caldera Variety 2, NV	Desert side notched	Desert side notched	one base tang snapped	Desert type
FS 189/4	Ln418	20.1 mm	20.1 mm	4.5 mm	1.00	≈11.0 mm	≈1.83	0%	≈11.0 mm	1.00	5.7 mm	2.5 mm	194°	179°	9°	>0.35	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	one base tang snapped	Desert type, xrf lists as 189/4
FS 173/1	Ln418	25.1 mm	25.1 mm	3.1 mm	1.00	17.4 mm	1.44	14%	6.2 mm	0.36	6.6 mm	4.2 mm	129°	78°	53°	1.30	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	too small for "dart point" category - Parowan basal notched
FS 31/49	Ln418	21.9 mm	21.4 mm	3.1 mm	0.98	18.6 mm	1.18	24%	3.9 mm	0.21	5.1 mm	3.7 mm	133°	68°	67°	0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	complete	looks like "arrow point-size" Gatecliff with barbs - Parowan basal notched
FS 146/3	Ln418	21.8 mm	21.8 mm	1.8 mm	1.00	>15.2 mm	NM	3%	4.7 mm	NM	6.5 mm	3.5 mm	147°	55°	89°	>0.70	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	one base tang snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 173/1	Ln418	>17.3 mm	>17.3 mm	3.3 mm	1.00	15.8 mm	NM	NM (LMW=3.9 mm)	5.6 mm	0.35	7.6 mm	3.0 mm	137°	73°	65°	>0.65	Kane Springs Wash Caldera Variety 1, NV	Parowan basal notched	out-of key	distal end snapped, edges reworked	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 85/1	Ln418	>11.2 mm	>11.2 mm	3.2 mm	1.00	14.6 mm	NM	NM (LMW=3.7 mm)	8.6 mm	0.59	9.8 mm	3.2 mm	150°	68°	83°	>0.65	Unknown Variety C	Parowan basal notched	out-of-key	blade snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 189/7	Ln418	>11.3 mm	>11.3 mm	1 mm	1.00	13.5 mm	NM	NM (LMW=1.7 mm)	4.1 mm	0.30	5.5 mm	3.6 mm	159°	79°	80°	>0.50	Unknown Variety C	Parowan basal notched	out-of-key	distal end snapped about half	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 200/10	Ln418	>19.4 mm	>19.4 mm	4.1 mm	1.00	13.7 mm	NM	NM (LMW=5.8 mm)	7.0 mm	0.51	8.2 mm	4.3 mm	141°	77°	65°	>1.00	Unknown Variety C	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	too small for "dart point" category - Parowan basal notched
FS 146/4	Ln418	>16.0 mm	>16.0 mm	1.8 mm	1.00	16.5 mm	NM	NM (LMW=3.7 mm)	5.5 mm	NM	7.0 mm	3.9 mm	137°	70°	67°	>0.90	Unknown Variety D	Parowan basal notched	out-of-key	distal end snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 146/5	Ln418	>22.9 mm	>22.9 mm	3.3 mm	1.00	>14.7 mm	NM	NM (LMW=1.6 mm)	7.8 mm	NM	8.7 mm	3.4 mm	133°	71°	63°	>1.15	Unknown Variety D	Parowan basal notched	*?Gatecliff contracting stem?*	distal end smashed, one edge heavily reworked	too small for "dart point" category - Parowan basal notched
FS 189/5	Ln418	>21.0 mm	>21.0 mm	3.8 mm	1.00	19.4 mm	NM	NM (LMW=3.5 mm)	7.6 mm	0.39	9.7 mm	4.3 mm	167°	75°	88°	>1.10	Unknown Variety E	Parowan basal notched	out-of-key	tip snapped	looks like "arrow point-size" Gatecliff - Parowan basal notched
FS 124/89	Ln418	>19.0 mm	>19.0 mm	4.1 mm	1.00	12.9 mm	NM	NM (LMW=6.0 mm)	8.2 mm	0.64	7.7 mm	3.0 mm	144°	111°	75°	>0.65	Kane Springs Wash Caldera Variety 1, NV	Rosegate	Rosegate	tip snapped, base chipped	
FS 87/11	Ln418	29.3 mm	28.9 mm	4.6 mm	0.99	18.3 mm	1.60	21%	11.2 mm	0.61	9.5 mm	3.7 mm	143°	112°	33°	1.40	Kane Springs Wash Caldera Variety 2, NV	Rosegate	*?Elko corner notched?*	complete	very small, looks more like Rosegate
FS 288/1	Ln418	27.0 mm	27.0 mm	5.9 mm	1.00	14.9 mm	1.81	36%	7.1 mm	0.48	6 mm	4.6 mm	176°	112°	59°	1.15	Kane Springs Wash Caldera Variety 2, NV	Rosegate	Rosegate	complete	
FS 99/1	Ln418	28.0 mm	28.0 mm	5.6 mm	1.00	12.5 mm	2.24	25%	8.4 mm	0.67	5.9 mm	3.8 mm	186°	126°	61°	1.10	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 132/2	Ln418	20.6 mm	20.3 mm	4.7 mm	0.99	15.2 mm	1.36	25%	7.3 mm	0.48	6.7 mm	3.0 mm	130°	112°	19°	0.55	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 141/4	Ln418	>20.1 mm	>20.1 mm	3.7 mm	1.00	15.0 mm	NM	NM (LMW=8.7 mm)	≈7.2 mm	≈0.48	6.6 mm	4.0 mm	128°	111°	17°	>1.20	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end snapped, one base tang chipped	
FS 150/2	Ln418	19.8 mm	19.2 mm	3.9 mm	0.97	10.0 mm	1.98	23%	7.0 mm	0.70	5.7 mm	3.0 mm	182°	125°	55°	0.50	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 153/7	Ln418	>16.8 mm	>16.8 mm	4.8 mm	1.00	11.1 mm	NM	NM (LMW=7.5 mm)	7.3 mm	0.66	6.0 mm	3.4 mm	182°	128°	65°	>0.55	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end snapped	
FS 153/8	Ln418	>21.4 mm	>21.4 mm	4.7 mm	1.00	12.1 mm	NM	NM (LMW=6.4 mm)	7.5 mm	0.62	6.8 mm	3.3 mm	186°	130°	57°	>0.80	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end snapped	
FS 178/1	Ln418	21.5 mm	21.2 mm	6.1 mm	0.99	14.7 mm	1.46	34%	7.5 mm	0.51	6.2 mm	3.5 mm	165°	108°	58°	0.65	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 212/1	Ln418	≈22.0 mm	≈22.0 mm	4.5 mm	1.00	15.5 mm	≈1.42	≈23%	8.8 mm	0.57	7.7 mm	3.3 mm	145°	96°	50°	≈0.80	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	extreme tip snapped	
FS 262/2	Ln418	18.8 mm	18.2 mm	4.9 mm	0.97	15.4 mm	1.22	27%	7.5 mm	0.49	6.7 mm	2.8 mm	145°	108°	38°	0.60	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	
FS 88/2	Ln418	21.2 mm	20.6 mm	4.2 mm	0.97	13.4 mm	1.58	26%	7.0 mm	0.52	6.1 mm	3.8 mm	152°	101°	51°	0.70	Unknown Variety C	Rosegate	Rosegate	complete	
FS 171/4	Ln418	27.2 mm	27.2 mm	5.7 mm	1.00	>11.4 mm	NM	25%	7.7 mm	NM	7.1 mm	2.9 mm	158°	106°	53°	>0.80	Unknown Variety C	Rosegate	Rosegate	blade snapped vertically from shoulder	
FS 219/6	Ln418	>25.5 mm	>25.6 mm	5.5 mm	1.00	12.0 mm	NM	NM (LMW=7.9 mm)	6.9 mm	0.58	5.7 mm	4.5 mm	182°	110°	72°	>1.1	Unknown Variety C	Rosegate	Rosegate	tip snapped, base chipped	
FS 291/1	Ln418	>23.5 mm	>23.5 mm	5.0 mm	1.00	18.7 mm	NM	NM (LMW=6.0 mm)	8.3 mm	0.44	7.2 mm	3.5 mm	153°	115°	40°	>1.30	Unknown Variety C	Rosegate	Rosegate	distal end snapped, one edge chipped	
FS 155/1	Ln418	25.4 mm	25.4 mm	6.3 mm	1.00	10.5 mm	2.42	32%	8.1 mm	0.77	6.0 mm	2.9 mm	167°	121°	45°	0.75	Unknown Variety E	Rosegate	Rosegate	one shoulder chipped	
FS 210/1	Ln418	>19.5 mm	>19.5 mm	6 mm	1.00	16.1 mm	NM	NM (LMW=6.4 mm)	9.5 mm	0.59	7.1 mm	3.4 mm	162°	110°	50°	>1.10	Unknown Variety E	Rosegate	Rosegate	distal end snapped	
FS 200/3	Ln418	≈26.8 mm	≈26.8 mm	5.4 mm	0.99	18.3 mm	≈1.46	≈28%	14.8 mm	0.81	10.7 mm	3.9 mm	159°	132°	28°	1.40	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	tip chipped	very small, looks more like Rosegate
FS 182/2	Ln418	30.8 mm	30.8 mm	6.5 mm	1.00	22.6 mm	1.36	24%	20.3 mm	0.90	7.2 mm	5.0 mm	197°	148°	50°	2.70	Kane Springs Wash Caldera Variety 2, NV	Elko corner notched	Elko corner notched	complete	
FS 79/3	Ln418	>13.3 mm	>13.3 mm	11.5 mm	1.00	>22.7 mm	NM	NM	22.7 mm	NM	15.4 mm	5.7 mm	201°	132°	70°	>1.70	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	blade snapped horizontally from shoulder to neck	
FS 116/2	Ln418	>36.0 mm	>34.4 mm	8.7 mm	0.96	25.0 mm	NM	NM (LMW=13.0 mm)	14.2 mm	0.57	16.5 mm	5.7 mm	161°	123°	39°	>4.70	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped, distal blade edges damaged	minimal pressure-flaking on one side
FS 153/1	Ln418	25.0 mm	25.0 mm	7.1 mm	1.00	17.8 mm	1.40	37%	11.5 mm	0.65	10.4 mm	4.0 mm	191°	109°	84°	1.70	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	tip appears reworked	
FS 155/4	Ln418	>34.3 mm	>32.3 mm	9.6 mm	0.94	28.7 mm	NM	NM (LMW=14.0 mm)	>19.3 mm	NM	17.4 mm	6.0 mm	215°	120°	96°	>5.50	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped, one base tang snapped	
FS 172/1	Ln418	>19.4 mm	>18.1 mm	7.5 mm	0.93	>20.6 mm	NM	NM (LMW=9.3 mm)	17.0 mm	NM	15.0 mm	4.9 mm	201°	135°	66°	>2.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	most of blade & one shoulder snapped	
FS 173/4	Ln418	>26.7 mm	>26.4 mm	6.4 mm	0.99	>20 mm	NM	NM (LMW≈7.9 mm)	14.8 mm	NM	10.7 mm	4.0 mm	148°	124°	23°	>2.00	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end and one shoulder snapped	
FS 176/1	Ln418	33.4 mm	33.4 mm	6.9 mm	1.00	≈24.7 mm	≈1.35	24%	16.7 mm	≈0.68	14.5 mm	5.1 mm	158°	114°	45°	3.50	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	small chip on one shoulder tang	
FS 176/2	Ln418	37.1 mm	36.5 mm	6.3 mm	0.98	21.9 mm	1.69	35%	15.6 mm	0.71	13.3 mm	5.0 mm	161°	120°	40°	3.20	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	complete	minimally pressure-flaked on one surface
FS 189/3	Ln418	33.7 mm	33.7 mm	6.3 mm	1.00	19.8 mm	1.70	16%	11.6 mm	0.59	8.7 mm	4.5 mm	132°	125°	8°	1.95	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	complete	asymmetrical base, "eagle point"-shaped
FS 204/2	Ln418	29.6 mm	29 mm	7.5 mm	0.98	20.2 mm	1.47	24%	13.2 mm	0.65	9.1 mm	3.5 mm	134°	111°	24°	1.90	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	complete	
FS 213/1	Ln418	>30.9 mm	>30.9 mm	8.5 mm	1.00	22.7 mm	NM	NM (LMW=10.85 mm)	14.6 mm	0.64	14.1 mm	5.1 mm	164°	104°	61°	>3.50	Panaca Summit (Modena area), NV/UT	Elko corner notched	out-of-key	one shoulder tang snapped at neck, distal end snapped & reworked	looks most like an Elko series, but PSA between Gatecliff and Elko types
FS 219/3	Ln418	>35.1 mm	>35.1 mm	7.2 mm	1.00	24.1 mm	NM	NM (LMW=14.9 mm)	14.7 mm	0.61	11.9 mm	5.0 mm	121°	110°	17°	>4.50	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end smashed	
FS 262/3	Ln418	>21.0 mm	>21.0 mm	5.2 mm	1.00	17.4 mm	NM	NM (LMW=11.6 mm)	10.2 mm	0.59	8.5 mm	2.8 mm	191°	123°	68°	>1.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped	looks more like a Rosegate than Elko
FS 291/12	Ln418	40.5 mm	40.5 mm	8.9 mm	1.00	29.1 mm	1.39	24%	19.2 mm	0.66	17.1 mm	5.5 mm	168°	130°	38°	4.80	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	one base tang snapped	
FS 291/9	Ln418	>39.0 mm	>39.0 mm	6.8 mm	1.00	28.2 mm	NM	NM (LMW=8.5 mm)	7.2 mm	0.26	16.3 mm	4.4 mm	156°	110°	47°	>5.30	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped, one distal edge smashed	
FS 296/4	Ln418	38.2 mm	38.2 mm	7.2 mm	1.00	22.6 mm	1.69	24%	>17.2 mm	NM	16.5 mm	4.1 mm	182°	116°	62°	>3.30	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	about 35% of base snapped diagonally	
FS 308/2	Ln418	30.5 mm	30.5 mm	7.4 mm	1.00	19.0 mm	0.62	39%	13.2 mm	0.69	11.8 mm	4.1 mm	194°	131°	64°	2.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	base and distal blade edges reworked	
FS 31/47	Ln418	23.8 mm	23.8 mm	5.5 mm	1.00	18.2 mm	1.31	30%	12.3 mm	0.68	11.6 mm	3.7 mm	204°	129°	74°	1.60	Unknown Variety B	Elko corner notched	Elko corner notched	complete, but appears extensively reworked	
FS 219/7	Ln418	24.5 mm	23.0 mm	5.2 mm	0.94	14.3 mm	1.71	26%	11.2 mm	0.78	9.9 mm	3.2 mm	170°	119°	51°	1.10	Unknown Variety C	Elko corner notched	Elko corner notched	complete	very small for "dart-point" (Rosegate?)
FS 219/4	Ln418	31.7 mm	30.2 mm	7.3 mm	0.95	19.3 mm	1.64	28%	10.5 mm	0.54	8.9 mm	4.4 mm	160°	117	43°	2.20	Unknown Variety D	Elko corner notched	Elko corner notched	complete	
FS 182/1	Ln418	32.4 mm	32.4 mm	5.2 mm	1.00	21.2 mm	1.53	23%	9.9 mm	0.47	13.1 mm	4.6 mm	168°	65°	104°	2.35	Kane Springs Wash Caldera Variety 2, NV	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 204/4	Ln418	32.0 mm	32.0 mm	7.4 mm	1.00	20 mm	1.60	26%	10.4 mm	0.52	15.0 mm	5.8 mm	199°	64°	45°	3.10	Kane Springs Wash Caldera Variety 2, NV	Gatecliff contracting stem	Gatecliff contracting stem	one distal edge appears reworked	
FS 103/1	Ln418	>27.3 mm	>27.3 mm	7.1 mm	1.00	21 mm	NM	NM (LMW=7.3 mm)	4.8 mm	0.23	10.0 mm	5.5 mm	200°	68°	130°	>2.80	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped horizontally	
FS 129/1	Ln418	>40.6 mm	>40.6 mm	5.3 mm	1.00	17.3 mm	NM	NM (LMW=6.0 mm)	8.1 mm	0.47	9.7 mm	4.3 mm	186°	70°	117°	>3.45	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 203/3	Ln418	>21.4 mm	>21.4 mm	9.4 mm	1.00	NM	NM	NM	7.4 mm	NM	16.0 mm	5.2 mm	184°	65°	125°	>2.40	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 204/3	Ln418	28.3 mm	27.7 mm	6.4 mm	0.98	18.6 mm	1.52	28%	4.2 mm	0.23	12.2 mm	4.5 mm	200°	50°	150°	1.90	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	xrf lists as 204/?
FS 204/5	Ln418	>22.5 mm	>22.5 mm	6.8 mm	1.00	26.6 mm	NM	NM (LMW=17.9 mm)	8.0 mm	0.30	13.3 mm	4.8 mm	186°	53°	135°	>3.30	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped	xrf lists as 304/5
FS 291/13	Ln418	>29.7 mm	>29.7 mm	8.8 mm	1.00	29.3 mm	NM	NM (LMW=11.0 mm)	12.3 mm	0.42	19.9 mm	5.2 mm	153°	92°	60°	>3.70	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped diagonally	
FS 291/2	Ln418	42.6 mm	42.3 mm	3.9 mm	0.99	18.0 mm	2.37	10%	6.3 mm	0.35	8.1 mm	4.2 mm	164°	69°	93°	2.70	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 298/2	Ln418	>21.2 mm	>21.2 mm	7.0 mm	1.00	23.1 mm	NM	NM (LMW=8.1 mm)	>10.0 mm	NM	12.2 mm	3.8 mm	167°	101°	67°	>1.80	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped, base snapped	appearance more similar to Elko corner notched
FS 391/21	Ln418	≈30.1 mm	≈30.1 mm	≈6.1 mm	1.00	22.3 mm	≈1.35	≈28%	≈6.0 mm	≈0.27	12 mm	4.0 mm	185°	42°	144°	≈2.20	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	small, diagonal snap across base	
FS 209/4	Ln418	>26.1 mm	>26.1 mm	7.3 mm	1.00	24.3 mm	NM	NM (LMW=7.5 mm)	5.2 mm	0.21	10.6 mm	3.4 mm	163°	62°	78°	>2.00	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped in v-shape	
FS 75/97	Ln418	40.4 mm	40.4 mm	6.8 mm	1.00	25.8 mm	1.57	22%	6.7 mm	0.26	11.1 mm	6.0 mm	151°	61°	91°	4.55	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	barbed on distal edges, barbs exhibit considerable wear on one side	
FS 306/2	Ln418	33.2 mm	33.2 mm	6.5 mm	1.00	19.0 mm	0.57	26%	7.3 mm	0.38	12.2 mm	4.9 mm	198°	75°	121°	2.50	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 312/1	Ln418	33.5 mm	33.5 mm	5.0 mm	1.00	21.7 mm	1.54	27%	5.7 mm	0.26	12.0 mm	4.7 mm	193°	70°	125°	2.90	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 201/3	Ln418	>23.0 mm	>22.3 mm	N/A	0.97	>23 mm	NM	NM	13.0 mm	NM	N/A	4.2 mm	N/A	N/A	N/A	2.20	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	snapped in half	
FS 261/3	Ln418	48.3 mm	48.3 mm	N/A	1.00	14 mm	3.45	45%	6.1 mm	0.44	N/A	5.2 mm	N/A	N/A	N/A	3.40	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	complete	looks like Humboldt without basal indentation
FS 279/1	Ln418	34.0 mm	29.3 mm	N/A	0.86	19.9 mm	1.71	24%	16.8 mm	0.84	N/A	5.3 mm	N/A	N/A	N/A	2.90	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 304/1	Ln418	37.6 mm	36.5 mm	N/A	0.97	16.2 mm	2.32	51%	9.8 mm	0.60	N/A	5.6 mm	N/A	N/A	N/A	2.90	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 417/3	Ln418	>19.0 mm	>16.7 mm	N/A	0.88	19.3 mm	NM	NM (LMW=9.0 mm)	17.2 mm	0.89	N/A	5.7 mm	N/A	N/A	N/A	>2.30	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	snapped at hafting element	
FS 153/9	Ln418	>20.8 mm	>19.5 mm	8.3 mm	0.94	17.1 mm	NM	NM (LMW=11.3 mm)	16.0 mm	0.94	10.5 mm	5.0 mm	205°	138°	68°	>1.80	Panaca Summit (Modena area), NV/UT	Large side notched, Northern	*?Elko corner notched*	distal end snapped, base damaged and reworked, reworked on distal edges	keys as Elko but is side notched, closest in appearance to Northern type
FS 296/1	Ln418	20.8 mm	20.8 mm	1.6 mm	1.00	15.3 mm	1.36	20%	2.2 mm	0.14	3.3 mm	3.2 mm	141°	67°	76°	0.80	Kane Springs Wash Caldera Variety 2, NV	Unknown leaf shaped	out-of-key	complete	anomalous - looks like a *Populus* ssp. leaf with a stubby stem
Cultural Unit IV (1020 BC)																					
FS 104/3	Ln418	≈18.1 mm	≈18.1 mm	N/A	1.00	≈14.0 mm	1.29	0%	≈14.0 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	0.50	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	minute snaps on tip and one base corner	xrf lists as 104/3
FS 169/9	Ln418	30.0 mm	27.5 mm	9.2 mm	0.92	13.5 mm	2.22	0%	13.5 mm	1.00	6.7 mm	3.0 mm	170°	165°	8°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	complete	Desert type, xrf lists as 168/9
FS 177/2	Ln418	>29.0 mm	>28.3 mm	4.7 mm	0.98	20.2 mm	NM	NM (LMW=6.1 mm)	13.6 mm	0.67	13.9 mm	5.0 mm	205°	108°	96°	>2.65	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	tip snapped, base snapped & reworked	
FS 318/1	Ln418	20.0 mm	19.0 mm	7.4 mm	0.95	24.6 mm	0.81	33%	14.8 mm	0.60	10.5 mm	4.4 mm	144°	108°	32°	1.55	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	entire blade extensively reworked	based on WB and general appearance, LM and LA were originally much larger
FS 323-15	Ln418	47.1 mm	47.1 mm	7.1 mm	1.00	21.5 mm	2.19	33%	6.7 mm	0.31	10.1 mm	4.1 mm	194°	85°	108°	4.40	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete, minimally flaked on one surface	
FS 324-1	Ln418	41.5 mm	41 mm	7.1 mm	0.99	24.2 mm	1.71	16%	7.8 mm	0.32	11.7 mm	4.1 mm	147°	69°	77°	2.20	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	large chip near distal end, possibly manufacture error
FS 332/5	Ln418	37.8 mm	37.8 mm	5.6 mm	1.00	24.7 mm	1.53	25%	7.8 mm	0.32	10.6 mm	6.0 mm	189°	54°	45°	3.50	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	complete	distal blade edges slightly barbed
FS 323-18	Ln418	35.0 mm	35.0 mm	7.2 mm	1.00	18.5 mm	1.89	36%	5.2 mm	0.28	9.0 mm	5.0 mm	196°	70°	67°	2.90	Unknown Variety B	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 84/1	Ln418	29.2 mm	29.2 mm	6.5 mm	1.00	22.5 mm	1.30	37%	7.4 mm	0.33	9.9 mm	5.6 mm	153°	82°	75°	2.90	Unknown Variety B	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 332/7	Ln418	>30.2 mm	>30.2 mm	7.3 mm	1.00	24.7 mm	NM	NM (LMW=15.8 mm)	6.8 mm	0.28	11.6 mm	7.2 mm	180°	74°	105°	>4.60	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	small amount of iron oxide apparent (almost mahogany obsidian)
FS 180/1	Ln418	23.7 mm	23.7 mm	5.2 mm	1.00	26.0 mm	1.10	23%	5.8 mm	0.22	9.2 mm	3.9 mm	162°	65°	84°	1.80	Unknown Variety D	Gatecliff contracting stem	Gatecliff contracting stem	distal end extensively reworked	
FS 331-4	Ln418	36.5 mm	35.2 mm	6.6 mm	0.96	22 mm	1.66	21%	8.2 mm	0.37	12.0 mm	3.8 mm	192°	68°	124°	2.35	Kane Springs Wash Caldera Variety 2, NV	Gatecliff split stem	Gatecliff split stem	complete	
FS 104/2	Ln418	>22.5 mm	>17.1 mm	N/A	0.76	15.4 mm	NM	0%	15.4 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	>1.30	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	distal end snapped	looks like a triangular shaped Humboldt
Cultural Unit III (1790 BC)																					
FS 357/1	Ln418	>18.2 mm	>18.0 mm	N/A	0.99	12.5 mm	NM	0%	12.5 mm	1.00	N/A	4.3 mm	N/A	N/A	N/A	>1.00	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	distal end snapped	slightly thick similar to other Cottonwoods from UT Fremont sites
FS 230/1	Ln418	>23.1 mm	>23.1 mm	N/A	1.00	14.6 mm	NM	0%	14.6 mm	1.00	N/A	2.3 mm	N/A	N/A	N/A	>0.70	Unknown Variety C	Cottonwood triangular	Cottonwood triangular	tip snapped	
FS 241/2	Ln418	35.1 mm	34.5 mm	7.1 mm	0.98	18.6 mm	1.89	23%	10.2 mm	0.55	8 mm	4.7 mm	151°	126°	26°	2.30	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	complete	very asymmetrical, shaped like Clifford Jake's "eagle point"
FS 354/2	Ln418	>24.2 mm	>24.2 mm	8.2 mm	1.00	>18.0 mm	NM	NM (LMW=9.6 mm)	18.4 mm	NM	13.4 mm	3.9 mm	138°	127°	11°	>1.60	Kane Springs Wash Caldera Variety 2, NV	Elko corner notched	Elko corner notched	blade snapped diagonally across one shoulder	
FS 147/1	Ln418	>23.6 mm	>23.6 mm	10.1 mm	1.00	>17.2 mm	NM	NM (LMW=11.0 mm)	15.6 mm	NM	12.3 mm	4.2 mm	187°	144°	42°	>1.30	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	blade snapped diagonally across one shoulder	
FS 352/1	Ln418	34.0 mm	33.3 mm	6.7 mm	0.98	≈16.5 mm	≈2.06	24%	13.2 mm	≈0.80	7.4 mm	4.1 mm	145°	123°	17°	>1.20	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	serrated distal edges, one shoulder tang snapped	
FS 147/2	Ln418	36.0 mm	36.0 mm	3.7 mm	1.00	24.5 mm	1.47	13%	5.9 mm	0.24	13.6 mm	5.6 mm	165°	30°	135°	3.70	Kane Springs Wash Caldera Variety 1, NV	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 334/4	Ln418	≈34.5 mm	≈34.5 mm	4.5 mm	1.00	24.8 mm	≈1.39	≈24%	10.7 mm	0.43	14.3 mm	4.8 mm	199°	77°	128°	≈3.60	Kane Springs Wash Caldera Variety 2, NV	Gatecliff contracting stem	Gatecliff contracting stem	tip slightly chipped	
FS 337/7	Ln418	43.4 mm	43.4 mm	7.7 mm	1.00	25.9 mm	1.68	18%	6.1 mm	0.24	11.5 mm	4.9 mm	158°	52°	108°	4.20	Kane Springs Wash Caldera Variety 2, NV	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 229/1	Ln418	27.5 mm	27.5 mm	3.7 mm	1.00	20.0 mm	1.38	15%	3.0 mm	0.15	5.2 mm	4.0 mm	140°	63°	77°	1.65	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete, but edges and base appear reworked	barbed shoulder tangs
FS 248/1	Ln418	>22.3 mm	>22.3 mm	6.9 mm	1.00	22.7 mm	NM	NM (LMW=8.4 mm)	5.6 mm	0.25	13.4 mm	5.9 mm	197°	65°	132°	>2.40	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped in half	
FS 334/1	Ln418	32.6 mm	32.6 mm	7.0 mm	1.00	18.7 mm	1.74	26%	7.5 mm	0.40	13.0 mm	3.7 mm	182°	67°	115°	2.10	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 334/10	Ln418	31.7 mm	31.7 mm	5.3 mm	1.00	20.9 mm	1.52	22%	6.3 mm	0.30	10.2 mm	3.3 mm	153°	62°	91°	2.00	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 334/14	Ln418	38.4 mm	38.4 mm	5.0 mm	1.00	26.4 mm	1.38	14%	7.0 mm	0.38	13.7 mm	5.2 mm	184°	78°	106°	3.90	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 334/2	Ln418	≈39.0 mm	≈39.0 mm	4.9 mm	1.00	26.3 mm	1.48	14%	7.7 mm	0.29	10.3 mm	5.0 mm	165°	80°	86°	3.30	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	small chip at tip	
FS 334/3	Ln418	37.8 mm	37.5 mm	6.2 mm	0.99	>20.0 mm	NM	20%	6.8 mm	NM	11.1 mm	5.4 mm	163°	56°	107°	>2.70	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	shoulder snapped vertically	
FS 334/48	Ln418	>26.1 mm	>26.1 mm	5.8 mm	1.00	29.2 mm	NM	NM (LMW=15.9 mm)	10.1 mm	0.35	15.1 mm	4.1 mm	193°	60°	136°	>3.20	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped	
FS 337/6	Ln418	>16.7 mm	>16.7 mm	8.1 mm	1.00	>25.6 mm	NM	NM	10.3 mm	NM	12.9 mm	4.8 mm	195°	91°	106°	>1.50	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	base and shoulders only	
FS 337/9	Ln418	>30.7 mm	>30.7 mm	6.5 mm	1.00	21.6 mm	NM	NM (LMW=7.2 mm)	5.6 mm	0.26	10.0 mm	5.0 mm	120°	64°	98°	>3.30	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped, one distal edge damaged and partly reworked	
FS 338/2	Ln418	45.2 mm	45.2 mm	7.0 mm	1.00	19.5 mm	2.32	22%	7.6 mm	0.39	11.1 mm	4.1 mm	203°	75°	128°	3.20	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 358/2	Ln418	39.5 mm	39.5 mm	6.3 mm	1.00	17.9 mm	2.21	18%	4.3 mm	0.24	9.0 mm	5.0 mm	205°	53°	153°	2.70	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 357/2	Ln418	>23.0 mm	>23.0 mm	7.7 mm	1.00	23.0 mm	NM	NM (LMW=9.1 mm)	5.6 mm	0.24	12.3 mm	4.6 mm	172°	53°	121°	>2.20	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped and chipped	

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
FS 358/12	Ln418	>29.2 mm	>29.2 mm	6.5 mm	1.00	25.9 mm	NM	NM (LMW=7.5 mm)	6.4 mm	0.25	9.8 mm	4.1 mm	176°	83°	93°	>3.10	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 358/14	Ln418	>30.1 mm	>30.1 mm	8.1 mm	1.00	>21.7 mm	NM	NM (LMW=11.5 mm)	5.7 mm	NM	11.0 mm	5.3 mm	165°	66°	101°	>3.60	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped horizontally and vertically through one shoulder	
FS 358/3	Ln418	34.3 mm	34.3 mm	7.9 mm	1.00	22.6 mm	1.52	28%	8.3 mm	0.37	13.2 mm	5.1 mm	211°	68°	142°	3.60	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 358/7	Ln418	≈40.0 mm	≈40.0 mm	9.3 mm	1.00	22.8 mm	≈1.75	≈33%	4.6 mm	0.21	11.2 mm	4.6 mm	196°	65°	131°	≈3.90	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	tip slightly chipped	
FS 361/1	Ln418	32.4 mm	32.4 mm	8.0 mm	1.00	24.3 mm	1.33	30%	4.5 mm	0.19	17.5 mm	4.9 mm	174°	49°	126°	3.10	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 361/4	Ln418	>21.7 mm	>21.7 mm	7.7 mm	1.00	23.9 mm	NM	NM (LMW=8.3 mm)	6.6 mm	0.28	10.7 mm	4.6 mm	185°	62°	123°	>2.20	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped/smashed in half	base only flaked on one side, possibly broken during manufacture
FS 369/2	Ln418	37.6 mm	37.6 mm	7.5 mm	1.00	21.1 mm	1.78	32%	5.5. mm	0.26	14.4 mm	5.9 mm	227°	47°	166°	3.80	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 369/5	Ln418	36.0 mm	36.0 mm	6.2 mm	1.00	23.2 mm	1.55	23%	7.0 mm	0.30	12.4 mm	4.2 mm	190°	45°	144°	2.90	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	minimal pressure flaking on one side (almost a uniface)
FS 233/3	Ln418	≈27 mm	≈27 mm	6.1 mm	1.00	19.3 mm	1.40	29%	8.1 mm	0.42	10.7 mm	5.5 mm	208°	75°	116°	2.05	Unknown Variety B	Gatecliff contracting stem	Gatecliff contracting stem	small chip at tip	
FS 237/6	Ln418	29.2 mm	29.2 mm	3.9 mm	1.00	18.0 mm	1.62	51%	4.1 mm	0.23	7.0 mm	4.1 mm	190°	67°	139°	2.10	Unknown Variety B	Gatecliff contracting stem	Gatecliff contracting stem	shoulders and base appear reworked	
FS 443/28	Ln418	34.5 mm	34.5 mm	6.0 mm	1.00	23.7 mm	1.46	23%	9.3 mm	0.39	14.2 mm	6.7 mm	198°	65°	136°	5.15	Unknown Variety B	Gatecliff contracting stem	Gatecliff contracting stem	appears incompletely manufactured	minimally flaked and thickest at tip
FS 334/11	Ln418	30.9 mm	30.9 mm	6.8 mm	1.00	21.8 mm	1.42	53%	4.9 mm	0.22	8.9 mm	4.9 mm	175°	74°	102°	2.60	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	barbed, distal end appears reworked	
FS 334/16	Ln418	>30.2 mm	>29.5 mm	8.4 mm	0.98	30.7 mm	NM	NM (LMW=10.0 mm)	11.7 mm	0.38	16.2 mm	4.9 mm	161°	67°	88°	>4.50	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped in half	
FS 338/1	Ln418	37.3 mm	37.3 mm	6.5 mm	1.00	20.7 mm	1.80	28%	7.1 mm	0.34	11.5 mm	4.6 mm	203°	59°	39°	3.00	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	one shoulder and side of appears reworked	
FS 338/11	Ln418	>25.5 mm	>25.5 mm	3.8 mm	1.00	18.4 mm	NM	NM (LMW=6.4 mm)	3.6 mm	0.20	7.8 mm	4.3 mm	174°	63°	111°	>1.50	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 361/3	Ln418	≈34.8 mm	≈34.8 mm	7.7 mm	1.00	21.3 mm	≈1.63	≈47%	10.0 mm	0.47	14.5 mm	4.2 mm	195°	68°	130°	≈3.50	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	tip slightly chipped	
FS 235/7	Ln418	>25.1 mm	>25.1 mm	8.2 mm	1.00	21.9 mm	NM	NM (LMW=9.2 mm)	5.5 mm	0.25	13.6 mm	3.2 mm	195°	65°	132°	>1.50	Unknown Variety D	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped and reworked	
FS 337/3	Ln418	>25.2 mm	>25.2 mm	6.5 mm	1.00	21.6 mm	NM	NM (LMW=8.4 mm)	6.4 mm	0.30	11.8 mm	4.8 mm	163°	67°	95°	2.10	Unknown Variety D	Gatecliff contracting stem	Gatecliff contracting stem	distal end smashed	
FS 241/1	Ln418	32.2 mm	32.2 mm	6.7 mm	1.00	20.3 mm	1.59	34%	8.1 mm	0.40	11.7 mm	5.0 mm	158°	67°	93°	2.70	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	complete, serrated edges	
FS 252/2	Ln418	32.8 mm	32.8 mm	5.0 mm	1.00	22.9 mm	1.43	26%	9.2 mm	0.40	12.4 mm	4.7 mm	201°	65°	137°	3.50	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 354/1	Ln418	>34 mm	>32.8 mm	8.3 mm	0.96	18.1 mm	NM	NM (LMW=12.1 mm)	7.8 mm	0.43	11.3 mm	3.5 mm	185°	78°	108°	>1.70	Kane Springs Wash Caldera Variety 1, NV	Gatecliff split stem	Gatecliff split stem	one distal edge smashed, tip snapped, distal end snapped vertically	
FS 334/12	Ln418	39.5 mm	≈37.8 mm	6.9 mm	≈0.96	23 mm	1.72	28%	≈10.2 mm	≈0.44	13.2 mm	4.7 mm	212°	80°	133°	>3.80	not obsidian	Gatecliff split stem	Gatecliff split stem	one corner of base and one shoulder snapped	
FS 239/2	Ln418	>38.5 mm	>37.5 mm	5.7 mm	0.97	16.7 mm	NM	NM (LMW=10.0 mm)	6.9 mm	0.41	11.7 mm	5.5 mm	212°	75°	132°	>3.10	Panaca Summit (Modena area), NV/UT	Gatecliff split stem	Gatecliff split stem	tip snapped	distinct corner notch on one side only, appearance more like Humboldt
FS 234/1	Ln418	34.1 mm	33.1 mm	6.0 mm	0.97	27.7 mm	1.23	26%	7.0 mm	0.25	12.7 mm	4.0 mm	175°	55°	120°	2.60	Unknown Variety C	Gatecliff split stem	Gatecliff split stem	complete	small amount of cortex remaining
FS 337/8	Ln418	28.2 mm	28.2 mm	N/A	1.00	17.4 mm	1.62	26%	14.0 mm	0.80	N/A	3.5 mm	N/A	N/A	N/A	1.70	Unknown Variety C	Humboldt	out-of-key	heavily reworked	probably reworked Humboldt
FS 240/4	Ln418	24.8 mm	24.0 mm	N/A	0.97	17.2 mm	1.44	0%	17.2 mm	1.00	N/A	4.1 mm	N/A	N/A	N/A	1.55	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	heavily reworked	probably reworked Humboldt, minimally flaked on one side
FS 244/3	Ln418	>24.0 mm	>21.9 mm	N/A	0.91	13.3 mm	NM	NM (LMW=18.7 mm)	11.8 mm	0.88	N/A	3.6 mm	N/A	N/A	N/A	>1.50	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	distal end snapped, reworked	looks like small Humboldt, xrf lists as 249/3
FS 364/1	Ln418	46.0 mm	41.4 mm	20 mm	0.90	18.9 mm	2.43	0%	18.9 mm	1.00	11.3 mm	5.2 mm	211°	153°	64°	3.85	Panaca Summit (Modena area), NV/UT	Large side notched, Sudden	Large side notched	complete	Sudden type
Cultural Unit II (2680 BC, 1990 BC, 1970 BC)																					
FS 378/2	Ln418	≈27.5 mm	≈27.5 mm	6.2 mm	1.00	24.3 mm	1.13	23%	≈13.5 mm	≈0.55	13 mm	4.3 mm	154°	117°	38°	>2.10	Kane Springs Wash Caldera Variety 1, NV	Elko corner notched	Elko corner notched	one base tang snapped	
FS 250/1	Ln418	>14.8 mm	>14.8 mm	6.8 mm	1.00	27.8 mm	NM	NM (LMW=7.4 mm)	7.3 mm	0.26	13.5 mm	3.6 mm	137°	131°	7°	>1.40	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	blade snapped above haft element, one side base chipped	
FS 380/1	Ln418	>17.0 mm	>17.0 mm	9.1 mm	1.00	>18.5 mm	NM	NM (LMW=12.0 mm)	>14.6 mm	NM	11.2 mm	5.3 mm	187°	130°	52°	>1.60	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	base tangs, one shoulder & most of blade snapped (snapped from 4 directions min.)	
FS 404/8	Ln418	49.6 mm	48.1 mm	7.9 mm	0.97	23.4 mm	2.12	31%	>19.6 mm	NM	17.2 mm	4 mm	211°	125°	87°	>4.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	half of base snapped diagonally	
FS 246/1	Ln418	33.3 mm	33.3 mm	6.6 mm	1.00	20.2 mm	1.65	24%	4.4 mm	0.22	9.7 mm	4.3 mm	178°	72°	107°	2.30	Kane Springs Wash Caldera Variety 1, NV	Gatecliff contracting stem	Gatecliff contracting stem	tip reworked	
FS 418/21	Ln418	>13.8 mm	>13.8 mm	5.7 mm	1.00	23 mm	NM	NM (LMW=7.32 mm)	5.3 mm	0.23	14 mm	6.3 mm	174°	49°	125°	>1.50	Kane Springs Wash Caldera Variety 1, NV	Gatecliff contracting stem	Gatecliff contracting stem	snapped above haft element	
FS 375/3	Ln418	50.4 mm	50.4 mm	6.7 mm	1.00	24.1 mm	2.09	27%	3.7 mm	0.15	14.5 mm	4.3 mm	203°	56°	147°	4.70	Kane Springs Wash Caldera Variety 2, NV	Gatecliff contracting stem	Gatecliff contracting stem	tip reworked	
FS 242/2	Ln418	>25.3 mm	>25.3 mm	7.4 mm	1.00	24.8 mm	NM	NM (LMW=21.8 mm)	7.0 mm	NM	13.4 mm	4.3 mm	163°	66°	98°	>2.70	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	snapped above haft element	
FS 251/3	Ln418	38.4 mm	38.4 mm	9.3 mm	1.00	23.4 mm	1.64	27%	6.8 mm	0.29	13.5 mm	5.7 mm	205°	80°	126°	3.75	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	extensive reworking above haft element	wear pattern more consistent with knife use?
FS 253/3	Ln418	44.2 mm	44.2 mm	7.2 mm	1.00	28 mm	1.58	26%	6.6 mm	0.24	12.1 mm	4.8 mm	212°	65°	148°	4.60	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	complete	
FS 48/33	Ln418	>20.3 mm	>20.3 mm	6.7 mm	1.00	>18.2 mm	NM	NM (LMW=7.3 mm)	7.7 mm	NM	10.8 mm	4.4 mm	151°	68°	85°	>2.40	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	blade snapped in five directions	
FS 370/1	Ln418	29.1 mm	29.1 mm	7.0 mm	1.00	19.5 mm	1.49	45%	7.0 mm	0.36	10.2 mm	4.9 mm	191°	77°	62°	>1.90	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	one shoulder snapped	distal blade edges barbed
FS 272/1	Ln418	33.2 mm	32.0 mm	6.7 mm	0.96	21.8 mm	1.52	25%	8.2 mm	0.38	9.7 mm	5.0 mm	155°	79°	78°	2.50	Unknown Variety C	Gatecliff split stem	Gatecliff split stem	barbed on distal edges, complete	
FS 445/8	Ln418	36 mm	34.7 mm	6.2 mm	0.96	22.8 mm	1.58	23%	10.5 mm	0.46	13.0 mm	4.7 mm	186°	78°	105°	3.50	Unknown Variety C	Gatecliff split stem	Gatecliff split stem	complete	
FS 344/6	Ln418	35.7 mm	34.8 mm	6.1 mm	0.97	23.7 mm	1.51	22%	9.9 mm	0.42	12.7 mm	5.2 mm	169°	84°	87°	3.15	Unknown Variety D	Gatecliff split stem	Gatecliff split stem	complete	xrf lists as 334/6
FS 379-12	Ln418	>19.5 mm	>18.1 mm	N/A	0.93	16.7 mm	NM	NM (LMW=10.1 mm)	15.0 mm	0.90	N/A	4.0 mm	N/A	N/A	N/A	>1.50	???	Humboldt	Humboldt	distal end snapped and reworked, base reworked	not geochemically analyzed?
FS 250/3	Ln418	36.1 mm	34.6 mm	N/A	0.96	13.9 mm	2.60	37%	7.7 mm	0.55	N/A	4.1 mm	N/A	N/A	N/A	2.00	Kane Springs Wash Caldera Variety 2, NV	Humboldt	Humboldt	complete	
FS 242/1	Ln418	28.4 mm	27.4 mm	N/A	0.96	17.2 mm	1.65	39%	12.8 mm	0.74	N/A	4.4 mm	N/A	N/A	N/A	>1.85	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	large chip at distal end beneath tip	looks like large Cottonwood leaf shaped
FS 256/1	Ln418	28.2 mm	26.5 mm	N/A	0.94	11.7 mm	2.41	0%	11.7 mm	1.00	N/A	4.8 mm	N/A	N/A	N/A	1.30	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	complete	looks most like Cottonwood triangular but too thick
FS 266/1	Ln418	31.4 mm	27.2 mm	N/A	0.87	16.0 mm	1.96	37%	15 mm	0.94	N/A	4.2 mm	N/A	N/A	N/A	1.90	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key		looks like large Cottonwood leaf shaped, xrf lists as 268/1
FS 266/2	Ln418	>31.0 mm	>30.5 mm	N/A	0.98	18.4 mm	NM	NM (LMW=14.0 mm)	12.5 mm	0.68	N/A	6.2 mm	N/A	N/A	N/A	>3.40	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	tip and corner of base snapped	looks like large Cottonwood leaf shaped
FS 268/2	Ln418	34.8 mm	34.5 mm	N/A	0.99	11.3 mm	3.08	43%	8.7 mm	0.77	N/A	3.9 mm	N/A	N/A	N/A	>1.60	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	large chip on one edge at top of hafting element	looks like a Humboldt without basal indentation
FS 270/9	Ln418	50.6 mm	47.6 mm	N/A	0.94	16.9 mm	2.99	37%	10.3 mm	0.61	N/A	5.9 mm	N/A	N/A	N/A	4.90	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 278/1	Ln418	40.8 mm	40.4 mm	N/A	0.99	15.4 mm	2.65	27%	9.1 mm	0.59	N/A	5.3 mm	N/A	N/A	N/A	2.85	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	complete	looks like Humboldt without basal indentation
FS 379-11	Ln418	>29.5 mm	>28.1 mm	N/A	0.95	14.1 mm	NM	NM (LMW=7.9 mm)	13.0 mm	0.92	N/A	4.4 mm	N/A	N/A	N/A	>1.90	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	tip snapped	looks like small Humboldt
FS 379-13	Ln418	49 mm	47 mm	N/A	0.96	11.6 mm	4.22	26%	11.0 mm	0.95	N/A	4.7 mm	N/A	N/A	N/A	2.60	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	complete	looks like Humboldt but WB/WM too high
FS 385-26	Ln418	29.3 mm	27.9 mm	N/A	0.95	13.1 mm	2.24	38%	10.5 mm	0.80	N/A	2.8 mm	N/A	N/A	N/A	1.10	Panaca Summit (Modena area), NV/UT	Humboldt	*?Cottonwood leaf shaped?*	reworked	
FS 392/1	Ln418	26.6 mm	22.1 mm	N/A	0.83	18.2 mm	1.46	38%	17.0 mm	0.93	N/A	5.1 mm	N/A	N/A	N/A	2.00	Panaca Summit (Modena area), NV/UT	Humboldt	out-of-key	complete	
FS 395/3	Ln418	>21.5 mm	>18.6 mm	N/A	0.87	13.0 mm	NM	NM (LMW=13 mm)	10.5 mm	0.81	N/A	4.0 mm	N/A	N/A	N/A	>1.20	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end snapped	minimal pressure flaking on one side
FS 399/1	Ln418	>30.5 mm	>27.2 mm	N/A	0.89	19.8 mm	NM	NM (LMW=13.9 mm)	16.5 mm	0.83	N/A	5.1	N/A	N/A	N/A	>2.90	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end smashed	
FS 402/2	Ln418	41.0 mm	40.2 mm	N/A	0.98	16.3 mm	2.52	35%	6.7 mm	0.41	N/A	6.0 mm	N/A	N/A	N/A	3.70	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 404/9	Ln418	41.6 mm	40 mm	N/A	0.96	16.3 mm	2.55	27%	7.0 mm	0.43	N/A	4.0 mm	N/A	N/A	N/A	2.80	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 406/6	Ln418	30.2 mm	29.6 mm	N/A	0.98	15.5 mm	1.95	43%	6 mm	0.39	N/A	5.4 mm	N/A	N/A	N/A	2.30	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	tip and base appear slightly damaged	
FS 412/2	Ln418	27.7 mm	25.7 mm	N/A	0.93	17.5 mm	1.58	15%	17 mm	0.97	N/A	3.8 mm	N/A	N/A	N/A	1.30	Panaca Summit (Modena area), NV/UT	Humboldt	*?Cottonwood triangular?*	reworked	
FS 413/1	Ln418	27.9 mm	27.1 mm	N/A	0.97	11.9 mm	2.34	38%	7.6 mm	0.64	N/A	4.5 mm	N/A	N/A	N/A	1.50	Panaca Summit (Modena area), NV/UT	Humboldt	*?Cottonwood leaf shaped?*	heavily reworked	
FS 414/2	Ln418	>18.0 mm	>15.2 mm	N/A	0.84	18.3 mm	NM	NM (LMW=12.1 mm)	16.5 mm	0.90	N/A	4.9 mm	N/A	N/A	N/A	>1.90	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end snapped above hafting element	
FS 422/5	Ln418	42.1 mm	40.2 mm	N/A	0.95	21.5 mm	1.96	37%	14.6 mm	0.68	N/A	6.4 mm	N/A	N/A	N/A	≈5.60	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	chip on one edge above max. width	
FS 425/1	Ln418	39.7 mm	38.4 mm	N/A	0.97	13.1 mm	3.03	38%	8.0 mm	0.61	N/A	5.5 mm	N/A	N/A	N/A	2.40	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	patches of hydration rind on one surface
FS 432/18	Ln418	>42.1 mm	>40.6 mm	N/A	0.96	16.2 mm	NM	NM (LMW=15.3 mm)	9.0 mm	0.55	N/A	6.3 mm	N/A	N/A	N/A	>4.50	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end snapped diagonally	
FS 441/10	Ln418	39.4 mm	38.4 mm	N/A	0.97	17.1 mm	2.30	39%	3.9 mm	0.23	N/A	5.8 mm	N/A	N/A	N/A	3.20	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	serrated edges, mostly on one side of proximal half
FS 441/16	Ln418	>18.6 mm	>16.6 mm	N/A	0.89	15.4 mm	NM	NM (LMW=18.3 mm)	11.0 mm	0.71	N/A	3.5 mm	N/A	N/A	N/A	>0.90	Panaca Summit (Modena area), NV/UT	Humboldt	*?Cottonwood leaf shaped?*	blade snapped diagonally	
FS 441/8	Ln418	≈37.4 mm	≈35.4 mm	N/A	0.95	12.4 mm	≈3.02	≈43%	9.2 mm	0.74	N/A	4.5 mm	N/A	N/A	N/A	≈1.90	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	tip chipped	
FS 445/1	Ln418	26.1 mm	23.5 mm	N/A	0.90	13.4 mm	1.95	31%	12.1 mm	0.90	N/A	3.3 mm	N/A	N/A	N/A	1.10	Panaca Summit (Modena area), NV/UT	Humboldt	*?Cottonwood leaf shaped?*	heavily reworked	
FS 445/6	Ln418	47.9 mm	45.7 mm	N/A	0.95	13.8 mm	3.47	28%	10.1 mm	0.73	N/A	5.2 mm	N/A	N/A	N/A	3.20	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 445/7	Ln418	34.5 mm	33.4 mm	N/A	0.97	16.5 mm	2.09	31%	11.7 mm	0.71	N/A	4.6 mm	N/A	N/A	N/A	2.40	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	complete	
FS 375/2	Ln418	35.1 mm	31.9 mm	N/A	0.91	16.4 mm	2.14	59%	10.9 mm	0.66	N/A	5.6 mm	N/A	N/A	N/A	2.75	Unknown Variety A	Humboldt	Humboldt	distal end appears slightly reworked	
FS 445/3	Ln418	42.1 mm	38.9 mm	N/A	0.92	19 mm	2.22	14%	17.6 mm	0.93	N/A	6.3 mm	N/A	N/A	N/A	3.80	Unknown Variety C	Humboldt	out-of-key	complete	looks like Humboldt but WB/WM too high
FS 268/38	Ln418	29.2 mm	25.0 mm	11.6 mm	0.86	20.2 mm	1.45	0%	20.2 mm	1.00	15.9 mm	4.2 mm	217°	129°	90°	1.80	Panaca Summit (Modena area), NV/UT	Large side notched, Northern	out-of-key	complete	large, side notched point but DSA too low - Northern type
FS 48/37	Ln418	38.3 mm	37.7 mm	12.5 mm	0.98	21 mm	1.82	47%	2.0 mm	0.95	9.7 mm	6.5 mm	189°	169°	19°	4.50	Panaca Summit (Modena area), NV/UT	Large side notched, Northern	Large side notched	distal blade edges exhibit retouch	Northern type
FS 375/1	Ln418	≈51.1 mm	≈49.4 mm	10.2 mm	0.97	≈21.7 mm	2.35	≈37%	≈14.4 mm	0.66	12.1 mm	5.5 mm	138°	178°	43°	6.00	Panaca Summit (Modena area), NV/UT	Large side notched, unknown	Large side notched	barbed bottom half blade, distal blade edges & base exhibit damage & much retouch	very long & thin in comparison to typical "Large side notched" - unknown type
FS 379-14	Ln418	>28.4 mm	>28.0 mm	N/A	0.99	13.1 mm	NM	NM (LMW=19.4 mm)	11.2 mm	0.85	N/A	4.0 mm	N/A	N/A	N/A	>1.60	Panaca Summit (Modena area), NV/UT	Unknown leaf-shaped	out-of-key	distal end snapped	
FS 392/10	Ln418	26.1 mm	26.1 mm	N/A	1.00	14.3 mm	1.83	38%	13.4 mm	0.94	N/A	3.4 mm	N/A	N/A	N/A	1.40	Panaca Summit (Modena area), NV/UT	Unknown leaf shaped	*?Cottonwood leaf shaped?*	reworked	although typable, appears that it's actually an unfinished point, maybe Rosegate
FS 402/3	Ln418	39.5 mm	39.5 mm	N/A	1.00	18.2 mm	2.17	50%	7.9 mm	0.43	N/A	7.3 mm	N/A	N/A	N/A	3.65	Unknown Variety C	Unknown leaf-shaped	out-of-key	complete	looks like large Cottonwood leaf shaped
Cultural Unit I (5150 BC, 4570 BC)																					
FS 426/1	Ln418	35.3 mm	35.3 mm	9.4 mm	1.00	26.5 mm	1.33	22%	19.8 mm	0.75	9.1 mm	5.3 mm	139°	144°	12°	3.80	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal blade edges exhibit retouch	
FS 431/16	Ln418	>16.2 mm	>15.6 mm	7.0 mm	0.96	>23.7 mm	NM	NM (LMW=9.8 mm)	16.6 mm	NM	13.4 mm	6.1 mm	174°	118°	56°	>2.00	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	most of blade and one shoulder snapped	
FS 444/56	Ln418	36.0 mm	36.0 mm	7.7 mm	1.00	22.8 mm	1.58	31%	11.5 mm	0.50	10.8 mm	5.5 mm	177°	120°	55°	3.10	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal blade edges appear reworked	
FS 446/3	Ln418	43.5 mm	43.5 mm	7.4 mm	1.00	28.3 mm	1.54	37%	>13.0 mm	NM	16.8 mm	8.0 mm	175°	122°	52°	>9.50	Unknown Variety B	Elko corner notched	Elko corner notched	tip chipped, base snapped across one shoulder	extremely large, looks more like a "spear point"
FS 449/1	Ln418	34.0 mm	34.0 mm	7.8 mm	1.00	23.3 mm	1.46	27%	13.1 mm	0.56	10.4 mm	4.6 mm	143°	121°	23°	3.00	Unknown Variety B	Elko corner notched	Elko corner notched	cortex present on one side - complete	
FS 446/5	Ln418	34.3 mm	34.3 mm	8.8 mm	1.00	19.4 mm	1.77	41%	11.5 mm	0.59	9.3 mm	5.1 mm	154°	113°	37°	2.70	Unknown Variety C	Elko corner notched	Elko corner notched	complete	
FS 450/2	Ln418	>31.4 mm	>31.4 mm	8.4 mm	1.00	25.1 mm	NM	NM (LMW=9.5 mm)	13.9 mm	0.55	11.9 mm	6.2 mm	140°	105°	37°	>4.30	Unknown Variety C	Elko corner notched	Elko corner notched	distal end smashed & reworked, edges reworked	
No Provenience Data Available																					
FS 2/48	Ln418	≈27.7 mm	≈27.7 mm	N/A	1.00	14.3 mm	≈1.94	≈32%	3.4 mm	0.24	N/A	3.5 mm	N/A	N/A	N/A	≈1.20	Panaca Summit (Modena area), NV/UT	Cottonwood leaf shaped	Cottonwood leaf shaped	extreme tip snapped	minimally pressure-flaked on one side
FS 2/66	Ln418	≈22.4 mm	≈22.4 mm	N/A	1.00	12.7 mm	≈1.76	≈20%	6.1 mm	0.48	N/A	2.9 mm	N/A	N/A	N/A	≈0.70	Unknown Variety B	Cottonwood leaf shaped	Cottonwood leaf shaped	tip snapped	
FS 1/18	Ln418	23.9 mm	23.9 mm	N/A	1.00	12.3 mm	1.93	19%	10.1 mm	0.82	N/A	4.4 mm	N/A	N/A	N/A	1.30	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	complete	cortex at base, minimally pressure-flaked, appears to be an unfinished Cottonwood triangular
FS 496/4	Ln418	>20.1 mm	>19.7 mm	N/A	0.98	18.8 mm	NM	0%	18.8 mm	1.00	N/A	3.2 mm	N/A	N/A	N/A	>1.00	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	tip snapped	
FS 492/2	Ln418	19.6 mm	17.3 mm	10.0 mm	0.88	≈12.2 mm	≈1.61	0%	≈12.2 mm	1.00	4.2 mm	2.2 mm	201°	164°	38°	≈0.40	Oak Spring Butte	Desert side notched	Desert side notched	small chip on one base tang	
FS 2/47	Ln418	20.3 mm	20.3 mm	4.0 mm	1.00	8.7 mm	2.33	36%	5.5 mm	0.63	4.2 mm	1.9 mm	198°	130°	70°	0.30	Unknown Variety B	Rosegate	Rosegate	complete	
FS 499/4	Ln418	>24.1	>23.9	7.6 mm	0.99	19.4 mm	NM	NM (LMW=8.5 mm)	18.7 mm	0.96	5 mm	4.9 mm	207°	138°	70°	>2.60	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	extreme tip snapped	
FS 1/5	Ln418	>15.3 mm	>15.3 mm	7.7 mm	1.00	18.6 mm	NM	NM (LMW=9.5 mm)	11.6 mm	0.62	11.3 mm	4.9 mm	209°	105°	104°	>1.50	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	distal end snapped	
FS 2/41	Ln418	34.2 mm	34.2 mm	6.6 mm	1.00	20.7 mm	1.65	23%	7.0 mm	0.34	11 mm	4.3 mm	195°	85°	110°	2.40	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	complete	
Southern Utah University, Cedar City (n=200)																					
Evans Mound (site), Iron County, UT (42In40), AD 1050 to AD 1175, n =200 (general note: nearly all haft elements bear traces of pitch)																					
37-5120	In40	26.4 mm	26.4 mm	5.5 mm	1.00	11.0 mm	2.40	25%	>9.8 mm	NM	7.6 mm	2.9 mm	221°	166°	55°	>0.70	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	one base tang snapped, one shoulder chipped	slender, convex base type similar to 8363 (Rosegate side notched?)
37-7984	In40	>28.9 mm	>28.9 mm	5.9 mm	1.00	11.4 mm	NM	NM (LMW=6.1 mm)	8.1 mm	0.71	4.9 mm	3.4 mm	192°	134°	58°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	distal end snapped	slender, convex base type similar to 8363 (Rosegate side notched?)
37-8363	In40	35.5 mm	35.5 mm	7.0 mm	1.00	12.8 mm	2.77	26%	12.4 mm	0.97	9.5 mm	3.6 mm	182°	167°	15°	1.30	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	complete	long, slender, side notched point with a general appearance very similar to Rosegate series (Rosegate side notched?)
37-4997	In40	30.5 mm	30.5 mm	2.7 mm	1.00	15.0 mm	2.03	7%	5.3 mm	0.35	6.3 mm	3.4 mm	136°	87°	69°	0.95	Black Mountain, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-8707	In40	19.8 mm	19.8 mm	1.6 mm	1.00	17.5 mm	1.13	7%	5.3 mm	0.30	7.3 mm	3.7 mm	130°	62°	68°	0.85	Black Rock area, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-8598	In40	35.6 mm	35.6 mm	2.3 mm	1.00	>15.5 mm	NM	7%	4.8 mm	NM	6.1 mm	4.2 mm	130°	71°	59°	≈1.50	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder tang & one distal edge damaged	looks like contracting stem Eastgate - Parowan basal notched
27-379	In40	30.4 mm	30.4 mm	3.6 mm	1.00	16.2 mm	1.88	13%	5.6 mm	0.35	8.2 mm	3.9 mm	159°	77°	102°	1.20	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	*?Gatecliff contracting stem?*	complete, distal blade edges appear worn	looks like contracting stem Eastgate - Parowan basal notched
37-10563	In40	22.8 mm	22.8 mm	3.4 mm	1.00	>18.4 mm	NM	6%	4.2 mm	NM	6.8 mm	3.5 mm	141°	79°	62°	>0.9	not obsidian	Parowan basal notched	out-of-key	one shoulder tang snapped, edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-9661	In40	≈31.7 mm	≈31.7 mm	≈2.0 mm	NM	22.7 mm	≈1.40	≈0%	≈6.9 mm	≈0.30	8.5 mm	3.5 mm	126°	77°	49°	≈1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	bottom edge of base chipped	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-3993	In40	33.7 mm	33.2 mm	1.6 mm	0.99	19.1 mm	1.74	0%	6.8 mm	0.36	7.4 mm	3.5 mm	150°	74°	76°	1.40	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	base chipped	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-4800	In40	>25.9 mm	>25.9 mm	1.8 mm	1.00	18.8 mm	NM	NM (LMW=4.6 mm)	5.7 mm	0.30	7.7 mm	4.4 mm	149°	81°	68°	>1.60	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end chipped, one corner of base & adjacent shoulder tang damaged & reworked	looks like contracting stem Eastgate - Parowan basal notched
37-9998	In40	26.0 mm	26.0 mm	1.9 mm	1.00	12.3 mm	2.11	9%	4.3 mm	0.35	5.1 mm	2.7 mm	149°	84°	65°	0.55	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-3201	In40	>20.8 mm	>20.8 mm	1.9 mm	1.00	13.1 mm	NM	NM (LMW=2.0 mm)	4.7 mm	0.36	6.0 mm	3.0 mm	157°	70°	87°	>0.55	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-14062	In40	42.0 mm	42.0 mm	1.9 mm	1.00	17.0 mm	2.47	3%	6.2 mm	0.36	6.8 mm	4.1 mm	156°	74°	82°	1.95	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip worn in manner similar to a borer/drill, bottom edge of base possibly snapped	looks like contracting stem Eastgate - Parowan basal notched
37-9476	In40	>27.8 mm	>27.8 mm	2.0 mm	1.00	19.6 mm	NM	NM (LMW=1.0 mm)	5.2 mm	0.27	6.2 mm	4.0 mm	143°	77°	76°	≈1.45	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped	looks like contracting stem Eastgate - Parowan basal notched
37-11777	In40	>27.2 mm	>27.2 mm	2.1 mm	1.00	>16.3 mm	NM	NM (LMW=2.0 mm)	5.4 mm	NM	7.1 mm	3.6 mm	138°	37°	101°	>1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped, one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched
37-11018	In40	37.8 mm	37.1 mm	2.2 mm	0.98	17.7 mm	2.14	2%	7.4 mm	0.42	8.6 mm	2.8 mm	127°	76°	51°	1.30	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-4613	In40	>19.9 mm	>19.9 mm	2.2 mm	1.00	18.5 mm	NM	NM (LMW=1.6 mm)	6.2 mm	0.34	7.6 mm	3.8 mm	154°	74°	80°	>0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-7198	In40	>29.5 mm	>29.5 mm	2.2 mm	1.00	≈17.8	NM	0%	>4.6 mm	NM	7.0 mm	3.9 mm	137°	83°	54°	>1.35	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped, corners of base snapped, one shoulder tang chipped	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-11567	In40	>22.5 mm	>22.5 m	2.2 mm	1.00	19.4 mm	NM	NM (LMW=2.3 mm)	5.9 mm	0.30	8.3 mm	4.1 mm	147°	63°	84°	>1.40	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-7928	In40	>17.2 mm	>17.2 mm	2.3 mm	1.00	14.3 mm	NM	NM (LMW=2.1 mm)	3.3 mm	0.23	6.0 mm	2.6 mm	116°	50°	66°	>0.50	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-7858	In40	35.1 mm	35.1 mm	2.3 mm	1.00	14.7 mm	2.39	6%	5.9 mm	0.40	6.6 mm	3.5 mm	126°	85°	41°	1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-4955	In40	>31.8 mm	>31.8 mm	2.4 mm	1.00	17.5 mm	NM	NM (LMW=2.2 mm)	2.9 mm	0.17	7.1 mm	3.7 mm	139°	46°	93°	>1.45	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-13123	In40	27.4 mm	27.4 mm	2.4 mm	1.00	16.7 mm	1.64	8%	6.2 mm	0.37	8.3 mm	3.9 mm	139°	63°	76°	1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched, no pitch on base
37-7150	In40	>17.6 mm	>17.6 mm	2.4 mm	1.00	19.3 mm	NM	NM (LMW=1.3 mm)	7.0 mm	0.36	8.6 mm	4.0 mm	133°	72°	61°	>1.10	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped from 3 directions - macrocrystals visible along fractured edge	looks like contracting stem Eastgate - Parowan basal notched

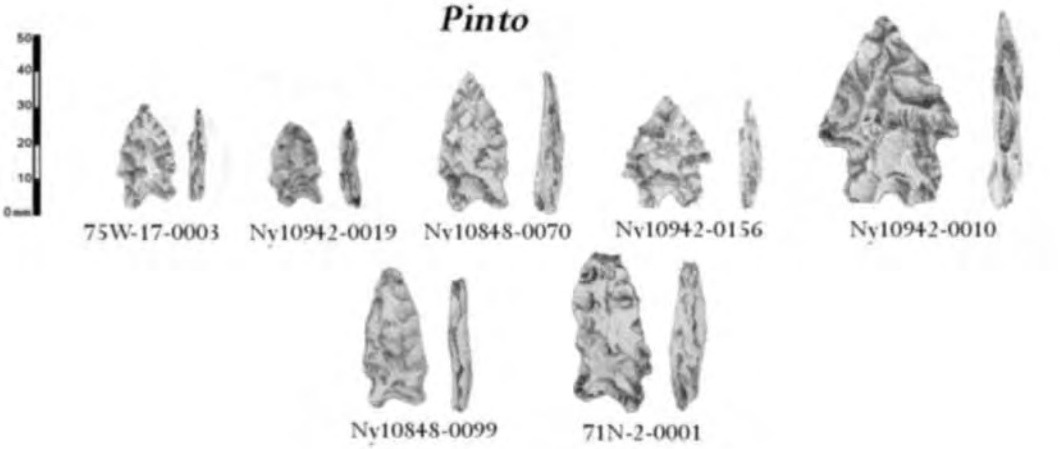
Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
37-399	In40	25.5 mm	25.5 mm	2.5 mm	1.00	12.8 mm	1.99	18%	4.8 mm	0.38	5.4 mm	3.4 mm	141°	87°	54°	0.85	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-3041	In40	>21.2 mm	>21.2 mm	2.5 mm	1.00	17.8 mm	NM	NM (LMW=1.7 mm)	4.8 mm	0.27	6.5 mm	3.5 mm	138°	67°	71°	>1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges reworked	looks like contracting stem Eastgate - Parowan basal notched
37-10660	In40	27.0 mm	27.0 mm	2.5 mm	1.00	15.9 mm	1.70	12%	3.7 mm	0.23	5.3 mm	3.8 mm	170°	64°	106°	1.05	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched, no pitch on base
37-9663	In40	>23.4 mm	>23.4 mm	2.6 mm	1.00	14.5 mm	NM	NM (LMW=4.1 mm)	4.7 mm	0.32	5.7 mm	3.4 mm	162°	67°	95°	>0.95	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Rose Spring - Parowan basal notched
37-10098	In40	31.0 mm	31.0 mm	2.6 mm	1.00	19.2 mm	1.61	5%	6.1 mm	0.32	7.8 mm	3.9 mm	126°	60°	66°	1.45	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched, LS,WN & WB for haft element
37-2299	In40	>25.5 mm	>25.5 mm	2.7 mm	1.00	17.3 mm	NM	NM (LMW=2.8 mm)	7.8 mm	0.45	8.7 mm	3.3 mm	139°	85°	54°	>1.35	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-10529	In40	>25.4 mm	>25.4 mm	2.7 mm	1.00	18.9 mm	NM	NM (LMW=0.8 mm)	6.0 mm	0.32	7.7 mm	3.4 mm	132°	74°	58°	>1.45	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one face minimally pressure-flaked	looks like contracting stem Eastgate - Parowan basal notched
37-373	In40	24.1 mm	24.1 mm	2.8 mm	1.00	16.9 mm	1.43	10%	6.7 mm	0.40	8.2 mm	3.0 mm	141°	62°	79°	0.85	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	one shoulder tang appears reworked	looks like contracting stem Eastgate - Parowan basal notched
37-8737	In40	>22.9 mm	>22.9 mm	2.8 mm	1.00	14.5 mm	NM	NM (LMW=4.1 mm)	3.5 mm	0.24	6.0 mm	3.7 mm	154°	82°	72°	>1.00	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-9836	In40	>26.6 mm	>26.6 mm	3.1 mm	1.00	>15.7 mm	NM	NM (LMW=4.3 mm)	6.0 mm	NM	7.6 mm	3.0 mm	146°	67°	79°	>0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges damaged, one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched
37-754	In40	≈25.1 mm	≈25.1 mm	3.1 mm	1.00	>15.7 mm	NM	≈19%	6.2 mm	NM	5.9 mm	3.2 mm	149°	89°	60°	>0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped one shoulder tang snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-9929	In40	31.8 mm	31.8 mm	3.2 mm	1.00	17.5 mm	1.82	13%	6.3 mm	0.36	7.7 mm	3.8 mm	117°	85°	32°	1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder tang reworked	looks like contracting stem Eastgate - Parowan basal notched
37-6972	In40	32.1 mm	32.1 mm	3.3 mm	1.00	>17.4 mm	NM	9%	6.6 mm	NM	7.7 mm	3.1 mm	148°	89°	59°	≈1.05	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder tang chipped	looks like contracting stem Eastgate - Parowan basal notched
37-8485	In40	31.2 mm	31.2 mm	3.3 mm	1.00	18.7 mm	1.67	15%	6.8 mm	0.36	9.6 mm	3.5 mm	142°	69°	73°	≈1.15	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	base edge partly snapped diagonally	looks like contracting stem Eastgate - Parowan basal notched, asymmetrical shoulders likely a manufacture error
37-2332	In40	27.8 mm	27.0 mm	3.4 mm	0.97	17.0 mm	1.64	12%	8.2 mm	0.48	8.2 mm	3.6 mm	134°	101°	33°	1.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	complete	looks like an Eastgate with a split stem - Parowan basal notched
37-5492	In40	>28.4 mm	>28.4 mm	3.5 mm	1.00	18.6 mm	NM	NM (LMW=2.4 mm)	8.3 mm	0.45	9.3 mm	3.3 mm	129°	88°	41°	>1.15	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one edge damaged	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-11103	In40	25.0 mm	25.0 mm	3.5 mm	1.00	17.8 mm	1.40	21%	7.2 mm	0.40	8.7 mm	3.9 mm	165°	63°	102°	≈1.10	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	small chip on one shoulder tang & base	looks like contracting stem Rose Spring - Parowan basal notched
37-11477	In40	31.1 mm	31.1 mm	3.7 mm	1.00	18.4 mm	1.69	10%	5.9 mm	0.32	7.0 mm	4.1 mm	164°	81°	83°	1.45	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete, distal blade edges appear damaged & reworked	looks like contracting stem Rose Spring - Parowan basal notched
37-12594	In40	>17.5 mm	>17.5 mm	3.8 mm	1.00	>15.3 mm	NM	NM (LMW=4.1 mm)	5.2 mm	NM	5.8 mm	3.7 mm	148°	81°	67°	>0.65	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	distal end snapped, one shoulder tang snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-8219	In40	26.9 mm	26.9 mm	3.8 mm	1.00	16.7 mm	1.61	13%	6.7 mm	0.40	7.5 mm	3.9 mm	124°	71°	53°	1.35	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip worn in manner similar to a borer/drill	looks like contracting stem Eastgate - Parowan basal notched
37-2962	In40	>21.7 mm	>21.7 mm	4.1 mm	1.00	16.7 mm	NM	NM (LMW=6.8 mm)	7.0 mm	0.42	7.4 mm	3.3 mm	115°	85°	30°	>1.10	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges damaged	looks like contracting stem Eastgate - Parowan basal notched
37-9785	In40	>36.6 mm	>36.6 mm	4.1 mm	1.00	21.9 mm	NM	NM (LMW=5.9 mm)	5.8 mm	0.26	9.9 mm	4.1 mm	172°	64°	108°	>2.20	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-11416	In40	28.0 mm	28.0 mm	4.1 mm	1.00	17.8 mm	1.57	14%	9.4 mm	0.53	9.8 mm	4.3 mm	135°	86°	49°	1.30	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip worn, base slightly damaged	looks like contracting stem Eastgate - Parowan basal notched
37-13434	In40	25.4 mm	25.4 mm	4.2 mm	1.00	>14.4 mm	NM	NM (LMW=4.3 mm)	9.7 mm	NM	10.0 mm	3.7 mm	162°	95°	67°	>1.00	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder snapped	looks like contracting stem Eastgate - Parowan basal notched
37-5549	In40	>35.9 mm	>35.9 mm	4.9 mm	1.00	16.6 mm	NM	NM (LMW=5.1 mm	>5.8 mm	NM	7.9 mm	4.7 mm	183°	102°	81°	>2.00	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	1 shoulder tang chipped, tip snapped in 2 directions, 1 edge of base snapped diagonally	asymmetrical base, looks like contracting stem Eastgate - Parowan basal notched
37-13936	In40	>32.4 mm	>31.5 mm	1.5 mm	0.97	18.5 mm	NM	0%	3.9 mm	0.21	6.3 mm	4.2 mm	140°	61°	79°	>1.50	Pumice Hole Mine, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, base reworked	looks like contracting stem Eastgate - Parowan basal notched
37-3004	In40	31.2 mm	31.2 mm	1.6 mm	1.00	16.5 mm	1.89	2%	6.0 mm	0.36	7.4 mm	3.9 mm	144°	73°	71°	1.25	Pumice Hole Mine, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-3459	In40	22.3 mm	22.3 mm	2.2 mm	1.00	18.2 mm	1.23	10%	8.1 mm	0.45	8.8 mm	3.7 mm	125°	73°	52°	0.85	Pumice Hole Mine, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched, traces of pitch on base & notches
37-13356	In40	>11.6 mm	>11.6 mm	2.4 mm	1.00	14.3 mm	NM	NM (LMW=2.4 mm)	4.0 mm	0.28	5.9 mm	3.3 mm	156°	78°	78°	>0.50	Pumice Hole Mine, UT	Parowan basal notched	out-of-key	distal end snapped, minimally pressure-flaked on one face	looks like contracting stem Eastgate - Parowan basal notched
37-13302	In40	>19.6 mm	>19.6 mm	4.1 mm	1.00	16.7 mm	NM	NM (LMW=4.8 mm)	8.0 mm	0.48	8.4 mm	3.6 mm	140°	87°	53°	>1.05	Pumice Hole Mine, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges heavily worn/damaged	looks like contracting stem Eastgate - Parowan basal notched
37-12061	In40	29.2 mm	29.2 mm	3.0 mm	1.00	17.7 mm	1.65	8%	6.9 mm	0.39	10.2 mm	3.5 mm	140°	57°	83°	1.25	Unknown Variety B	Parowan basal notched	*?Gatecliff contracting stem?*	base asymmetrical , possibly damaged	looks like contracting stem Eastgate - Parowan basal notched
37-10894	In40	26.7 mm	26.7 mm	1.5 mm	1.00	14.6 mm	1.83	5%	4.4 mm	0.30	6.0 mm	4.3 mm	133°	67°	66°	1.00	Unknown Variety C	Parowan basal notched	out-of-key	complete, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-2257	In40	≈26.1 mm	≈26.1 mm	2.9mm	1.00	16.0 mm	≈1.63	≈15%	5.2 mm	0.33	7.8 mm	3.7 mm	170°	84°	86°	≈1.05	Unknown Variety C	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped	looks like contracting stem Eastgate - Parowan basal notched
37-4020	In40	21.8 mm	21.8 mm	3.0 mm	1.00	17.4 mm	1.25	7%	>4.6 mm	NM	7.4 mm	3.2 mm	121°	86°	35°	0.80	Unknown Variety C	Parowan basal notched	out-of-key	one corner of base chipped, distal end appears resharpened	looks like contracting stem Eastgate - Parowan basal notched
37-7656	In40	29.7 mm	29.7 mm	3.3 mm	1.00	12.5 mm	2.38	12%	6.2 mm	0.50	8.4 mm	3.0 mm	205°	73°	132°	0.80	Unknown Variety C	Parowan basal notched	out-of-key	complete	looks like mini-Gatecliff (shoulder tangs end above neck) but rest of appearance within Rosegate series
37-5323	In40	27.4 mm	27.4 mm	3.3 mm	1.00	16.0 mm	1.71	12%	6.3 mm	0.39	8.4 mm	3.5 mm	170°	72°	98°	0.95	Unknown Variety C	Parowan basal notched	out-of-key	complete	looks like mini-Gatecliff (shoulder tangs end above neck) but rest of appearance within Rosegate series
37-5508	In40	>28.2 mm	>28.2 mm	4.6 mm	1.00	14.4 mm	NM	NM (LMW=8.5 mm)	6.1 mm	0.42	6.4 mm	3.5 mm	164°	84°	80°	>1.35	Unknown Variety C	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Rose Spring - Parowan basal notched
37-8257	In40	>26.3 mm	>26.3 mm	4.1 mm	1.00	17.4 mm	NM	NM (LMW=5.9 mm)	5.6 mm	0.32	8.7 mm	3.4 mm	123°	73°	50°	>1.00	Unknown Variety D	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-10532	In40	27.6 mm	27.2 mm	1.3 mm	0.99	16.3 mm	1.69	2%	8.1 mm	0.50	9.6 mm	2.7 mm	148°	85°	63°	0.75	Unknown Variety E	Parowan basal notched	out-of-key	distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-379	In40	22.7 mm	22.7 mm	2.3 mm	1.00	>15.4 mm	NM	5%	5.8 mm	NM	7.0 mm	3.2 mm	146°	71°	75°	>0.7	Unknown Variety E	Parowan basal notched	out-of-key	one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched
37-7598	In40	>25.4 mm	>25.3 mm	1.1 mm	0.996	14.5 mm	NM	0%	3.0 mm	0.21	4.9 mm	3.6 mm	139°	61°	78°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-7595	In40	29.3 mm	29.3 mm	1.2 mm	1.00	16.0 mm	1.83	3%	4.8 mm	0.30	6.1 mm	4.2 mm	142°	60°	82°	1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-10466	In40	37.3 mm	37.3 mm	1.2 mm	1.00	18.8 mm	1.98	5%	6.6 mm	0.35	8.2 mm	4.8 mm	133°	67°	66°	2.40	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped & reworked, one shoulder tang chipped, edge of base chipped, edges worn	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element, mahogany obsidian
37-12673	In40	≈32.2 mm	≈32.2 mm	1.3 mm	1.00	14.9 mm	≈2.16	0%	5.6 mm	0.38	6.2 mm	3.1 mm	147°	80°	67°	≈0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	small chip on tip	looks like contracting stem Eastgate - Parowan basal notched
37-1678	In40	27.0 mm	27.0 mm	1.3 mm	1.00	15.2 mm	1.78	4%	5.0 mm	0.33	5.8 mm	3.7 mm	143°	88°	55°	1.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end appears resharpened	looks like contracting stem Eastgate - Parowan basal notched
37-2334	In40	31.2 mm	31.2 mm	1.3 mm	1.00	16.6 mm	1.88	6%	3.4 mm	0.20	5.2 mm	3.9 mm	144°	65°	79°	1.55	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-7041	In40	21.2 mm	21.2 mm	1.4 mm	1.00	15.6 mm	1.36	4%	3.0 mm	0.19	5.7 mm	3.3 mm	157°	83°	74°	0.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-673	In40	≈25.0 mm	≈25.0 mm	1.4 mm	1.00	≈17.1 mm	≈1.46	≈11%	5.0 mm	≈0.29	7.0 mm	3.5 mm	119°	82°	37°	≈1.35	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped, one shoulder damaged & reworked, distal blade edges resharpened	looks like contracting stem Eastgate - Parowan basal notched
37-9662	In40	25.5 mm	25.5 mm	1.4 mm	1.00	15.4 mm	1.66	0%	4.6 mm	0.30	5.9 mm	3.5 mm	132°	79°	53°	0.80	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-5989	In40	27.0 mm	27.0 mm	1.4 mm	1.00	18.2 mm	1.48	4%	7.0 mm	0.38	8.5 mm	3.6 mm	139°	67°	72°	1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-2820	In40	>20.4 mm	>20.4 mm	1.6 mm	1.00	16.7 mm	NM	0%	5.5 mm	0.33	7.1 mm	3.0 mm	131°	69°	62°	>0.80	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-4049	In40	28.2 mm	28.2 mm	1.6 mm	1.00	17.5 mm	1.61	7%	5.3 mm	0.30	7.1 mm	3.5 mm	138°	78°	60°	1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched, not a dart point, mahogany obsidian
37-11283	In40	32.8 mm	32.8 mm	1.6 mm	1.00	13.7 mm	2.39	3%	6.3 mm	0.46	8.2 mm	3.5 mm	151°	66°	85°	0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-10380	In40	>18.7 mm	>18.7 mm	1.7 mm	1.00	12.0 mm	NM	NM (LMW=2.5 mm)	3.5 mm	0.29	3.9 mm	3.1 mm	159°	62°	97°	>0.60	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip snapped, distal blade edges damaged	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-11461	In40	23.5 mm	23.5 mm	1.7 mm	1.00	15.3 mm	1.54	15%	5.6 mm	0.37	6.0 mm	3.6 mm	127°	81°	46°	0.85	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	shoulder tangs snapped, one reworked, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-9452	In40	32.8 mm	32.8 mm	1.7 mm	1.00	18.2 mm	1.80	7%	2.3 mm	0.13	6.6 mm	3.8 mm	128°	32°	96°	1.50	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	very small chip on one base tang	minimal pressure-flaking on one face, looks like contracting stem Eastgate - Parowan basal notched
37-11415	In40	23.4 mm	23.4 mm	1.7 mm	1.00	18.6 mm	1.26	0%	6.4 mm	0.34	7.7 mm	3.9 mm	139°	80°	59°	1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges appear resharpened	looks like contracting stem Eastgate - Parowan basal notched
37-10962	In40	40.9 mm	40.9 mm	1.7 mm	1.00	19.0 mm	2.15	3%	6.3 mm	0.33	7.2 mm	4.4 mm	135°	84°	51°	2.35	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	edge of base possibly snapped	looks like contracting stem Eastgate - Parowan basal notched
37-6211	In40	27.9 mm	25.8 mm	1.8 mm	0.92	>17.6 mm	NM	0%	4.8 mm	NM	5.4 mm	3.3 mm	119°	70°	49°	>0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip chipped, one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-1534	In40	>18.5 mm	>18.5 mm	1.8 mm	1.00	19.0 mm	NM	0%	5.8 mm	0.31	9.3 mm	3.8 mm	133°	45°	88°	>1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, one face minimally flaked, LS, WN, & WB for haft element
37-3006	In40	23.2 mm	23.2 mm	1.8 mm	1.00	15.6 mm	1.49	11%	5.3 mm	0.34	6.2 mm	4.2 mm	141°	74°	67°	1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-13189	In40	33.2 mm	33.2 mm	1.8 mm	1.00	18.3 mm	1.81	4%	5.6 mm	0.31	6.5 mm	4.6 mm	143°	67°	76°	1.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-9090	In40	23.0 mm	23.0 mm	1.9 mm	1.00	17.4 mm	1.32	10%	6.4 mm	0.37	7.4 mm	2.6 mm	117°	78°	39°	0.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-3643	In40	24.7 mm	24.7 mm	1.9 mm	1.00	>20.4 mm	NM	9%	8.4 mm	NM	9.5 mm	3.4 mm	143°	79°	66°	>1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder snapped	looks like contracting stem Eastgate - Parowan basal notched
37-8562	In40	>27.8 mm	>27.6 mm	1.9 mm	0.99	17.5 mm	NM	0%	4.7 mm	0.27	6.7 mm	4.2 mm	128°	69°	59°	>1.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges damaged	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian, LS, WN & WB for haft element
37-5527	In40	>28.9 mm	>28.9 mm	2.0 mm	1.00	17.5 mm	NM	NM (LMW=2.0 mm)	2.4 mm	0.14	4.7 mm	3.5 mm	132°	67°	65°	>1.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges damaged	looks like contracting stem Eastgate - Parowan basal notched
37-3005	In40	22.8 mm	22.8 mm	2.0 mm	1.00	15.3 mm	1.49	8%	3.4 mm	0.22	4.3 mm	3.5 mm	159°	79°	80°	0.85	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-6252	In40	17.9 mm	17.7 mm	2.0 mm	0.99	16.8 mm	1.07	0%	4.9 mm	0.29	5.7 mm	3.6 mm	130°	81°	49°	0.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal blade edges & tip worn	looks like contracting stem Eastgate - Parowan basal notched, LS, WN, & WB for haft element
37-6307	In40	36.2 mm	36.2 mm	2.1 mm	1.00	≈18.5 mm	≈1.96	6%	6.3 mm	≈0.34	7.7 mm	3.0 mm	130°	71°	59°	1.45	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip of one shoulder tang snapped	minimal pressure-flaking on one face, looks like contracting stem Eastgate - Parowan basal notched
37-13848	In40	23.2 mm	23.2 mm	2.1 mm	1.00	17.6 mm	1.32	8%	5.8 mm	0.33	6.7 mm	4.5 mm	162°	74°	88°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-2298	In40	29.1 mm	29.1 mm	2.2 mm	1.00	17.9 mm	1.63	5%	5.8 mm	0.32	7.6 mm	2.6 mm	163°	67°	96°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-1459	In40	28.0 mm	28.0 mm	2.2 mm	1.00	16.5 mm	1.70	11%	5.5 mm	0.20	8.5 mm	3.4 mm	140°	68°	72°	1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	one edge from tip to base reworked	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-11947	In40	23.8 mm	23.8 mm	2.2 mm	1.00	19.0 mm	1.25	6%	7.8 mm	0.41	8.9 mm	3.8 mm	146°	82°	64°	1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-10379	In40	>29.9 mm	>29.9 mm	2.2 mm	1.00	17.7 mm	NM	NM (LMW=2.4 mm)	4.9 mm	0.28	8.1 mm	4.0 mm	148°	61°	87°	>1.45	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-2355	In40	26.8 mm	26.8 mm	2.3 mm	1.00	18.1 mm	1.48	9%	6.6 mm	0.36	8.4 mm	3.3 mm	177°	83°	94°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	base chipped	looks like contracting stem Eastgate - Parowan basal notched, traces of pitch on base & notches
37-10378	In40	30.0 mm	30.0 mm	2.3 mm	1.00	20.8 mm	1.44	6%	6.3 mm	0.30	9.1 mm	3.5 mm	132°	76°	56°	1.60	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip curves (possibly damaged & reworked), base chipped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-13254	In40	>24.5 mm	>24.5 mm	2.3 mm	1.00	16.7 mm	NM	NM (LMW=4.9 mm)	7.4 mm	0.44	8.4 mm	3.5 mm	177°	63°	114°	>0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip snapped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-1347	In40	>18.1 mm	>18.1 mm	2.3 mm	1.00	≈16.3 mm	NM	NM (LMW=2.6 mm)	5.2 mm	≈0.32 mm	6.3 mm	3.6 mm	134°	84°	50°	>1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang chipped	looks like contracting stem Eastgate - Parowan basal notched
37-8263	In40	>36.5 mm	>36.5 mm	2.3 mm	1.00	15.7 mm	NM	NM (LMW=2.5 mm)	3.2 mm	0.20	6.5 mm	3.8 mm	148°	53°	95°	>1.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-994	In40	>27.6 mm	>27.6 mm	2.3 mm	1.00	20.6 mm	NM	NM (LMW=1.9 mm)	5.6 mm	0.27	6.6 mm	4.4 mm	112°	81°	31°	>1.60	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-1282	In40	>26.7 mm	>26.7 mm	2.4 mm	1.00	14.8 mm	NM	NM (LMW=2.2 mm)	2.9 mm	0.20	4.8 mm	3.7 mm	155°	58°	97°	>1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-10381	In40	20.9 mm	20.9 mm	2.4 mm	1.00	≈16.1 mm	≈1.30	15%	6.4 mm	≈0.40	7.9 mm	3.8 mm	129°	73°	56°	≈0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	one shoulder tang chipped, distal blade edges reworked & worn	looks like contracting stem Eastgate - Parowan basal notched
37-381	In40	>16.5 mm	>16.5 mm	2.4 mm	1.00	17.8 mm	NM	NM (LMW=1.4 mm)	6.5 mm	0.37	8.7 mm	4.2 mm	157°	67°	90°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-13987	In40	>20.0 mm	>19.9 mm	2.5 mm	0.995	15.0 mm	NM	NM (LMW=3.2 mm)	3.8 mm	0.25	6.0 mm	3.1 mm	136°	64°	72°	>0.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip snapped, both faces minimally pressure-flaked, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-9091	In40	27.6 mm	27.6 mm	2.5 mm	1.00	19.3 mm	1.43	5%	5.9 mm	0.21	7.7 mm	3.2 mm	136°	70°	66°	1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-9209	In40	24.1 mm	24.1 mm	2.5 mm	1.00	17.7 mm	1.36	17%	9.7 mm	0.55	10.3 mm	5.4 mm	157°	103°	54°	1.55	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	appears unfinished on one side, possibly due to inferior quality of material	looks like contracting stem Eastgate - Parowan basal notched
37-3069	In40	29.2 mm	29.2 mm	2.6 mm	1.00	15.9 mm	1.84	8%	2.8 mm	0.18	6.6 mm	3.2 mm	136°	70°	66°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-10059	In40	≈22.4 mm	≈22.4 mm	2.6 mm	1.00	≈17.8 mm	≈1.26	≈11%	5.7 mm	≈0.32	8.5 mm	3.8 mm	139°	45°	94°	≈1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	small chip in tip & one shoulder tang	looks like contracting stem Eastgate - Parowan basal notched
37-390	In40	>20.4 mm	>20.4 mm	2.7 mm	1.00	18.6 mm	NM	NM (LMW=2.2 mm)	2.4 mm	0.13	5.0 mm	3.2 mm	147°	52°	95°	>0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped from 2 directions	looks like contracting stem Eastgate - Parowan basal notched
37-2744	In40	30.3 mm	30.3 mm	2.7 mm	1.00	18.0 mm	1.68	9%	≈5.7 mm	0.32	6.7 mm	3.3 mm	143°	63°	80°	1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	one corner of base chipped	looks like contracting stem Eastgate - Parowan basal notched
37-4956	In40	≈24.8 mm	≈24.8 mm	2.7 mm	1.00	15.9 mm	≈1.56	≈11%	4.4 mm	0.28	5.9 mm	3.4 mm	156°	59°	97°	≈0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip chipped	looks like contracting stem Eastgate - Parowan basal notched
37-8935	In40	39.5 mm	39.5 mm	2.7 mm	1.00	≈15.0 mm	≈2.63	7%	5.8 mm	≈0.39	6.4 mm	3.6 mm	157°	81°	76°	1.40	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	small chip on one base tang	looks like contracting stem Eastgate - Parowan basal notched
37-3898	In40	>30.2 mm	>30.2 mm	2.7 mm	1.00	>14.2 mm	NM	NM (LMW=3.5 mm)	5.4 mm	NM	6.4 mm	4.1 mm	105°	80°	25°	>1.55	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one edge & one shoulder tang damaged & reworked	looks like contracting stem Eastgate - Parowan basal notched
37-11125	In40	28.6 mm	28.6 mm	2.7 mm	1.00	18.1 mm	1.58	18%	4.7 mm	0.26	8.4 mm	4.3 mm	170°	64°	106°	1.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-11019	In40	31.8 mm	31.5 mm	2.7 mm	0.99	18.5 mm	1.72	12%	7.4 mm	0.40	8.9 mm	4.3 mm	162°	65°	97°	1.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-5990	In40	27.2 mm	27.2 mm	2.7 mm	1.00	17.0 mm	1.60	5%	4.3 mm	0.25	6.6 mm	4.7 mm	145°	80°	65°	1.40	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-13283	In40	≈40.0 mm	≈40.0 mm	2.8 mm	1.00	>18.5 mm	NM	≈7%	8.5 mm	NM	8.5 mm	2.8 mm	140°	95°	45°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped, one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched
37-3784	In40	>23.2 mm	>23.2 mm	2.8 mm	1.00	16.5 mm	NM	NM (LMW=1.3 mm)	1.1 mm	0.07	5.5 mm	2.8 mm	146°	49°	97°	>0.80	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip snapped	looks similar to Gunther type - Parowan basal notched
37-10382	In40	21.5 mm	21.5 mm	2.8 mm	1.00	18.2 mm	1.18	15%	8.0 mm	0.44	7.9 mm	3.3 mm	138°	95°	43°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal blade edges & tip reworked, bottom edge of base possibly snapped	looks like either a contracting stem Eastgate - Parowan basal notched or Rosegate
37-7110	In40	>25.4 mm	>25.4 mm	2.8 mm	1.00	16.1 mm	NM	NM (LMW=1.6 mm)	5.2 mm	0.32	6.1 mm	3.5 mm	136°	77°	59°	>0.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	tip chipped	looks like contracting stem Eastgate - Parowan basal notched
37-7445	In40	>37.7 mm	>37.7 mm	2.8 mm	1.00	19.3 mm	NM	NM (LMW=2.9 mm)	6.0 mm	0.31	7.8 mm	3.6 mm	159°	76°	83°	>1.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-2042	In40	≈29.2 mm	≈29.2 mm	2.8 mm	1.00	17.7 mm	≈1.65	≈11%	6.5 mm	0.37	8.0 mm	3.8 mm	132°	87°	45°	>1.45	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip chipped, one corner base chipped, one distal edge near tip severely damaged	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-2412	In40	>22.6 mm	>22.6 mm	2.8 mm	1.00	15.2 mm	NM	NM (LMW=3.6 mm)	3.3 mm	0.22	6.7 mm	4.0 mm	128°	64°	63°	>1.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges damaged	looks like contracting stem Eastgate - Parowan basal notched, iron oxide stain at one shoulder (mahogany" obsidian)
37-13772	In40	27.6 mm	27.6 mm	2.9 mm	1.00	15.3 mm	1.80	22%	5.7 mm	0.37	6.8 mm	3.3 mm	172°	80°	92°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Rose Spring - Parowan basal notched
37-10280	In40	27.1 mm	27.1 mm	2.9 mm	1.00	17.9 mm	1.51	7%	5.3 mm	0.30	7.1 mm	3.5 mm	136°	80°	56°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-10814	In40	>25.0 mm	>25.0 mm	2.9 mm	1.00	16.2 mm	NM	0%	5.7 mm	0.35	6.9 mm	3.8 mm	127°	75°	52°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, LS, WN & WB for haft element
37-11105	In40	>28.0 mm	>28.0 mm	2.9 mm	1.00	16.5 mm	NM	NM (LMW=2.9 mm)	6.7 mm	0.41	8.1 mm	3.9 mm	149°	62°	87°	>1.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang reworked	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-9554	In40	21.2 mm	21.2 mm	3.0 mm	1.00	11.8 mm	1.80	17%	4.4 mm	0.37	5.8 mm	3.1 mm	187°	85°	102°	0.55	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal blade edges reworked	looks like mini-Gatecliff (shoulder tangs end above neck) but rest of appearance within Rosegate series
37-8564	In40	>19.9 mm	>19.9 mm	3.0 mm	1.00	21.0 mm	NM	NM (LMW=1.4 mm)	4.8 mm	0.23	6.8 mm	3.6 mm	137°	68°	69°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, streaks of pink clay or paint visible both faces
37-9553	In40	≈32.2 mm	≈32.2 mm	3.0 mm	1.00	13.1 mm	≈2.46	≈16%	5.3 mm	0.40	6.9 mm	4.5 mm	163°	68°	95°	≈1.55	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	small chip on tip	looks like contracting stem Rose Spring - Parowan basal notched
37-11510	In40	>32.8 mm	>32.8 mm	3.0 mm	1.00	21.4 mm	NM	NM (LMW=2.0 mm)	8.7 mm	0.40	8.6 mm	4.8 mm	154°	98°	56°	>2.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one edge of base chipped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-8937	In40	>27.1 mm	>27.1 mm	3.1 mm	1.00	>16.9 mm	NM	NM (LMW=1.3 mm)	7.1 mm	NM	7.1 mm	3.4 mm	121°	95°	26°	>1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip & one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-10531	In40	22.1 mm	22.1 mm	3.1 mm	1.00	15.5 mm	1.43	19%	6.7 mm	0.43	7.5 mm	4.1 mm	156°	80°	76°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder tang chipped, all edges reworked	looks like contracting stem Eastgate - Parowan basal notched
37-7646	In40	26.0 mm	26.0 mm	3.2 mm	1.00	18.0 mm	1.44	15%	6.0 mm	0.33	8.3 mm	3.4 mm	140°	69°	71°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
37-9983	In40	>18.9 mm	>18.9 mm	3.2 mm	1.00	16.2 mm	NM	NM (LMW=3.2 mm)	3.9 mm	0.24	5.0 mm	3.6 mm	141°	72°	69°	>1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges damaged	looks like contracting stem Eastgate - Parowan basal notched
37-3144	In40	>20.2 mm	>20.2 mm	3.2 mm	1.00	13.0 mm	NM	NM (LMW=3.6 mm)	5.1 mm	0.39	6.0 mm	3.7 mm	184°	84°	100°	>0.75	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-7048	In40	>23.1 mm	>23.1 mm	3.2 mm	1.00	15.0 mm	NM	NM (LMW=2.7 mm)	6.1 mm	0.41	6.7 mm	4.2 mm	147°	84°	63°	>1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-2712	In40	32.5 mm	32.5 mm	3.3 mm	1.00	16.7 mm	1.95	10%	5.4 mm	0.32	6.0 mm	3.2 mm	134°	86°	48°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate, not a dart point, mahogany obsidian - Parowan basal notched
37-6468	In40	27.7 mm	27.7 mm	3.3 mm	1.00	14.4 mm	1.92	14%	6.6 mm	0.46	7.6 mm	3.4 mm	189°	84°	105°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal blade edges reworked	looks like mini-Gatecliff (shoulder tangs end above neck) but rest of appearance within Rosegate series
37-1084	In40	33.7 mm	33.7 mm	3.3 mm	1.00	14.3 mm	2.36	12%	≈4.9 mm	≈0.34	5.9 mm	3.5 mm	185°	88°	97°	≈1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	base chipped	looks like contracting stem Eastgate - Parowan basal notched
37-13255	In40	>17.8 mm	>17.8 mm	3.3 mm	1.00	14.7 mm	NM	NM (LMW=4.8 mm)	4.2 mm	0.29	4.6 mm	3.6 mm	161°	83°	78°	>0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-9684	In40	46.0 mm	46.0 mm	3.3 mm	1.00	18.3 mm	2.51	11%	4.9 mm	0.27	9.0 mm	3.8 mm	145°	83°	62°	1.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched
37-11109	In40	23.6 mm	23.6 mm	3.3 mm	1.00	13.9 mm	1.70	19%	6.0 mm	0.43	6.7 mm	4.5 mm	175°	73°	102°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges & tip worn	looks like contracting stem Rose Spring - Parowan basal notched
37-3688	In40	>25.5 mm	>25.5 mm	3.4 mm	1.00	15.5 mm	NM	NM (LMW=3.8 mm)	5.5 mm	0.35	7.4 mm	3.6 mm	153°	63°	90°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-11104	In40	>29.9 mm	>29.9 mm	3.4 mm	1.00	14.3 mm	NM	NM (LMW=3.6 mm)	6.3 mm	0.44	7.4 mm	3.6 mm	132°	93°	39°	>1.45	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-2187	In40	32.2 mm	32.2 mm	3.5 mm	1.00	15.6 mm	2.06	10%	4.4 mm	0.28	5.2 mm	3.2 mm	158°	87°	71°	1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate, not a dart point - Parowan basal notched
37-2892	In40	20.3 mm	20.3 mm	3.5 mm	1.00	16.1 mm	1.26	15%	6.2 mm	0.39	6.2 mm	3.8 mm	128°	92°	36°	0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip damaged & reworked, base chipped	looks like contracting stem Eastgate - Parowan basal notched

Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
37-8563	In40	>18.1 mm	>18.1 mm	3.5 mm	1.00	17.3 mm	NM	NM (LMW=3.4 mm)	4.0 mm	0.23	6.7 mm	4.2 mm	147°	70°	77°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, edges damaged & reworked	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-13034	In40	>19.6 mm	>19.6 mm	3.5 mm	1.00	19.0 mm	NM	NM (LMW=2.1 mm)	6.7 mm	0.35	6.6 mm	4.2 mm	139°	101°	38°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal end snapped, edges worn	looks like contracting stem Eastgate - Parowan basal notched
37-3543	In40	>20.5 mm	>20.5 mm	3.5 mm	1.00	14.3 mm	NM	NM (LMW=3.0 mm)	6.2 mm	0.43	6.5 mm	4.3 mm	152°	84°	68°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-4010	In40	40.6 mm	40.6 mm	3.5 mm	1.00	17.4 mm	2.33	6%	5.7 mm	0.33	7.1 mm	4.5 mm	123°	87°	46°	1.85	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Eastgate - Parowan basal notched, traces of pitch on base & notches
37-1993	In40	26.4 mm	26.4 mm	3.6 mm	1.00	11.4 mm	2.32	10%	4.5 mm	0.39	5.8 mm	3.1 mm	137°	87°	50°	0.75	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	one shoulder tang chipped & reworked	looks like contracting stem Rose Springs (MWP & DSA), traces of pitch on base & notches - Parowan basal notched
37-2333	In40	28.5 mm	28.5 mm	3.6 mm	1.00	16.5 mm	1.73	17%	5.1 mm	0.31	5.9 mm	3.4 mm	179°	83°	96°	1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	one shoulder tang chipped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-541	In40	29.8 mm	29.8 mm	3.6 mm	1.00	16.4 mm	1.82	10%	8.4 mm	0.51	8.7 mm	3.8 mm	159°	94°	65°	1.40	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end appears resharpened	looks like contracting stem Eastgate - Parowan basal notched
37-11020	In40	>20.1 mm	>20.1 mm	3.6 mm	1.00	17.4 mm	NM	NM (LMW=5.1 mm	6.4 mm	0.37	7.7 mm	4.8 mm	139°	85°	54°	>1.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges heavily worn	looks like contracting stem Eastgate - Parowan basal notched
37-13686	In40	>19.5 mm	>19.5 mm	3.7 mm	1.00	21.1 mm	NM	NM (LMW=3.2 mm)	7.9 mm	0.37	8.6 mm	3.3 mm	130°	84°	46°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, minimally pressure-flaked on one face	looks like contracting stem Eastgate - Parowan basal notched
37-2306	In40	>21.7 mm	>21.7 mm	3.7 mm	1.00	17.0 mm	NM	NM (LMW=3.8 mm)	7.8 mm	0.46	7.6 mm	3.9 mm	147°	96°	51°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like Rose Springs with small base
37-11262	In40	29.0 mm	29.0 mm	3.8 mm	1.00	15.1 mm	1.92	14%	4.8 mm	0.32	6.1 mm	3.7 mm	182°	75°	107°	1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	all edges appear damaged & reworked	looks like contracting stem Rose Spring - Parowan basal notched
37-9315	In40	>27.2 mm	>26.8 mm	3.8 mm	0.99	18.1 mm	NM	NM (LMW=3.6 mm)	6.2 mm	0.34	7.8 mm	4.8 mm	132°	82°	50°	>1.40	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped	looks like contracting stem Eastgate - Parowan basal notched
37-2455	In40	27.5 mm	27.5 mm	3.9 mm	1.00	14.0 mm	1.96	17%	3.9 mm	0.28	5.4 mm	4.0 mm	162°	74°	88°	0.90	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Rose Springs based on MWP & PSA, like Clifford's "eagle point" - Parowan basal notched
37-5234	In40	>32.9 mm	>32.9 mm	4.0 mm	1.00	≈14.3	NM	NM (LMW≈5.0 mm)	4.6 mm	≈0.32	4.9 mm	4.0 mm	131°	86°	45°	>1.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang snapped	looks like contracting stem Rose Spring - Parowan basal notched, mahogany obsidian
37-12379	In40	>19.0 mm	>19.0 mm	4.0 mm	1.00	16.2 mm	NM	NM (LMW=4.6 mm)	5.0 mm	0.31	6.4 mm	4.1 mm	122°	82°	40°	>0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-9760	In40	>18.8 mm	>18.8 mm	4.1 mm	1.00	20.0 mm	NM	NM (LMW=3.7 mm)	5.4 mm	0.27	6.5 mm	3.2 mm	138°	86°	52°	>1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade snapped	looks like contracting stem Eastgate - Parowan basal notched
37-6607	In40	>26.0 mm	>26.0 mm	4.1 mm	1.00	16.6 mm	NM	NM (LMW=4.6 mm)	6.7 mm	0.40	8.0 mm	3.4 mm	138°	86°	52°	>1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-8486	In40	>22.2 mm	>22.2 mm	4.1 mm	1.00	>17.6 mm	NM	NM (LMW=3.8 mm)	5.4 mm	NM	6.8 mm	3.5 mm	136°	88°	48°	>0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang snapped	looks like contracting stem Eastgate - Parowan basal notched
37-1724	In40	>23.5 mm	>23.5 mm	4.2 mm	1.00	16.0 mm	NM	NM (LMW=2.9 mm)	5.6 mm	0.35	6.7 mm	4.0 mm	121°	83°	38°	>1.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped	looks like contracting stem Eastgate - Parowan basal notched
37-12635	In40	>11.4 mm	>11.4 mm	4.3 mm	1.00	20.1 mm	NM	NM (LMW=4.8 mm)	8.0 mm	0.40	8.3 mm	3.5 mm	127°	82°	45°	>0.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	most of blade snapped	looks like contracting stem Eastgate - Parowan basal notched
37-10530	In40	>27.4 mm	>27.4 mm	4.8 mm	1.00	18.8 mm	NM	NM (LMW=4.3 mm)	6.5 mm	0.35	8.4 mm	4.7 mm	126°	66°	60°	>1.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
37-4834	In40	28.6 mm	28.6 mm	5.0 mm	1.00	17.7 mm	1.62	19%	5.1 mm	0.28	7.3 mm	4.0 mm	192°	86°	106°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip reworked	looks like contracting stem Rose Springs (MWP & DSA) - Parowan basal notched
37-492	In40	33.4 mm	33.4 mm	5.7 mm	1.00	16.0 mm	2.09	24%	6.2 mm	0.39	6.5 mm	4.0 mm	172°	92°	80°	1.45	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks most like a parallel stem Rose Springs (MWP & DSA)
37-2674	In40	23.0 mm	23.0 mm	5.5 mm	1.00	11.6 mm	1.98	33%	6.0 mm	0.52	4.7 mm	3.0 mm	212°	100°	112°	>0.60	Black Rock area, UT	Rosegate	Rosegate	one shoulder tang snapped	mahogany obsidian
37-6833	In40	>25.4 mm	>25.4 mm	5.3 mm	1.00	14.3 mm	NM	NM (LMW=6.4 mm)	8.5 mm	0.59	6.9 mm	4.3 mm	153°	111°	42°	>1.40	Black Rock area, UT	Rosegate	Rosegate	distal end snapped, one shoulder tang chipped	
37-1346	In40	37.2 mm	37.2 mm	3.0 mm	1.00	15.9 mm	2.34	12%	8.8 mm	0.55	8.2 mm	3.7 mm	160°	122°	38°	1.40	Black Rock area, UT	Rosegate	Rosegate	one shoulder tang chipped	
37-11221	In40	35.7 mm	35.7 mm	4.7 mm	1.00	12.2 mm	2.93	16%	8.5 mm	0.70	7.2 mm	3.9 mm	178°	115°	63°	1.25	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	complete	distal blade edges serrated
37-13433	In40	22.5 mm	22.5 mm	3.9 mm	1.00	>16.9 mm	NM	NM (LMW=4.4 mm)	9.9 mm	NM	10.4 mm	3.4 mm	147°	92°	53°	>0.90	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	one shoulder tang snapped & reworked, distal blade edges worn & reworked	
37-4637	In40	33.0 mm	33.0 mm	4.8 mm	1.00	11.4 mm	2.89	16%	10.5 mm	0.92	7.9 mm	3.3 mm	208°	1 30°	78°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	*?Elko corner notched?*	distal end appears resharpened	looks like Rosegate but WB too large, traces of pitch on base & notches
37-7890	In40	>22.6 mm	>22.6 mm	>3.4 mm	NM	12.8 mm	NM	NM (LMW>5.0 mm)	≈6.4 mm	≈0.50	5.8 mm	3.0 mm	196°	153°	43°	>0.70	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	out-of-key	tip chipped, bottom of base snapped horizontally	asymmetrical - looks like a cross between a small, side notched point and Rosegate
37-2595	In40	>15.8 mm	>15.8 mm	5.2 mm	1.00	15.9 mm	NM	NM (LMW=6.6 mm)	5.8 mm	0.36	5.1 mm	3.0 mm	175°	110°	65°	>0.60	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	distal end snapped	mahogany obsidian
37-11263	In40	22.5 mm	22.0 mm	4.3 mm	0.98	13.6 mm	1.65	29%	7.4 mm	0.54	6.9 mm	3.2 mm	219°	100°	119°	0.80	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	all edges appear damaged & reworked	mahogany obsidian
37-8936	In40	30.2 mm	30.1 mm	5.6 mm	0.997	>14.7 mm	NM	22%	8.3 mm	NM	7.3 mm	3.5 mm	152°	115°	37°	>1.05	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	one shoulder tang snapped	
37-4435	In40	37.8 mm	37.8 mm	5.3 mm	1.00	15.7 mm	2.41	15%	8.5 mm	0.54	7.4 mm	2.7 mm	140°	97°	43°	1.25	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	complete	mahogany obsidian
37-5121	In40	>21.7 mm	>21.7 mm	5.4 mm	1.00	15.2 mm	NM	NM (LMW=6.8 mm)	8.5 mm	0.56	6.8 mm	3.5 mm	150°	123°	27°	>1.00	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	distal end & part of one edge damaged, possibly during manufacture	no pitch on base in contrast to majority of this collection
37-13562	In40	36.1 mm	36.1 mm	4.4 mm	1.00	15.6 mm	2.31	13%	8.7 mm	0.56	7.7 mm	3.5 mm	184°	99°	85°	1.20	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	complete	minimal pressure-flaking at proximal end
37-14000	In40	27.8 mm	27.4 mm	2.9 mm	0.99	19.3 mm	1.44	12%	8.7 mm	0.45	9.4 mm	3.5 mm	150°	106°	44°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	distal blade edges worn	
37-1494	In40	>11.5 mm	>11.1 mm	3.1 mm	0.97	19.4 mm	NM	NM (LMW=2.1 mm)	8.8 mm	0.45	8.2 mm	3.8 mm	149°	106°	43°	>0.75	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	blade snapped	Eastgate type
37-13712	In40	>34.9 mm	>34.5 mm	4.2 mm	0.99	≈13.1 mm	NM	NM (LMW=6.7 mm)	8.9 mm	≈0.68	7.1 mm	3.4 mm	161°	125°	37°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	tip snapped, one shoulder reworked	
37-13618	In40	>24.2 mm	>24.2 mm	3.8 mm	1.00	>17.8 mm	NM	NM (LMW=3.3 mm)	8.9 mm	NM	8.3 mm	3.4 mm	167°	104°	63°	>0.95	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	tip chipped, one shoulder tang snapped, distal blade edges heavily worn	
37-8727	In40	>21.0 mm	>21.0 mm	5.4 mm	1.00	19.5 mm	NM	NM (LMW=5.5 mm)	9.3 mm	0.48	8.3 mm	3.9 mm	157°	109°	58°	>1.20	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	distal end & one edge damaged & partly reworked	mahogany obsidian
37-12720	In40	>24.5 mm	>24.5 mm	6.3 mm	1.00	16.8 mm	NM	NM (LMW=7.8 mm)	9.7 mm	0.58	8.7 mm	3.8 mm	189°	95°	94°	>1.15	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	tip snapped, edges worn	mahogany obsidian
37-1767	In40	>28.2 mm	>28.2 mm	7.7 mm	1.00	14.3 mm	NM	NM (LMW=8.1 mm)	9.7 mm	0.68	6.0 mm	4.4 mm	149°	116°	33°	>1.40	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	distal end snapped	some cortex remaining on one distal face
37-4861	In40	>30.6 mm	>30.1 mm	6.0 mm	0.98	19.9 mm	NM	NM (LMW=8.2 mm)	≈12.3 mm	0.62	9.6 mm	4.7 mm	132°	124°	8°	>2.60	Black Rock area, UT	Elko corner notched	Elko corner notched	distal end snapped, one base tang & one shoulder tang chipped, distal blade edges reworked	mahogany obsidian
37-2742	In40	≈43.3 mm	≈42.9 mm	8.4 mm	0.99	18.5 mm	2.29	≈30%	13.7 mm	0.74	10.9 mm	5.6 mm	197°	133°	64°	4.75	Wildhorse Canyon, Mineral Mountains, UT	Elko corner notched	Elko corner notched	tip chipped, distal blade edges worn & reworked	artifact appears slightly weathered or polished (perhaps an ornament?)
37-2871	In40	36.6 mm	36.6 mm	8.4 mm	1.00	18.5 mm	1.98	32%	7.3 mm	0.39	11.4 mm	4.9 mm	149°	78°	71°	3.05	Wildhorse Canyon, Mineral Mountains, UT	Gatecliff contracting stem	Gatecliff contracting stem	distal blade edges damaged & worn, tip worn & reworked to narrow point	based on usewear pattern, the artifact may have been a hafted drill/borer rather than a point
37-3401	In40	>30.9 mm	>30.9 mm	12.8 mm	1.00	>20.6 mm	NM	NM	>20.2 mm	NM	15.3 mm	5.2 mm	217°	156°	61°	>3.35	Wildhorse Canyon, Mineral Mountains, UT	Large side notched, Northern	Large side notched	distal end snapped, one base & adjacent shoulder tang snapped & reworked, distal blade edges reworked	most similar to Northern type
37-13430	In40	34.9 mm	34.0 mm	12.3 mm	0.97	26.7 mm	1.31	34%	21.3 mm	0.80	16.9 mm	6.1 mm	179°	126°	53°	4.10	Panaca Summit (Modena area), NV/UT	drill	*?Elko corner notched?*	wear pattern at distal end consistent with borer/drill	likely a hafted drill, not a point
University of Utah, Salt Lake City (n=154)																					
Median Village, Iron County, UT (42In124), AD 900 to AD 1050, n=14																					
FS 181.39	In124	48.9 mm	48.9 mm	N/A	1.00	22.4 mm	2.18	0%	22.4 mm	1.00	N/A	4.9 mm	N/A	N/A	N/A	4.05	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	one side of distal edge worn from slightly above midpoint to tip	looks like large Cottonwood triangular
FS 432-212	In124	>22.6 mm	>22.6 mm	N/A	1.00	19.0 mm	NM	NM (LMW=4.3 mm)	18.2 mm	0.96	N/A	3.9 mm	N/A	N/A	N/A	>1.50	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	out-of-key	tip snapped, one corner of base snapped & worn, distal blade edges worn & reworked	looks like large Cottonwood triangular
FS 39-34	In124	34.5 mm	34.5 mm	N/A	1.00	14.3 mm	2.41	0%	14.3 mm	1.00	N/A	3.9 mm	N/A	N/A	N/A	1.60	Pumice Hole Mine, UT	Cottonwood triangular	out-of-key	one distal edge worn from midpoint to tip	looks like large Cottonwood triangular
FS 61.49	In124	37.6 mm	37.6 mm	1.4 mm	1.00	17.1 mm	2.20	10%	4.2 mm	0.25	5.2 mm	5.2 mm	140°	79°	61°	2.00	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end appears slightly reworked	looks like contracting stem Eastgate - Parowan basal notched
FS 498.61	In124	36.6 mm	36.6 mm	3.0 mm	1.00	19.7 mm	1.86	5%	≈8.4 mm	≈0.43	8.9 mm	4.1 mm	123°	94°	29°	>1.90	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	one corner of base snapped diagonally	looks like contracting stem Eastgate - Parowan basal notched
FS 37.83	In124	>23.8 mm	>23.8 mm	4.4 mm	1.00	20.1 mm	NM	NM (LMW=4.5 mm)	8.0 mm	0.40	8.1 mm	4.1 mm	135°	92°	47°	>1.65	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped diagonally, one shoulder tang chipped	looks like contracting stem Eastgate - Parowan basal notched
FS 408.236	In124	>20.8 mm	>20.8 mm	2.6 mm	1.00	16.9 mm	NM	NM (LMW=2.6 mm)	5.7 mm	0.34	7.0 mm	3.9 mm	141°	77°	64°	>1.60	Unknown Variety B	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, one shoulder tang reworked	looks like contracting stem Eastgate - Parowan basal notched
FS 40-132	In124	23.7 mm	23.7 mm	2.8 mm	1.00	17.0 mm	1.39	11%	4.4 mm	0.26	6.4 mm	3.7 mm	129°	84°	45°	0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	small chips on one shoulder tang, edge of base, & tip	looks like contracting stem Eastgate - Parowan basal notched
FS 93.86	In124	33.6 mm	33.6 mm	3.1 mm	1.00	16.6 mm	2.02	18%	4.7 mm	0.28	5.9 mm	4.6 mm	140°	82°	58°	2.10	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges slightly damaged, tip worn	looks like large, thick, contracting stem Rose Spring - Parowan basal notched
FS 45.45	In124	26.4 mm	26.4 mm	3.2 mm	1.00	16.8 mm	1.57	19%	7.5 mm	0.45	7.4 mm	4.0 mm	159°	93°	66°	1.10	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	complete	looks like contracting stem Rose Spring - Parowan basal notched with slightly serrated edges
FS 352.69	In124	20.3 mm	20.3 mm	1.6 mm	1.00	18.7 mm	1.09	10%	4.2 mm	0.22	5.9 mm	3.3 mm	133°	61°	72°	0.95	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip worn	looks like contracting stem Eastgate - Parowan basal notched
FS 379.79	In124	33.6 mm	33.6 mm	3.9 mm	1.00	17.4 mm	1.93	11%	5.2 mm	0.30	6.9 mm	4.5 mm	115°	79°	36°	1.75	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end appears reworked & worn	looks like contracting stem Eastgate - Parowan basal notched
FS 41.16	In124	>19.5 mm	>19.5 mm	4.2 mm	1.00	17.7 mm	NM	NM (LMW=5.2 mm)	8.0 mm	0.45	7.6 mm	3.2 mm	148°	97°	51°	>0.80	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	tip snapped, minimal pressure-flaking on one face	
FS 368.102	In124	>29.1 mm	>29.1 mm	N/A	1.00	16.0 mm	≈1.82	≈7%	15.2 mm	0.95	N/A	4.6 mm	N/A	N/A	N/A	≈1.55	Wildhorse Canyon, Mineral Mountains, UT	drill	out-of-key	tip chipped, edges of distal end worn like a borer/drill	looks like a large, thick Cottonwood triangular - based on wear, probably a hafted drill or boring tool
Sevier Lake, Millard County, UT (42Md3, 42Md5, & 42Md6), n=12																					
10028.1	Md3	18.9 mm	18.9 mm	N/A	1.00	>8.6 mm	NM	0%	>8.6 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.60	Black Rock area, UT	Cottonwood triangular	Cottonwood triangular	one corner of base snapped, tip & distal blade edges worn	
10649	Md3	>24.4 mm	>23.8 mm	5.6 mm	0.98	13.5 mm	NM	NM (LMW=8.6 mm)	>9.7 mm	NM	8.0 mm	3.3 mm	195°	140°	55°	>0.95	Black Rock area, UT	Desert side notched	Desert side notched	1 base tang snapped, tip & 1 shoulder tang snapped & reworked, distal blade edges reworked	small, side notched point, very similar in appearance to Rosegate, mahogany obsidian (Rosegate side notched?)
9996	Md3	20.5 mm	20.5 mm	4.4 mm	1.00	13.6 mm	1.51	26%	3.7 mm	0.27	5.4 mm	2.6 mm	137°	80°	57°	0.50	Black Rock area, UT	Parowan basal notched	out-of-key	distal blade edges heavily worn & reworked	looks like contracting stem Rose Spring - Parowan basal notched
9973	Md3	23.4 mm	23.4 mm	4.2 mm	1.00	16.6 mm	1.41	16%	7.2 mm	0.43	6.9 mm	3.5 mm	146°	101°	45°	0.95	Black Rock area, UT	Parowan basal notched	out-of-key	distal blade edges worn & reworked	looks like Eastgate (Rosegate cluster)
9991	Md3	>21.6 mm	>21.6 mm	4.9 mm	1.00	16.7 mm	NM	NM (LMW=4.6 mm)	6.2 mm	0.37	6.6 mm	3.7 mm	151°	87°	64°	>1.15	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped & reworked, distal blade edges reworked	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
9975	Md3	>21.5 mm	>21.5 mm	>1.5 mm	NM	>14.1 mm	NM	NM	NM	NM	6.5 mm	4.3 mm	169°	86°	63°	>0.85	Black Rock area, UT	Parowan basal notched	out-of-key	base & both shoulder tangs snapped, distal blade edges worn	probably Parowan basal notched
10656	Md5	>19.3 mm	>19.3 mm	3.3 mm	1.00	>15.8 mm	NM	NM (LMW=3.0 mm)	6.9 mm	NM	7.2 mm	3.3 mm	131°	78°	53°	>0.90	Black Rock area, UT	Parowan basal notched	out-of-key	one shoulder tang & distal end snapped& reworked, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
1067	Md6	>27.1 mm	>27.1 mm	4.3 mm	1.00	13.1 mm	NM	NM (LMW=4.9 mm)	>4.7 mm	NM	6.6 mm	4.0 mm	204°	89°	115°	>1.30	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, base snapped on 1 corner, distal blade edges heavily reworked	looks like contracting stem Rose Spring - Parowan basal notched
9983	Md3	>23.6 mm	>23.6 mm	3.6 mm	1.00	14.8 mm	NM	NM (LMW=4.3 mm)	4.8 mm	0.32	5.5 mm	4.0 mm	170°	70°	100°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	looks like contracting stem Rose Spring - Parowan basal notched
9979	Md3	24.0 mm	24.0 mm	4.5 mm	1.00	13.9 mm	1.73	29%	6.3 mm	0.45	5.7 mm	3.1 mm	149°	101°	48°	0.75	Black Rock area, UT	Rosegate	Rosegate	distal blade edges heavily worn & reworked	
9994	Md6	19.0 mm	19.0 mm	5.2 mm	1.00	>11.3 mm	NM	NM (LMW=8.6 mm)	6.3 mm	NM	5.6 mm	2.5 mm	168°	122°	46°	>0.40	Black Rock area, UT	Rosegate	Rosegate	blade split vertically from tip	
20017	Md6	>20.5 mm	>20.5 mm	4.2 mm	1.00	16.8 mm	NM	NM (LMW=4.0 mm)	6.6 mm	0.39	5.7 mm	4.2 mm	150°	118°	32°	>1.00	Black Rock area, UT	Rosegate	Rosegate	distal end snapped, distal blade edges heavily reworked	mahogany obsidian
Kanosh Mounds, Millard County, UT (42Md2), n=15(note: some points in this collection appear to be transitional side notched to corner notched (PSA) but within Rosegate cluster).																					
9011	Md2	>25.5 mm	>25.5 mm	N/A	1.00	13.7 mm	NM	0%	13.7 mm	1.00	N/A	3.9 mm	N/A	N/A	N/A	>0.85	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood triangular	Cottonwood triangular	distal end snapped, distal blade edges worn	
9158	Md2	≈27.7 mm	≈27.7 mm	6.5 mm	1.00	13.8 mm	≈2.01	≈24%	12.6 mm	0.91	6.7 mm	3.2 mm	184°	173°	11°	≈0.80	Black Rock area, UT	Desert side notched	Desert side notched	tip chipped	closely resembles Rosegates in this assemblage, pitch on haft element (Rosegate side notched?)
9181	Md2	22.0 mm	21.8 mm	5.5 mm	0.99	9.9 mm	2.22	0%	9.9 mm	1.00	7.3 mm	2.7 mm	234°	149°	85°	0.55	Black Rock area, UT	Desert side notched	Desert side notched	tip & distal blade edges worn	minimally pressure-flaked on 1 face, appears unfinished
9365	Md2	28.5 mm	28.5 mm	4.0 mm	1.00	13.7 mm	2.08	4%	3.4 mm	0.25	4.3 mm	3.3 mm	114°	88°	26°	0.85	Black Mountain, UT	Parowan basal notched	out-of-key	distal blade edges from midpoint to tip worn	looks like contracting stem Eastgate - Parowan basal notched
9067	Md2	28.3 mm	28.3 mm	4.1 mm	1.00	13.3 mm	2.13	18%	5.5 mm	0.41	5.4 mm	3.3 mm	106°	95°	11°	0.80	Black Rock area, UT	Parowan basal notched	out-of-key	small chip on one shoulder tang, distal blade edges worn	Parowan basal notched, pitch on haft element
9938	Md2	24.2 mm	24.2 mm	4.8 mm	1.00	13.7 mm	1.77	24%	7.4 mm	0.54	5.3 mm	3.6 mm	146°	125°	21°	0.70	Black Rock area, UT	Rosegate	Rosegate	distal blade edges reworked	
9366	Md2	25.8 mm	25.8 mm	3.9 mm	1.00	12.6 mm	2.05	18%	8.5 mm	0.67	7.7 mm	3.1 mm	139°	99°	40°	≈0.80	Black Rock area, UT	Rosegate	Rosegate	bottom edge of base snapped	serrated edges
8982	Md2	36.1 mm	36.1 mm	5.2 mm	1.00	15.8 mm	2.28	20%	8.0 mm	0.51	6.8 mm	4.1 mm	202°	136°	64°	1.75	Black Rock area, UT	Rosegate	out-of-key	one corner edge of base snapped, distal end worn	appearance similar to Rosegates (Rose Springs type) but PSA too large, pitch on haft element
9202	Md2	>29.3 mm	>29.3 mm	5.4 mm	1.00	13.3 mm	NM	NM (LMW=8.9 mm)	8.4 mm	0.63	6.1 mm	3.5 mm	161°	122°	39°	>1.15	Black Rock area, UT	Rosegate	Rosegate	distal end snapped, distal blade edges worn	pitch on haft element
9182	Md2	28.1 mm	28.1 mm	5.5 mm	1.00	11.4 mm	2.46	24%	7.0 mm	0.61	5.8 mm	3.3 mm	162°	123°	39°	0.80	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	small chip on tip, distal blade edges worn	pitch on haft element
9012	Md2	22.2 mm	22.2 mm	5.7 mm	1.00	14.1 mm	1.57	36%	7.9 mm	0.56	6.6 mm	2.9 mm	157°	146°	11°	0.70	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	out-of-key	distal end reworked	appearance similar to Rosegates (Rose Springs type) but PSA too large, pitch on haft element
9026	Md2	25.9 mm	24.4 mm	6.2 mm	0.94	15.5 mm	1.67	37%	13.4 mm	0.86	9.0 mm	4.3 mm	187°	140°	47°	1.50	Black Rock area, UT	Elko corner notched	Elko corner notched	distal end worn to flat edge, 1 distal edge concave	wear pattern resembles a scraper (especially tip), pitch on haft element
9057	Md2	29.4 mm	29.4 mm	7.3 mm	1.00	25.8 mm	1.14	31%	14.9 mm	0.58	12.7 mm	5.3 mm	155°	105°	50°	3.10	Pumice Hole Mine, UT	Elko corner notched	out-of-key	distal end heavily reworked, distal blade edges slightly serrated	pitch on haft element, most closely resembles Elko corner notched
9817	Md2	30.7 mm	30.1 mm	8.0 mm	0.98	15.8 mm	1.94	0%	15.8 mm	1.00	9.3 mm	3.7 mm	187°	141°	46°	1.10	Black Rock area, UT	drill	N/A	complete	base very thick & large - based on this & negligible wear, original intent of manufacturer was likely a drill/boring tool
9027	Md2	31.9 mm	31.9 mm	7.0 mm	1.00	20.6 mm	1.55	31%	11.8 mm	0.55	11.3 mm	4.1 mm	172°	102°	70°	2.30	Wildhorse Canyon, Mineral Mountains, UT	hafted knife blade	*?Gatecliff contracting stem?*	one distal edge worn into concave shape	pressure-flaked on edges only, pitch on haft element, probably a hafted scraping or cutting tool, not a point
Kanosh site, Millard County, UT (42Md1), n=5																					
8979	Md1	>32.4 mm	>32.4 mm	6.1 mm	1.00	11.3 mm	NM	NM (LMW=9.0 mm)	6.6 mm	0.58	4.2 mm	3.4 mm	160°	124°	36°	>1.00	Black Rock area, UT	Rosegate	Rosegate	tip snapped, distal blade edges slightly worn	pitch on haft element
AR 1753	Md1	33.4 mm	33.4 mm	6.3 mm	1.00	17.7 mm	1.89	25%	6.0 mm	0.34	8.4 mm	4.7 mm	165°	81°	84°	2.40	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end worn	looks more like a larger, contracting stem Rose Springs - Parowan basal notched
9862	Md1	>25.5 mm	>25.5 mm	3.8 mm	1.00	13.8 mm	NM	NM (LMW=4.8 mm)	5.5 mm	0.40	6.2 mm	3.5 mm	171°	80°	91°	>1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, pitch on haft element
9387	Md1	34.6 mm	34.6 mm	N/A	1.00	19.1 mm	1.81	0%	19.1 mm	1.00	N/A	3.7 mm	N/A	N/A	N/A	1.85	Wildhorse Canyon, Mineral Mountains, UT	hafted knife blade	out-of-key	distal blade edges worn from midpoint to tip, tip reworked - blunted	possibly a hafted knife rather than a point
AR 1754	Md1	28.6 mm	28.6 mm	N/A	1.00	16.5 mm	1.73	0%	16.5 mm	1.00	N/A	4.6 mm	N/A	N/A	N/A	1.70	Wildhorse Canyon, Mineral Mountains, UT	hafted knife blade	out-of-key	tip blunt, distal blade edges worn - one edge convex, one slightly concave	looks more like a hafted knife blade than a point
Pine Park shelter, Washington County, UT (42Ws155), n=38																					
AR 485	Ws155	33.8 mm	30.2 mm	N/A	0.89	11.5 mm	2.94	22%	9.2 mm	0.80	N/A	4.5 mm	N/A	N/A	N/A	1.25	Tempiute Mountain, NV	Cottonwood leaf shaped	out-of-key	distal end worn	slender, barbed, shoulderless, leaf shaped, concave-base point
AR 410	Ws155	>20.1 mm	>20.1 mm	N/A	1.00	>14.5 mm	NM	0%	>14.5 mm	1.00	N/A	3.0 mm	N/A	N/A	N/A	>0.70	Kane Springs Wash Caldera Variety 2, NV	Cottonwood triangular	Cottonwood triangular	tip snapped, small chip on one corner of base	
AR 408	Ws155	>21.2 mm	>21.1 mm	N/A	1.00	14.2 mm	NM	0%	14.2 mm	1.00	N/A	3.3 mm	N/A	N/A	N/A	>0.85	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	tip snapped, distal blade edges toward tip slightly worn	
AR 490	Ws155	>19.2 mm	>19.2 mm	N/A	1.00	14.3 mm	NM	0%	14.3 mm	1.00	N/A	2.9 mm	N/A	N/A	N/A	>0.75	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
AR 399	Ws155	22.8 mm	22.8 mm	N/A	1.00	17.5 mm	1.30	0%	17.5 mm	1.00	N/A	5.9 mm	N/A	N/A	N/A	1.95	Unknown Variety D	Cottonwood triangular	out-of-key	distal blade edges slightly worn	looks most like thick Cottonwood triangular
AR 409	Ws155	>22.8 mm	>22.8 mm	N/A	1.00	19.0 mm	NM	0%	19.0 mm	1.00	N/A	5.6 mm	N/A	N/A	N/A	>1.75	Unknown Variety D	Cottonwood triangular	out-of-key	tip snapped, distal blade edges slightly worn	looks most like thick Cottonwood triangular
AR 472	Ws155	17.8 mm	15.5 mm	6.1 mm	0.87	13.6 mm	1.31	0%	13.6 mm	1.00	7.0 mm	2.4 mm	209°	166°	43°	0.35	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	complete	Sierra type
AR 480	Ws155	>29.6 mm	>29.6 mm	5.3 mm	1.00	9.7 mm	NM	NM (LMW=5.6 mm)	9.0 mm	0.93	6.1 mm	2.9 mm	214°	137°	77°	>0.75	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	tip snapped, distal blade edges toward tip worn	more similar in appearance to Rosegate cluster (Rosegate side notched?)
AR 471	Ws155	34.6 mm	33.4 mm	7.9 mm	0.97	18.9 mm	1.83	0%	18.9 mm	1.00	11.3 mm	4.1 mm	185°	159°	26°	1.90	Panaca Summit (Modena area), NV/UT	Desert side notched	*?Large side notched?*	tip slightly worn	distal blade edges serrated (most similar in appearance to Redding side notched within Rosegate cluster size), pitch on haft
AR 438	Ws155	24.6 mm	24.6 mm	3.8 mm	1.00	17.1 mm	1.44	19%	7.1 mm	0.42	8.3 mm	4.0 mm	145°	79°	66°	1.00	Kane Springs Wash Caldera Variety 2, NV	Parowan basal notched	out-of-key	distal blade edges heavily worn, tip reworked	looks like contracting stem Eastgate - Parowan basal notched
AR 455	Ws155	20.4 mm	20.4 mm	2.9 mm	1.00	9.9 mm	2.06	18%	4.7 mm	0.47	4.8 mm	3.0 mm	162°	79°	83°	0.50	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	distal blade edges worn toward tip	looks like contracting stem Rose Spring - Parowan basal notched
AR 448	Ws155	23.8 mm	23.8 mm	5.2 mm	1.00	17.6 mm	1.35	21%	6.8 mm	0.39	6.8 mm	4.5 mm	141°	88°	54°	1.15	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end from midpoint to tip heavily reworked	looks like contracting stem Eastgate - Parowan basal notched
AR 440	Ws155	29.7 mm	29.7 mm	2.4 mm	1.00	15.9 mm	1.87	4%	3.7 mm	0.23	5.1 mm	3.0 mm	143°	64°	81°	0.75	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	complete	looks like contracting stem Eastgate - Parowan basal notched
AR 470	Ws155	29.6 mm	29.6 mm	3.9 mm	1.00	18.9 mm	1.57	11%	7.3 mm	0.39	9.2 mm	4.5 mm	124°	78°	46°	1.35	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges slightly worn	looks like contracting stem Eastgate - Parowan basal notched
AR 443	Ws155	>24.4 mm	>24.4 mm	3.3 mm	1.00	14.7 mm	NM	NM (LMW=2.8 mm)	6.7 mm	0.46	7.8 mm	4.3 mm	155°	66°	89°	≈1.00	Panaca Summit (Modena area), NV/UT	Parowan basal notched	out-of-key	extreme tip snapped	looks more like contracting stem Eastgate - Parowan basal notched
AR 474	Ws155	23.9 mm	23.9 mm	4.1 mm	1.00	21.6 mm	1.11	26%	6.0 mm	0.28	8.6 mm	4.5 mm	178°	58°	120°	1.60	Unknown Variety B	Parowan basal notched	*?Gatecliff contracting stem?*	tip worn	looks more like contracting stem Eastgate - Parowan basal notched
AR 454	Ws155	>33.6 mm	>33.6 mm	6.4 mm	1.00	12.8 mm	NM	NM (LMW=6.3 mm)	9.7 mm	0.76	5.8 mm	3.7 mm	181°	130°	51°	>1.00	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	tip snapped, distal blade edges heavily damaged	minimally pressure-flaked on one face
AR 513	Ws155	25.3 mm	25.3 mm	5.3 mm	1.00	≈11.0 mm	≈2.30	26%	6.0 mm	≈0.55	5.3 mm	3.1 mm	169°	104°	65°	≈0.60	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	tip reworked, one shoulder tang chipped	
AR 452	Ws155	26.5 mm	26.5 mm	4.2 mm	1.00	12.0 mm	2.21	18%	6.1 mm	0.51	4.7 mm	3.1 mm	132°	126°	16°	0.75	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	small chip on bottom edge of one shoulder tang	
AR 453	Ws155	19.0 mm	19.0 mm	3.4 mm	1.00	13.9 mm	1.37	24%	6.5 mm	0.47	5.8 mm	4.1 mm	162°	103°	61°	0.85	Panaca Summit (Modena area), NV/UT	Rosegate	Rosegate	distal end damaged & reworked	
AR 509	Ws155	23.0 mm	23.0 mm	4.5 mm	1.00	15.2 mm	1.51	18%	11.0 mm	0.72	9.5 mm	3.3 mm	176°	115°	61°	>0.95	Panaca Summit (Modena area), NV/UT	Rosegate	*?Elko corner notched?*	distal end chipped toward tip	appearance definitely more like Rosegate than Elko (large-based Rosegate)
AR 451	Ws155	25.5 mm	25.5 mm	4.2 mm	1.00	13.5 mm	1.89	23%	6.8 mm	0.50	5.5 mm	2.9 mm	131°	108°	23°	0.70	Unknown Variety B	Rosegate	Rosegate	tip slightly worn	
AR 508	Ws155	>25.5 mm	>25.5 mm	4.6 mm	1.00	14.5 mm	NM	NM (LMW=5.0 mm)	7.5 mm	0.52	6.2 mm	3.3 mm	175°	107°	68°	>0.95	Unknown Variety B	Rosegate	Rosegate	tip snapped	distal blade edges slightly serrated
AR 506	Ws155	52.0 mm	52.0 mm	7.7 mm	1.00	26.9 mm	1.93	21%	20.6 mm	0.77	14.3 mm	5.2 mm	156°	149°	7°	>5.95	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	small chip on one shoulder tang, slight wear on distal edges	very large, very sharp, finely crafted, parallel flake scars
AR 418	Ws155	>41.8 mm	>41.8 mm	10.5 mm	1.00	25.5 mm	NM	NM (LMW=13.5 mm)	21.1 mm	0.83	15.7 mm	5.3 mm	215°	130°	85°	>6.05	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped & partly reworked, distal blade edges worn	
AR 419	Ws155	>41.0 mm	>41.0 mm	7.6 mm	1.00	19.0 mm	NM	NM (LMW=11.2 mm)	15.2 mm	0.80	11.7 mm	5.2 mm	191°	135°	56°	>3.70	Panaca Summit (Modena area), NV/UT	Elko corner notched	Elko corner notched	distal end snapped, distal blade edges worn, one edge exceptionally worn	pitch on haft element
AR 2892	Ws155	>27.2 mm	>25.2 mm	7.4 mm	0.93	21.9 mm	NM	NM (LMW=11.2 mm)	20.2 mm	0.94	15.0 mm	5.1 mm	217°	138°	81°	>3.20	Panaca Summit (Modena area), NV/UT	Elko eared	Elko eared	distal end snapped, distal blade edges damaged	

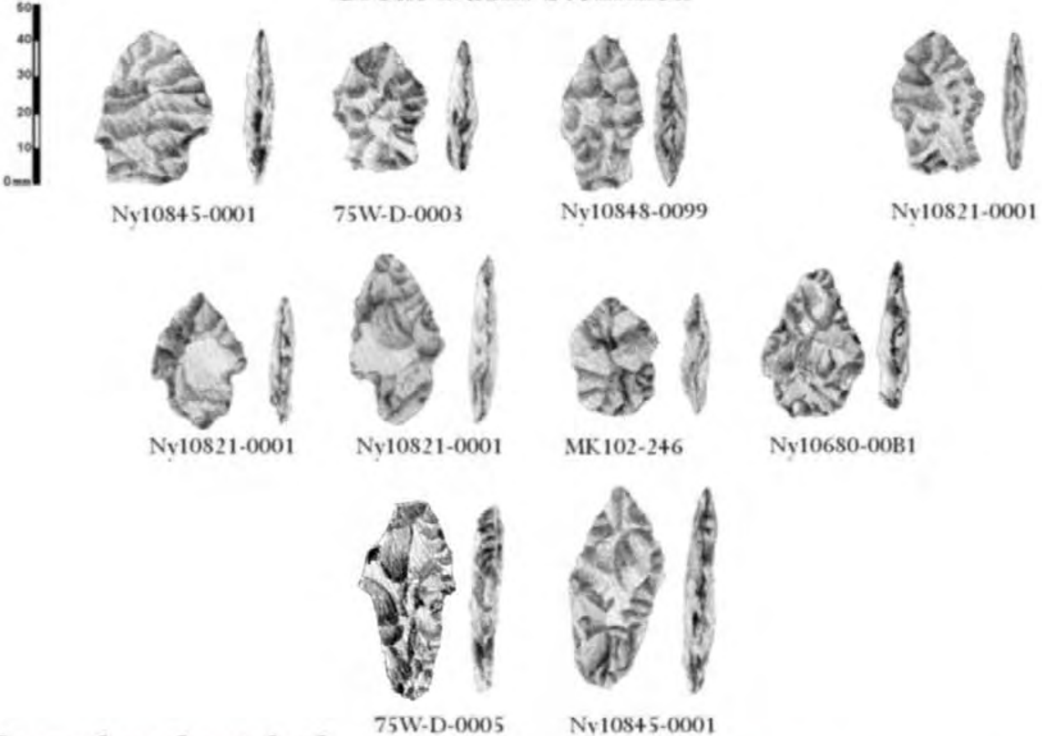
Specimen Number	Site Number	Length Max. (LM)	Length Axial (LA)	Length Stem (LS)	Basal Indent. Ratio (LA/LM)	Width Max. (WM)	LM/WM	Max. Width Pos. (100 x LMW/LM)	Width Base (WB)	WB/WM	Width Neck (WN)	Thickness	DSA	PSA	Notch Opening	Weight (grams)	Source	Point Type determination for this study (all references)	Point Type according to Monitor Valley key (Thomas 1981)	Condition	Comments
AR 2889	Ws155	>21.0 mm	>17.9 mm	9.8 mm	0.85	>24.8 mm	NM	NM	17.8 mm	NM	13.9 mm	5.4 mm	168°	127°	41°	>2.45	Panaca Summit (Modena area), NV/UT	Elko eared	Elko eared	blade snapped diagonally above shoulders	
AR 423	Ws155	>34.1 mm	>32.5 mm	10. 1 mm	<0.95	22.4 mm	NM	NM (LMW=14.0 mm)	14.8 mm	0.66	11.9 mm	6.8 mm	158°	115°	43°	>4.75	Unknown Variety C	Elko eared	Elko eared	distal end snapped, terminus of both ears snapped	BIR would be deeper if ears complete
AR 477	Ws155	27.7 mm	27.7 mm	7.0 mm	1.00	20.8 mm	1.33	35%	13.4 mm	0.64	14.5 mm	5.6 mm	195°	84°	111°	2.45	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	blade heavily worn & reworked	
AR 405	Ws155	>29.0 mm	>29.0 mm	4.2 mm	1.00	22.8 mm	NM	NM (LMW=11.6 mm)	5.1 mm	0.22	8.6 mm	4.8 mm	148°	72°	76°	>2.55	Unknown Variety C	Gatecliff contracting stem	Gatecliff contracting stem	tip snapped , small chip on base	distal blade edges barbed - found in Fremont sites
AR 473	Ws155	38.7 mm	38.7 mm	7.8 mm	1.00	22.8 mm	1.70	25%	10.7 mm	0.47	14.1 mm	5.5 mm	157°	76°	81°	3.60	Unknown Variety E	Gatecliff contracting stem	Gatecliff contracting stem	tip resharpened	distal blade edges barbed - found in Fremont sites
AR 488	Ws155	31.5 mm	28.6 mm	N/A	0.91	16.9 mm	1.86	31%	13.4 mm	0.79	N/A	5.0 mm	N/A	N/A	N/A	2.50	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end heavily reworked, one edge damaged a hafting juncture	
AR 2860	Ws155	>33.7 mm	>32.8 mm	N/A	0.97	19.2 mm	NM	NM (LMW=16.0 mm)	12.4 mm	0.65	N/A	7.4 mm	N/A	N/A	N/A	>5.40	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end snapped, edges worn	
AR 2859	Ws155	>25.9 mm	>23.5 mm	N/A	0.91	15.3 mm	NM	NM (LMW=9.3 mm)	13.1 mm	0.86	N/A	6.2 mm	N/A	N/A	N/A	>2.60	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	distal end snapped & heavily reworked	
AR 2861	Ws155	>23.3 mm	>20.7 MM	N/A	0.89	19.5 MM	NM	NM (LMW=9.5 mm)	15.6 mm	0.80	N/A	6.2 mm	N/A	N/A	N/A	>2.70	Panaca Summit (Modena area), NV/UT	Humboldt	Humboldt	blade snapped, edges worn	
AR 469	Ws155	29.5 mm	29.5 mm	9.6 mm	1.00	23.4 mm	1.26	34%	22.7 mm	0.97	7.9 mm	4.9 mm	196°	126°	70°	2.55	Panaca Summit (Modena area), NV/UT	Large side notched, Sudden	out-of-key	distal blade edges slightly worn	wide, squat, side notched point (about Elko size) - Sudden type
AR 426	Ws155	23.7 mm	23.7 mm	8.5 mm	1.00	19.0 mm	1.25	46%	18.5 mm	0.97	14.0 mm	4.6 mm	219°	147°	102°	2.10	Panaca Summit (Modena area), NV/UT	Large side notched, Sudden	Large side notched	blade heavily damaged & reworked	Sudden type
Pharo Village, Millard County, UT (42Md180), n=26																					
FS 198.226	Md180	21.5 mm	21.5 mm	N/A	1.00	12.9 mm	1.67	13%	11.1 mm	0.86	N/A	3.6 mm	N/A	N/A	N/A	0.75	Black Rock area, UT	Cottonwood triangular	out-of-key	tip slightly worn	appearance closest to Cottonwood triangular, mahogany obsidian
FS 220.77	Md180	24.4 mm	24.0 mm	N/A	0.98	17.3 mm	1.41	7%	17.1 mm	0.99	N/A	5.3 mm	N/A	N/A	N/A	1.40	Black Rock area, UT	Cottonwood triangular	out-of-key	distal blade edges worn	looks like thick Cottonwood triangular
FS 289.113	Md180	>15.0 mm	>15.0 mm	N/A	1.00	12.9 mm	NM	0%	12.9 mm	1.00	N/A	2.5 mm	N/A	N/A	N/A	>0.40	Black Rock area, UT	Cottonwood triangular	Cottonwood triangular	distal end snapped	
FS 103.111	Md180	20.8 mm	20.8 mm	4.2 mm	1.00	10.8 mm	1.93	0%	10.8 mm	1.00	7.0 mm	3.6 mm	229°	157°	72°	0.60	Black Rock area, UT	Desert side notched	Desert side notched	distal blade edges worn, one corner of base reworked	Rosegate-size, side notched point, pitch on haft element
FS 109.4	Md180	19.8 mm	19.5 mm	5.0 mm	0.98	12.1 mm	1.64	25%	10.7 mm	0.88	5.5 mm	3.3 mm	180°	161°	19°	0.50	Black Rock area, UT	Desert side notched	out-of-key	distal blade edges worn	most closely resembles Redding side notch w/ lopsided base
FS 272.32	Md180	17.4 mm	17.4 mm	4.5 mm	1.00	8.6 mm	2.02	29%	4.7 mm	0.55	4.6 mm	2.7 mm	191°	92°	99°	0.30	Black Rock area, UT	Parowan basal notched	out-of-key	distal blade edges slightly worn	looks like very small Parowan basal notched with serrated edges
FS 393.18	Md180	21.4 mm	21.4 mm	4.3 mm	1.00	13.5 mm	1.59	33%	5.0 mm	0.37	4.8 mm	3.9 mm	154°	89°	65°	0.75	Black Rock area, UT	Parowan basal notched	out-of-key	distal blade edges reworked	looks like contracting stem Eastgate - Parowan basal notched
FS 229.62	Md180	25.5 mm	25.5 mm	2.0 mm	1.00	16.0 mm	1.59	9%	2.4 mm	0.15	3.8 mm	3.8 mm	114°	76°	38°	1.25	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
FS 359.52	Md180	20.8 mm	20.8 mm	4.9 mm	1.00	>13.2 mm	NM	21%	6.3 mm	NM	6.4 mm	3.6 mm	143°	84°	42°	>0.70	Black Rock area, UT	Parowan basal notched	out-of-key	distal end damaged, one shoulder tang snapped & reworked	looks like parallel stem Eastgate - Parowan basal notched, pitch on notch
FS 1.152	Md180	20.1 mm	20.1 mm	4.5 mm	1.00	17.3 mm	1.16	27%	7.9 mm	0.46	8.2 mm	4.4 mm	150°	80°	52°	1.00	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges worn, tip & one shoulder tang reworked	looks like contracting stem Eastgate - Parowan basal notched, pitch on haft element
FS 22.227	Md180	>21.8 mm	>21.8 mm	2.1 mm	1.00	12.3 mm	NM	NM (LMW=2.7 mm)	4.8 mm	0.39	5.5 mm	4.3 mm	166°	82°	84°	>1.10	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
FS 48.61	Md180	33.5 mm	33.5 mm	3.0 mm	1.00	16.0 mm	2.09	14%	6.0 mm	0.38	6.0 mm	3.8 mm	142°	88°	54°	1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal blade edges worn, bottom edges of both shoulder tangs chipped	looks like parallel stem Eastgate - Parowan basal notched, pitch on haft element
FS 359.47	Md180	>17.8 mm	>17.8 mm	4.5 mm	1.00	≈14.0 mm	NM	NM (LMW=6.1 mm)	6.8 mm	≈0.49	6.8 mm	3.3 mm	125°	85°	40°	>0.70	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	tip snapped, one shoulder tang snapped, the other is chipped, distal blade edges heavily worn	looks like parallel stem Eastgate - Parowan basal notched, pitch on haft element
FS 288.114	Md180	>18.1 mm	>18.1 mm	4.4 mm	1.00	>10.0 mm	NM	NM (LMW=7.0 mm)	5.3 mm	NM	5.5 mm	2.7 mm	184°	73°	88°	>0.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	split diagonally from slightly below tip to neck	looks like contracting stem Rose Spring - Parowan basal notched
FS 235.31	Md180	>30.8 mm	>30.8 mm	5.3 mm	1.00	17.0 mm	NM	NM (LMW=6.2 mm)	8.2 mm	0.48	10.2 mm	5.5 mm	179°	83°	96°	>2.65	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, distal blade edges worn	could be an exceptionally thick Parowan basal notched considering majority of assemblage
FS 24.128	Md180	17.7 mm	17.7 mm	4.1 mm	1.00	9.9 mm	1.79	29%	7.8 mm	0.79	6.5 mm	2.7 mm	149°	107°	42°	0.40	Black Rock area, UT	Rosegate	Rosegate	tip slightly worn	distal blade edges serrated, very small in comparison to other Rosegates
FS 393.28	Md180	18.1 mm	18.1 mm	5.6 mm	1.00	13.8 mm	1.31	35%	6.8 mm	0.49	5.6 mm	3.1 mm	164°	102°	62°	0.45	Black Rock area, UT	Rosegate	Rosegate	distal blade edges reworked	
FS 393.29	Md180	16.2 mm	16.2 mm	4.1 mm	1.00	10.0 mm	1.62	30%	6.6 mm	0.66	5.5 mm	2.5 mm	183°	99°	94°	0.30	Black Rock area, UT	Rosegate	Rosegate	complete	very small in comparison to other Rosegates
FS 26.103	Md180	21.8 mm	21.8 mm	5.8 mm	1.00	11.2 mm	1.95	32%	6.7 mm	0.60	5.9 mm	2.0 mm	143°	101°	42°	0.40	Black Rock area, UT	Rosegate	Rosegate	point vertically split on 1 side parallel to tip edge of haft element by distal edge worked	based on lack of wear & size, split likely occurred during manufacture & attempt was made to correct error
FS 1.1A	Md180	≈22.3 mm	≈22.3 mm	5.6 mm	1.00	14.0 mm	≈1.59	≈25%	6.5 mm	0.46	5.3 mm	4.4 mm	164°	93°	71°	≈0.85	Black Rock area, UT	Rosegate	Rosegate	small chip on tip, distal blade edges worn, especially toward tip	
FS 69.158	Md180	>16.6 mm	>16.6 mm	4.4 mm	1.00	11.0 mm	NM	NM (LMW=6.4 mm)	6.2 mm	0.56	4.9 mm	3.1 mm	147°	118°	31°	>0.45	Black Rock area, UT	Rosegate	Rosegate	distal end smashed, distal blade edges heavily worn	
FS 393.21	Md180	28.8 mm	28.8 mm	7.8 mm	1.00	>16.6 mm	NM	NM (LMW=4.1 mm)	8.5 mm	NM	6.9 mm	3.4 mm	128°	112°	16°	>1.10	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	blade snapped vertically from tip to neck, remaining distal edge worn	
FS 385.191	Md180	43.5 mm	43.5 mm	9.1 mm	1.00	28.1 mm	1.55	29%	21.2 mm	0.75	18.3 mm	4.7 mm	146°	119°	27°	6.30	Black Rock area, UT	Elko corner notched	Elko corner notched	blade edges worn	mahogany obsidian - very wide for an Elko point, 30x magnification revealed small hairs caught in fissures, especially along edges - possibly a hafted scraping tool
FS 358.15	Md180	>22.3 mm	>20.7 mm	6.2 mm	0.93	24.0 mm	NM	NM (LMW=6.0 mm)	>13.1 mm	NM	10.8 mm	4.6 mm	152°	133°	19°	>1.95	Wildhorse Canyon, Mineral Mountains, UT	Elko eared	Elko eared	blade edges worn, one base tang snapped	
FS 102.17	Md180	28.5 mm	27.2 mm	N/A	0.95	17.3 mm	1.65	30%	11.6 mm	0.67	N/A	5.4 mm	N/A	N/A	N/A	2.20	Unknown 4	Humboldt	Humboldt	distal blade edges heavily worn	
FS 177.50	Md180	>20.3 mm	>20.3 mm	8.5 mm	1.00	>16.9 mm	NM	NM	15.5 mm	NM	11.4 mm	5.6 mm	212°	144°	72°	>1.60	Wildhorse Canyon, Mineral Mountains, UT	hafted tool	out-of-key	blade snapped diagonally from above 1 shoulder through neck, 1 base tang snapped at edge, heavily worn	medium-sized, side notched base & shoulder of some type of hafted tool (pitch on haft element), but difficult to determine if a point with so little of the blade
Garrison site, White Pine County, NV (26WP12, 26WP6, & 26WP7), n=14																					
FS 23554.7	WP7	>24.1 mm	>24.1 mm	N/A	1.00	13.8 mm	NM	NM (LMW=4.3 mm)	6.2 mm	0.45	N/A	3.5 mm	N/A	N/A	N/A	>1.05	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood leaf shaped	Cottonwood leaf shaped	blade edges heavily worn, tip snapped	based on small piece of tip snapped, it is highly likely that MWP would be >15%
23750	WP12	>13.0 mm	>13.0 mm	4.0 mm	1.00	9.3 mm	NM	NM (LMW=4.6 mm)	8.5 mm	0.91	4.5 mm	2.1 mm	201°	148°	53°	>0.35	Black Rock area, UT	Desert side notched	Desert side notched	distal end snapped	most similar to Redding side notched
FS 23469.15	WP6	>15.8 mm	>15.8 mm	4.5 mm	1.00	13.1 mm	NM	NM (LMW=6.2 mm)	10.4 mm	0.79	7.4 mm	3.5 mm	166°	155°	13°	>0.55	Black Rock area, UT	Desert side notched	Desert side notched	distal end snapped, blade edges worn, one base tang snapped & reworked	most similar to Redding side notched
FS 23611	WP7	20.3 mm	20.3 mm	4.9 mm	1.00	≈16.3 mm	≈1.25	≈35%	>10.0 mm	NM	6.0 mm	4.0 mm	164°	148°	16°	>0.90	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	blade edges heavily damaged, tip reworked, one shoulder & one base tang snapped	most similar to Redding side notched
WP6,7 B	WP6, 7	>19.4 mm	>19.4 mm	2.8 mm	1.00	16.6 mm	NM	NM (LMW=5.2 mm)	7.5 mm	0.45	8.0 mm	3.3 mm	137°	80°	57°	>1.05	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, blade edges heavily worn	looks like contracting stem Eastgate - Parowan basal notched
AR 1935	WP12	18.7 mm	18.7 mm	2.3 mm	1.00	14.1 mm	1.33	5%	4.2 mm	0.30	4.7 mm	2.9 mm	131°	86°	45°	0.50	Black Rock area, UT	Parowan basal notched	out-of-key	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
FS 23528.32	WP6	29.0 mm	29.0 mm	5.6 mm	1.00	13.4 mm	2.16	20%	3.3 mm	0.25	6.7 mm	3.4 mm	157°	72°	85°	0.75	Black Rock area, UT	Parowan basal notched	out-of-key	blade edges heavily worn, 1 side concave, 1 side convex, 1 edge of base snapped	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
FS 23627.1	WP7	21.7 mm	21.7 mm	1.6 mm	1.00	15.5 mm	1.40	14%	5.3 mm	0.34	6.9 mm	3.3 mm	137°	60°	37°	0.70	Black Rock area, UT	Parowan basal notched	out-of-key	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
FS 23572.19	WP7	30.5 mm	30.5 mm	1.8 mm	1.00	16.4 mm	1.86	0%	5.8 mm	0.35	6.3 mm	4.1 mm	130°	95°	35°	1.40	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
AR 1936	WP12	24.9 mm	24.4 mm	5.6 mm	0.98	15.9 mm	1.57	23%	7.7 mm	0.48	7.0 mm	3.4 mm	125°	95°	30°	0.80	Black Rock area, UT	Rosegate	Rosegate	blade edges worn	
26WP12	WP12	>16.0 mm	>16.0 mm	4.5 mm	1.00	16.6 mm	NM	NM (LMW=4.8 mm)	6.2 mm	0.37	5.0 mm	2.7 mm	133°	98°	45°	>0.60	Black Rock area, UT	Rosegate	Rosegate	distal end snapped, blade edges worn	
FS 23554.6	WP7	25.0 mm	24.1 mm	5.3 mm	0.96	14.8 mm	1.69	21%	8.5 mm	0.57	6.0 mm	3.8 mm	145°	130°	15°	1.00	Black Rock area, UT	Rosegate	Rosegate	blade edges slightly worn	red paint on hafted portion of blade edge and notches, possibly pitch in notches as well
WP6,7 A	WP6, 7	>15.6 mm	>15.6 mm	4.7 mm	1.00	13.7 mm	NM	NM (LMW=4.8 mm)	6.9 mm	0.50	6.0 mm	2.8 mm	160°	102°	58°	>0.45	Topaz Mountain, UT	Rosegate	Rosegate	distal end snapped, one blade edge heavily worn	
AR 1938	WP12	27.3 mm	27.3 mm	4.6 mm	1.00	14.5 mm	1.88	14%	8.2 mm	0.57	6.5 mm	2.6 mm	131°	115°	16°	0.65	Wildhorse Canyon, Mineral Mountains, UT	Rosegate	Rosegate	blade edges worn	
Paragonah Mounds, Iron County, UT (42In43), n=22																					
5558	In43	22.2 mm	22.2 mm	N/A	1.00	12.8 mm	1.73	0%	12.8 mm	1.00	N/A	4.2 mm	N/A	N/A	N/A	0.70	Black Mountain, UT	Cottonwood triangular	out-of-key	blade edges worn	most similar in appearance to a thick Cottonwood triangular
5546	In43	26.3 mm	26.3 mm	N/A	1.00	19.2 mm	1.37	0%	19.2 mm	1.00	N/A	5.0 mm	N/A	N/A	N/A	1.50	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood triangular	out-of-key	blade edges heavily worn	most similar in appearance to a thick Cottonwood triangular
AR 987	In43	33.3 mm	33.3 mm	4.7 mm	1.00	12.9 mm	2.58	20%	10.5 mm	0.81	6.0 mm	3.3 mm	160°	151°	9°	1.05	Black Rock area, UT	Desert side notched	Desert side notched	slight wear on blade edges	looks like side notched Rosegate
5553	In43	27.7 mm	27.7 mm	3.6 mm	1.00	15.3 mm	1.81	17%	6.0 mm	0.39	7.6 mm	3.7 mm	109°	73°	34°	1.05	Black Mountain, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn, distal end reworked	looks like contracting stem Eastgate - Parowan basal notched
5545	In43	31.8 mm	31.8 mm	3.8 mm	1.00	18.0 mm	1.77	19%	6.7 mm	0.37	7.4 mm	3.4 mm	128°	72°	56°	1.10	Black Mountain, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end of blade reworked, blade edges worn	looks like contracting stem Eastgate - Parowan basal notched, traces of pitch on edges of notches (30x magnification)
5562	In43	30.3 mm	30.0 mm	1.1 mm	0.99	16.3 mm	1.86	0%	5.4 mm	0.33	8.0 mm	4.0 mm	112°	53°	59°	1.50	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
5566	In43	35.3 mm	35.3 mm	1.6 mm	1.00	13.3 mm	2.65	16%	6.5 mm	0.49	6.6 mm	3.4 mm	168°	86°	82°	1.25	Panaca Summit (Modena area), NV/UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
5548	In43	31.5 mm	30.9 mm	0.7 mm	0.98	15.6 mm	1.02	6%	5.7 mm	0.37	6.3 mm	3.4 mm	132°	58°	74°	1.35	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges heavily worn & reworked	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
5551	In43	27.6 mm	27.6 mm	1.7 mm	1.00	15.5 mm	1.78	5%	6.3 mm	0.41	7.8 mm	3.7 mm	146°	55°	91°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	slight wear on blade edges	looks like contracting stem Eastgate - Parowan basal notched
5541	In43	29.3 mm	29.0 mm	1.7 mm	0.99	17.3 mm	1.69	9%	5.9 mm	0.34	6.3 mm	3.9 mm	138°	84°	54°	1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn, especially at tip	looks like contracting stem Eastgate - Parowan basal notched
5555	In43	29.5 mm	29.5 mm	2.9 mm	1.00	14.1 mm	2.09	18%	3.4 mm	0.24	5.2 mm	4.2 mm	113°	66°	48°	1.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn at distal end	looks like contracting stem Eastgate - Parowan basal notched, pitch on edges of notches (30x magnification)
5542	In43	25.5 mm	25.5 mm	2.4 mm	1.00	18.7 mm	1.36	9%	6.2 mm	0.33	7.3 mm	3.6 mm	150°	68°	82°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	blade edges worn at distal end	looks like contracting stem Eastgate - Parowan basal notched, traces of pitch on edges of notches (30x magnification)
5556	In43	28.6 mm	28.6 mm	2.6 mm	1.00	13.9 mm	2.06	23%	4.4 mm	0.32	5.6 mm	3.3 mm	122°	82°	40°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
5550	In43	28.7 mm	28.7 mm	2.3 mm	1.00	13.8 mm	2.08	12%	4.1 mm	0.30	5.2 mm	4.0 mm	155°	81°	74°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges heavily worn, distal end reworked	looks like contracting stem Eastgate - Parowan basal notched, mahogany obsidian
5536	In43	32.4 mm	32.4 mm	2.5 mm	1.00	19.3 mm	1.68	9%	8.1 mm	0.42	8.6 mm	2.5 mm	158°	67°	74°	1.05	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges slightly worn	looks like contracting stem Eastgate - Parowan basal notched, minimal pressure-flaking toward base
5565	In43	24.6 mm	24.6 mm	4.0 mm	1.00	21.8 mm	1.13	12%	7.7 mm	0.35	8.2 mm	4.2 mm	135°	71°	64°	1.20	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end of blade heavily damaged, edges worn	looks like contracting stem Eastgate - Parowan basal notched
5543	In43	≈25.5 mm	≈25.5 mm	2.0 mm	1.00	16.6 mm	≈1.54	≈2%	6.2 mm	0.37	6.9 mm	4.6 mm	143°	78°	65°	1.15	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	small chip on tip, blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
5561	In43	≈22.7 mm	≈22.7 mm	1.8 mm	1.00	17.6 mm	≈1.29	≈7%	6.3 mm	0.36	7.2 mm	3.7 mm	130°	63°	77°	1.00	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	blade edges heavily worn & reworked above shoulders, small chip at tip	looks like contracting stem Eastgate - Parowan basal notched
5544	In43	>27.1 mm	>27.1 mm	2.5 mm	1.00	16.2 mm	NM	NM (LMW=3.2 mm)	5.7 mm	0.35	7.1 mm	3.9 mm	128°	63°	65°	>1.30	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	tip snapped, blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
5547	In43	>27.4 mm	>27.4 mm	4.9 mm	1.00	19.3 mm	NM	NM (LMW=5.5 mm)	8.4 mm	0.44	8.5 mm	3.3 mm	136°	88°	48°	>1.25	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	*?Gatecliff contracting stem?*	distal end snapped, blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
5518	In43	>19.1 mm	>19.1 mm	2.0 mm	1.00	19.6 mm	NM	NM (LMW=0.2 mm)	5.0 mm	0.26	7.4 mm	3.8 mm	121°	65°	56°	>0.85	Wildhorse Canyon, Mineral Mountains, UT	Parowan basal notched	out-of-key	distal end snapped, blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
AR 986	In43	42.3 mm	42.3 mm	6.7 mm	1.00	21.8 mm	1.94	21%	6.9 mm	0.32	11.2 mm	5.5 mm	139°	84°	63°	3.80	Panaca Summit (Modena area), NV/UT	Gatecliff contracting stem	Gatecliff contracting stem	one blade edge & tip heavily worn	barbed on both blade edges
Marysvale 3 & 7, Piute County, UT (42Pi1 & 42Pi2), n=8																					
AR 4020	Pi1	32.0 mm	32.0 mm	N/A	1.00	13.5 mm	2.37	21%	12.7 mm	0.94	N/A	4.5 mm	N/A	N/A	N/A	1.40	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood leaf shaped	out-of-key	blade edges worn	most similar in appearance to a thick Cottonwood leaf shaped
20172-4	Pi2	31.6 mm	31.6 mm	N/A	1.00	16.8 mm	1.88	0%	16.8 mm	1.00	N/A	5.3 mm	N/A	N/A	N/A	2.10	Wildhorse Canyon, Mineral Mountains, UT	Cottonwood triangular	out-of-key	distal blade edges heavily worn	looks like thick Cottonwood triangular
AR 4014	Pi1	26.1 mm	26.1 mm	7.4 mm	1.00	13.1 mm	1.99	0%	13.1 mm	1.00	4.7 mm	3.3 mm	185°	167°	18°	0.85	Black Rock area, UT	Desert side notched	Desert side notched	blade edges slightly worn	mahogany obsidian, looks most like Bear River side notched
AR 4015	Pi1	19.8 mm	19.5 mm	5.9 mm	0.98	>11.7 mm	NM	0%	>11.7 mm	1.00	8.1 mm	3.5 mm	236°	172°	64°	>0.60	Topaz Mountain, UT	Desert side notched	Desert side notched	one base tang snapped, distal blade edges heavily worn	unknown sub-type - relatively narrow, slightly convex base, wide neck, narrow blade
20172-6	Pi2	22.1 mm	22.1 mm	4.2 mm	1.00	12.5 mm	1.77	0%	12.5 mm	1.00	10.2 mm	3.6 mm	230°	151°	79°	0.95	Black Rock area, UT	Desert side notched	Desert side notched	bottom edge of base snapped	Desert type
20172-9	Pi2	>18.5 mm	>18.5 mm	7.2 mm	1.00	13.5 mm	NM	0%	13.5 mm	1.00	7.0 mm	3.0 mm	217°	153°	64°	>0.55	Wildhorse Canyon, Mineral Mountains, UT	Desert side notched	Desert side notched	tip snapped, blade edges worn	most closely resembles Bear River side notch
AR 4023	Pi1	26.5 mm	26.5 mm	3.0 mm	1.00	16.4 mm	1.62	15%	6.1 mm	0.37	7.4 mm	4.4 mm	147°	73°	74°	1.25	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edges worn	looks like contracting stem Eastgate - Parowan basal notched
AR 4021	Pi1	41.1 mm	41.1 mm	4.2 mm	1.00	16.1 mm	2.55	18%	7.4 mm	0.46	7.6 mm	6.0 mm	212°	89°	119°	2.55	Black Rock area, UT	Parowan basal notched	*?Gatecliff contracting stem?*	blade edge heavily worn, especially at tip	looks like parallel stem Rose Spring - Parowan basal notched
State of Utah, School and Institutional Trust Lands Administration, Escalante Valley, Washington County, UT (42Ws2613 and 2615), n=6																					
FS-128 98.26	42WS2613	16.8 mm	13.0 mm		0.77	>9.0 mm	NM	0%	>9.0 mm	1.00	>5.6 mm	2.4 mm	262°	157°	85	>0.20	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	snapped in half vertically	relative symmetry assumed for MWP and WB/WM
FS-7 98.26	42Ws2615	>15.0 mm	>11.7 mm		0.78	>11.0 mm	NM	0%	>11.0 mm	1.00	6.2 mm	2.2 mm	240°	162°	78°	>0.35	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	tip snapped, one base tang snapped at notching, tip of remaining tang snapped	relative symmetry assumed for MWP and WB/WM
FS-35 98.26	42Ws2615	>23 mm	>18.7 mm		0.81	14.1 mm	NM	0%	14.1 mm	1.00	7.9 mm	3.9 mm	199°	163°	36°	>0.95	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	tip snapped, one shoulder reworked	
FS-115 98.26	42Ws2615	>9.7 mm	>5.8 mm		0.61	13.4 mm	NM	0%	13.4 mm	1.00	9.2 mm	2.8 mm	205°	153°	51°	>0.30	Panaca Summit (Modena area), NV/UT	Desert side notched	Desert side notched	distal end snapped horizontally above notching	base only
FS-9 98.26	42Ws2615	>17.0 mm	>15.4 mm	N/A	0.91	13.9 mm	NM	0%	13.9 mm	1.00	N/A	2.7 mm	N/A	N/A	N/A	>0.55	Panaca Summit (Modena area), NV/UT	Cottonwood triangular	Cottonwood triangular	tip snapped, tips of base chipped	
FS-6 98.26	42Ws2615	>19.8 mm	>17.6 mm	N/A	N/A	>19.0 mm	N/A	N/A	N/A	N/A	9.3 mm	3.1 mm	N/A	N/A	N/A	>0.90	Panaca Summit (Modena area), NV/UT	drill	N/A	borer snapped toward tip, both "finger tabs" snapped, one reworked	

NTTR EARLY POINT TYPES

Pinto



Great Basin Stemmed

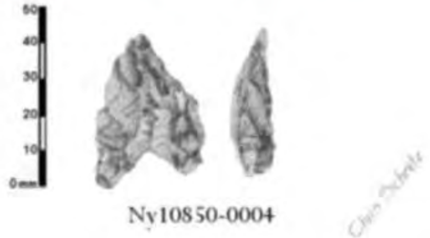


Large basal notched

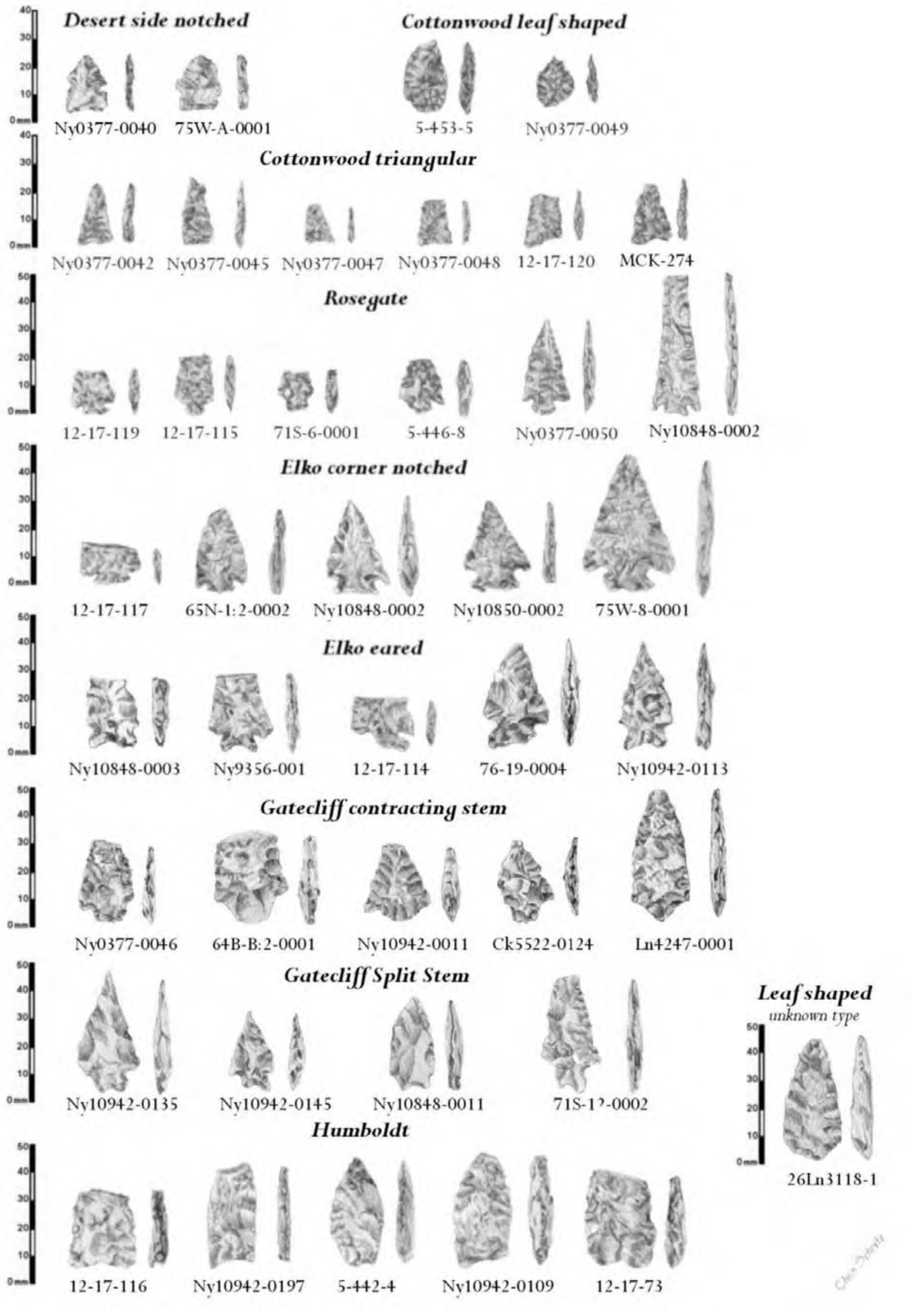
unknown type

Shoulderless concave base

unknown type



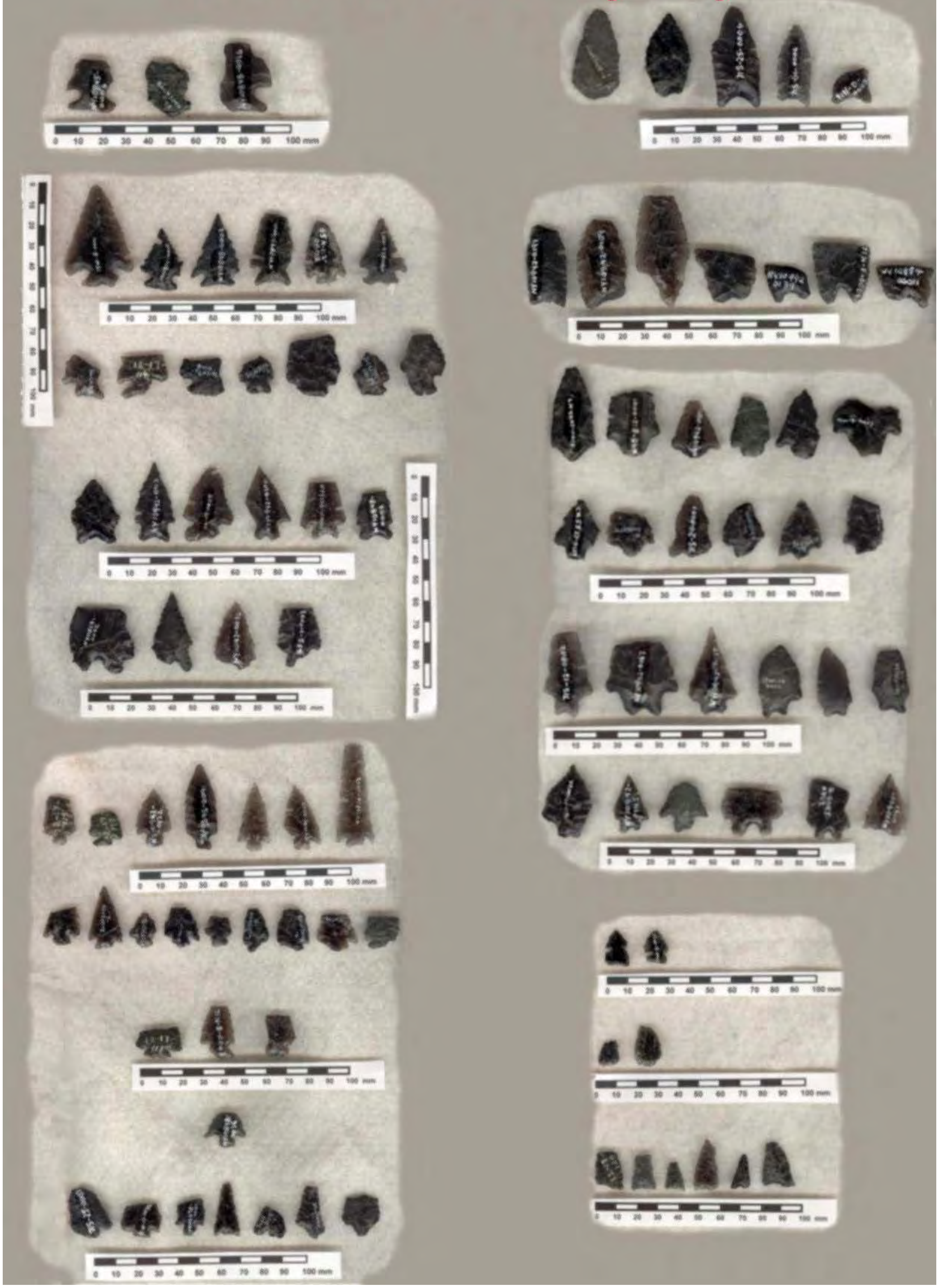
NTTR LATER POINT TYPES



STUDY AREA
POINT COLLECTIONS


Nevada Test & Training Range

Nevada Test & Training Range



Nevada State Museum, Carson City

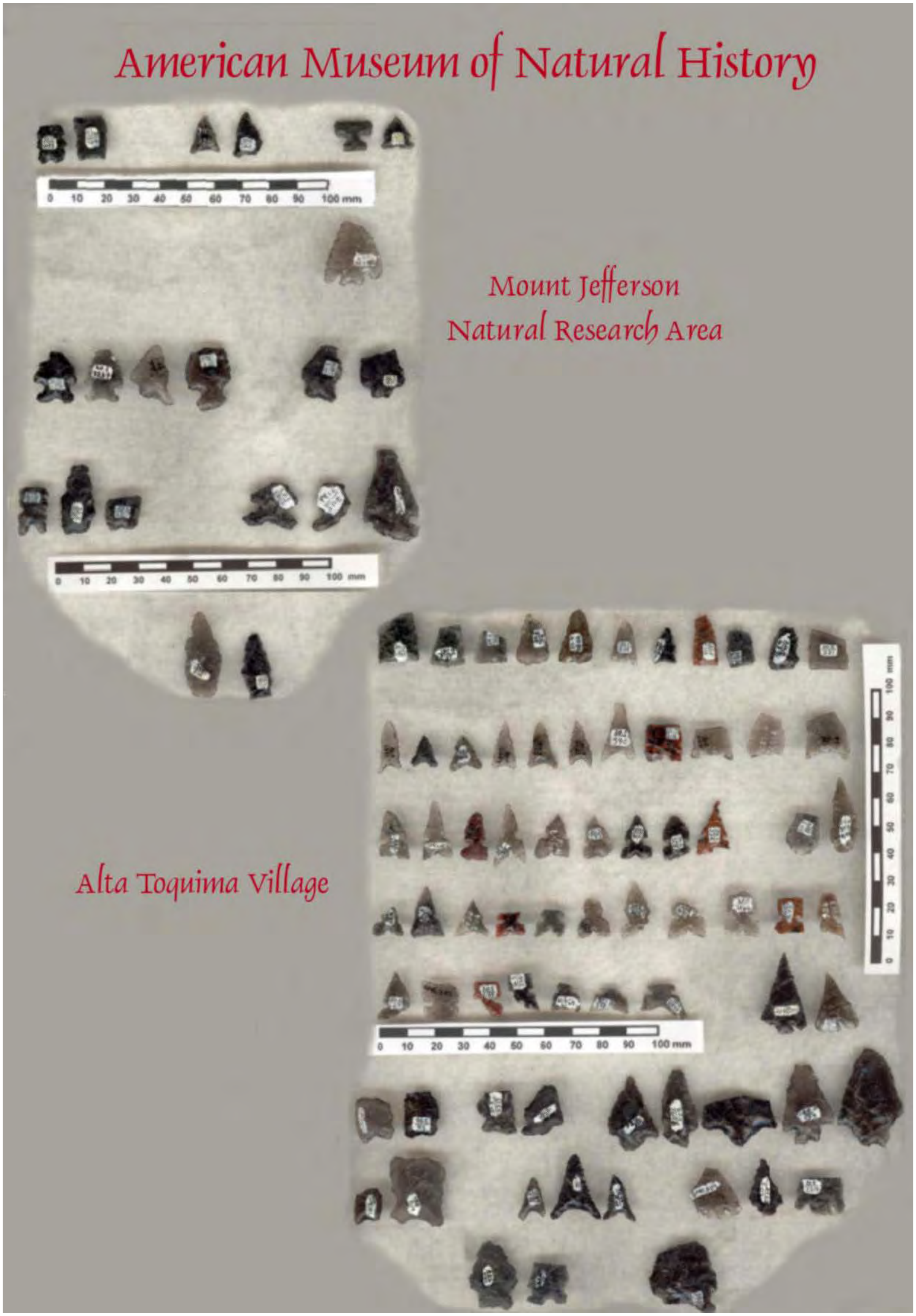
Mud Lake

Tippipah Spring

NORTH OF STUDY AREA
POINT COLLECTIONS

Joshua Tree National Park

Big Smoky Valley


American Museum of Natural History
Mount Jefferson Natural Research Area
Alta Toquima Village
0 10 20 30 40 50 60 70 80 90 100 mm
0 10 20 30 40 50 60 70 80 90 100 mm
0 10 20 30 40 50 60 70 80 90 100 mm
0 10 20 30 40 50 60 70 80 90 100 mm

C28

WEST OF STUDY AREA
POINT COLLECTIONS


Joshua Tree National Park
Owens Valley
0 10 20 30 40 50 60 70 80 90 100 mm

Death Valley National Park

Grapevine Mountains

Mesquite Flat

Furnace Creek fan

Eagle Borax mine

University of California, Davis

Deep Springs Valley

SOUTH OF STUDY AREA
POINT COLLECTIONS


Joshua Tree National Park
Mesquite Spring
Paradise River Valley
Crucero
Hinkley
Mesquite Valley
Saratoga Spring
Newberry Spring
Tule Spring
Surprise Spring
Joshua Tree National Park
Chiriaco Summit

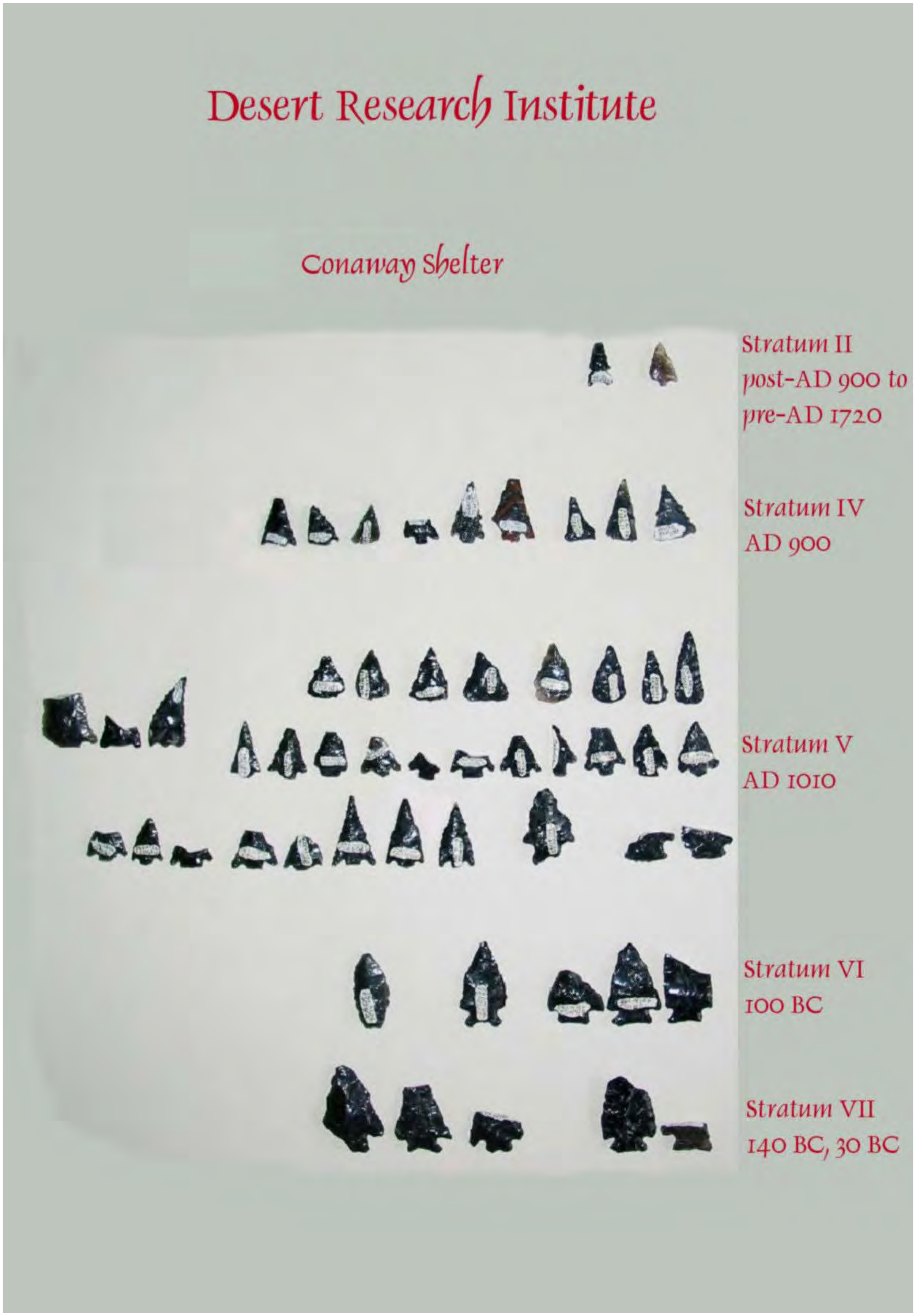
Death Valley National Park

Ash Meadows

Panamint Range

C36

EAST OF STUDY AREA
POINT COLLECTIONS


Desert Research Institute
Conaway Shelter
Stratum II
post-AD 900 to
pre-AD 1720
Stratum IV
AD 900
Stratum V
AD 1010
Stratum VI
100 BC
Stratum VII
140 BC, 30 BC

Desert Research Institute

O'Malley Shelter

Cultural Unit VII
surface, 40 cm in depth
Historic period

Cultural Unit VI
Strata 19-21
post-AD 1080 to
Historic period

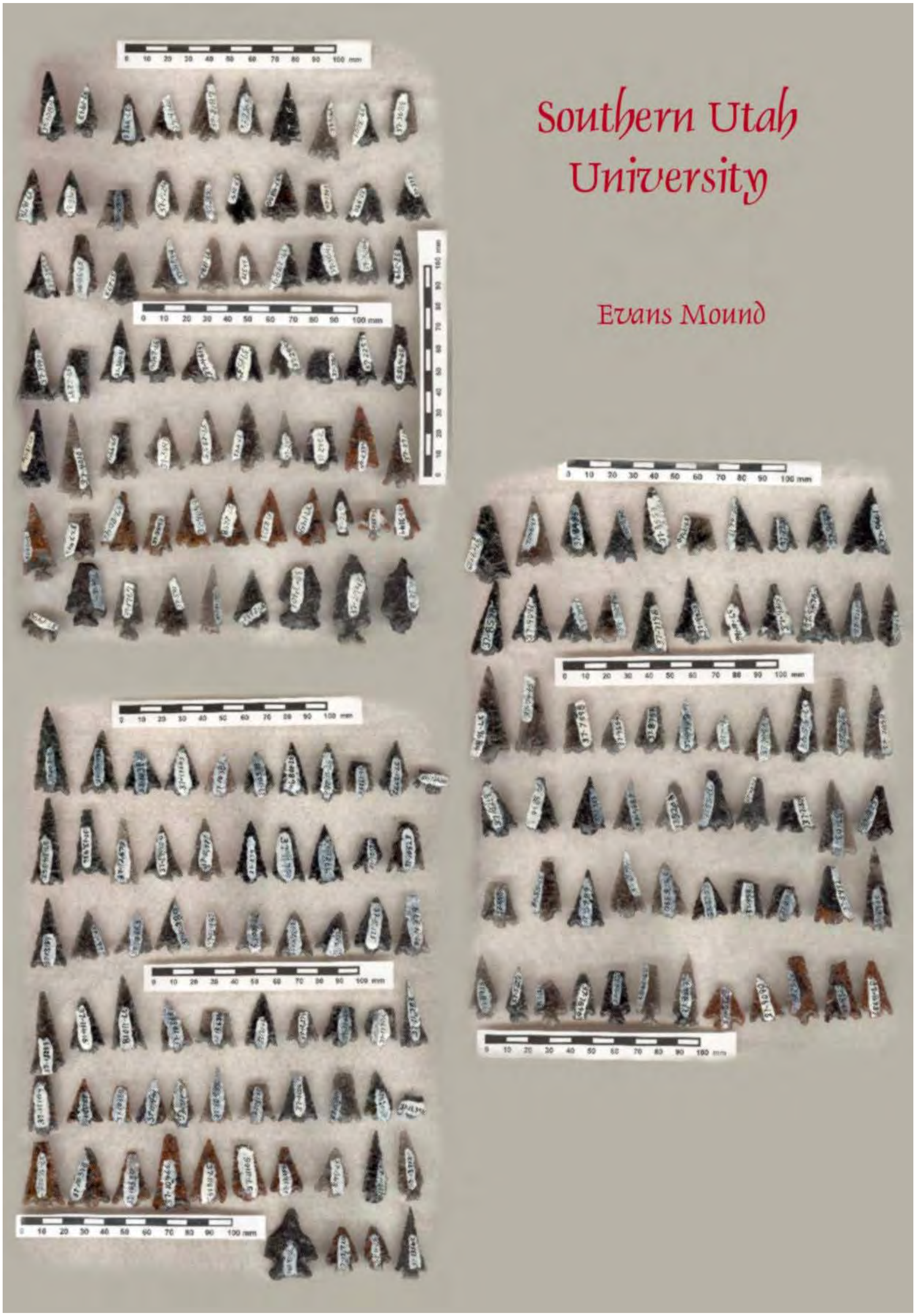
Cultural Unit V
Strata 15-18
AD 1060, AD 1080

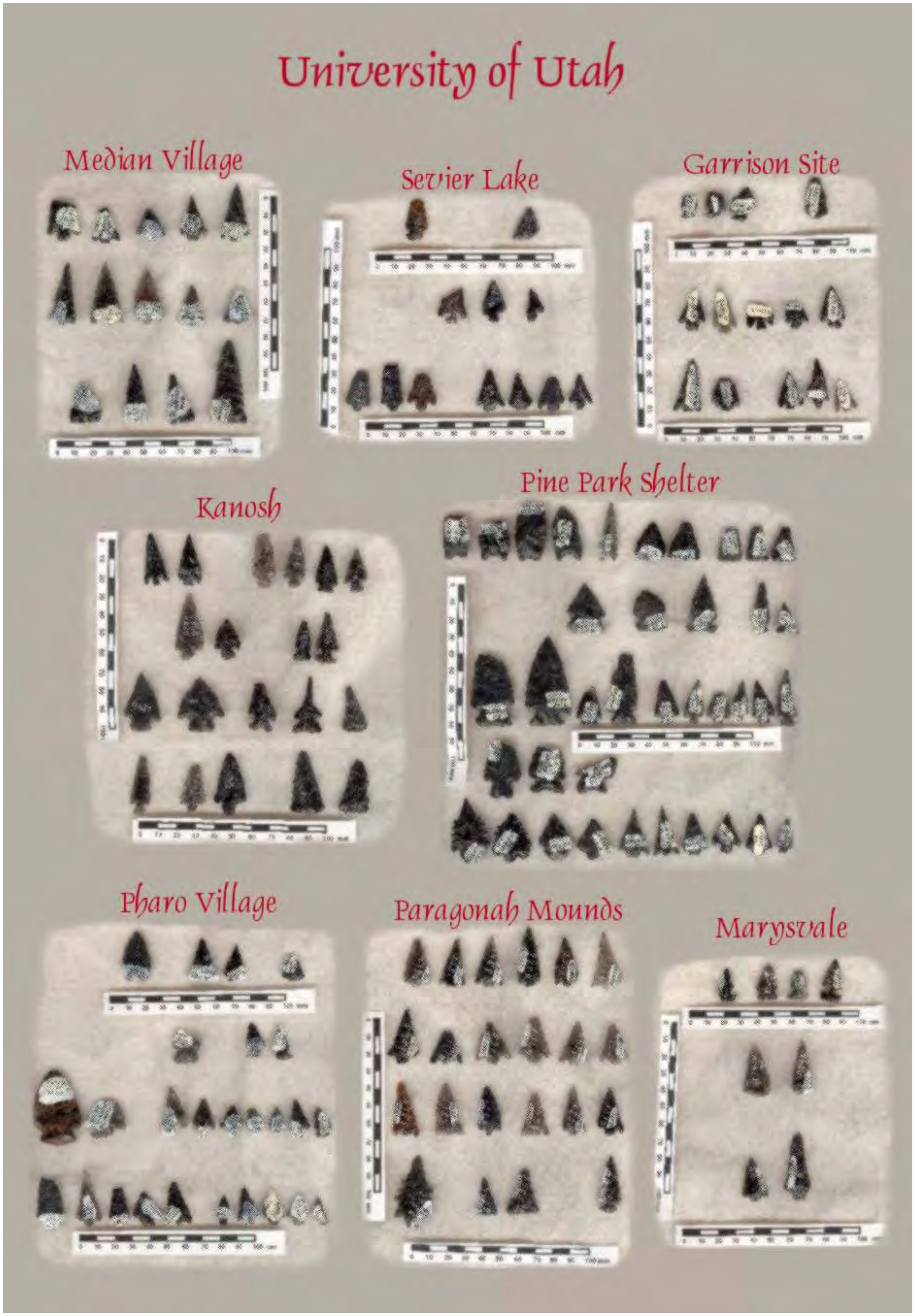
Cultural Unit IV
Strata 12-14
AD 1020

Cultural Unit III
Strata 7-11
1790 BC

Cultural Unit II
Strata 3-6
2680 BC, 1990 BC,
1970 BC

Cultural Unit I
Strata 1-2
5150, BC, 4570 BC


Southern Utah University
Evans Mound
0 10 20 30 40 50 60 70 80 90 100 mm


University of Utah
Median Village
Sevier Lake
Garrison Site
Kanosh
Pine Park Shelter
Pharo Village
Paragonah Mounds
Marysvale

APPENDIX D: Results of X-Ray Fluorescence Trace Element Analysis of Project Obsidian Artifacts

Craig E. Skinner

Appendix D: Results of X-Ray Fluorescence Trace Element Analysis of Project Obsidian Artifacts

Craig E. Skinner
Northwest Research Obsidian Studies Laboratory

Introduction

In this appendix, we present the results of the X-ray fluorescence (XRF) trace element provenance analysis of 2,015 artifacts that were characterized as part of this project. The rationale and research objectives guiding the selection of the artifacts are discussed elsewhere in this report. Forty-six individual geochemical obsidian sources situated in five different states (see figures D-1 and D-2) were identified during the course of the characterization studies of the artifacts. At the close of the project, the obsidian source identities of 143 of the specimens remains unknown. The trace element composition of 19 artifacts indicated that they were not obsidian.

All artifacts were analyzed by Richard E. Hughes, Geochemical Research Laboratory, Portola Valley, California. The details of the analytical method and XRF instrumentation used to determine the trace element composition of the specimens are the same as those described by Hughes in another section of this report.

Hughes' analytical results were delivered as a series of separate data tables bearing the following dates and titles:

- March 15, 2002 – *Wildhorse Spring (Nellis AFB) XRF Data*
- March 19, 2002 – *Jerome Spring (Nellis AFB) XRF Data*
- April 12, 2002 – *Various Sites (Nellis AFB) XRF Data*
- April 16, 2002 – *26Ny3393 XRF Data*
- September 18, 2002 – *Projectile Points I XRF Data*
- March 20, 2003 – *CA-Iny-441 Projectile Points XRF Data*
- May 6, 2003 – *Nellis Projectile Points XRF Data*
- July 10, 2003 – *CA-Iny-444 Debitage XRF Data*
- October 31, 2003 – *Joshua Tree National Park (Campbell Collection) XRF Data*
- November 4, 2003 – *Death Valley National Park XRF Data*
- November 4, 2004 – *Escalante Valley Sites XRF Data*
- November 26, 2003 – *Nevada State Museum XRF Data*
- December 23, 2003 – *Desert Research Institute XRF Data*
- January 6, 2004 – *Evans Mound (42In40) XRF Data*
- January 12, 2004 – *Nellis AFB XRF Data*
- January 16, 2004 – *University of Utah Collections XRF Data*
- February 10, 2004 – *American Museum of Natural History Collections XRF Data*
- February 17, 2004 – *Deep Springs Valley, CA XRF Data*

At the close of the artifact characterization phase of the project, all trace element data were transferred to a spreadsheet and all obsidian source names were standardized against a finalized list of names. Concurrent trace element investigations of obsidian sources in the Nellis Air Force Base region (many of which were very incompletely known at the inception of the project) had led to the evolution of an often confusing array of new or evolving source names. This final step was necessary so that all nomenclature would be consistent for analytical work done throughout the extended period of trace element studies that were carried out during the project. Further descriptive information about the specific obsidian sources that were identified may be found elsewhere in the project reports and at *www.sourcecatalog.com* (Northwest Research Obsidian Studies Laboratory 2004).

The obsidian source universe against which the artifacts were compared for the assignment of source names had expanded considerably during the multi-year period of artifact trace element analyses. To ensure that all obsidian source assignments were current, the sources of unknown artifacts that were identified during the different stages of the analytical work were reexamined and compared to any new source trace element data that were available at the conclusion of the artifact and source studies. Unknown geochemical obsidian sources for the entire project were also scrutinized at this point and placed into consistent alphanumeric categories. Unknown obsidian source clusters containing three or more artifacts were designated by an alphabetical suffix (Unknown Type A through Unknown Type G). Minor geochemical source groupings containing one or two artifacts were distinguished by a numeric suffix (Unknown 1 through Unknown 16). The trace element range of one of the unknown source groups, Unknown Type G (Gatecliff Group 1) resembled the composition of characterized obsidian artifacts from Gatecliff Shelter reported by Hughes in Thomas (1983: 392–408).

The final artifact trace element results that immediately follow this introduction are organized as four individual tables. Each table presents the results for artifacts that originated from archaeological sites located in one of four different major areas of the Great Basin: the *Central Basin* (Table D-1; N=588), the *Eastern Basin* (Table D-2; N=733), the *Western Basin* (Table D-3; N=582), and the *Southern Basin* (Table D-4; N=112).

References Cited

Northwest Research Obsidian Studies Laboratory
2004 U. S. Obsidian Source Catalog Website (www.sourcecatalog.com).

Thomas, D. H.
1983 The Archaeology of Monitor Valley: 2. Gatecliff Shelter. *Anthropological Papers of the American Museum of Natural History* 59.

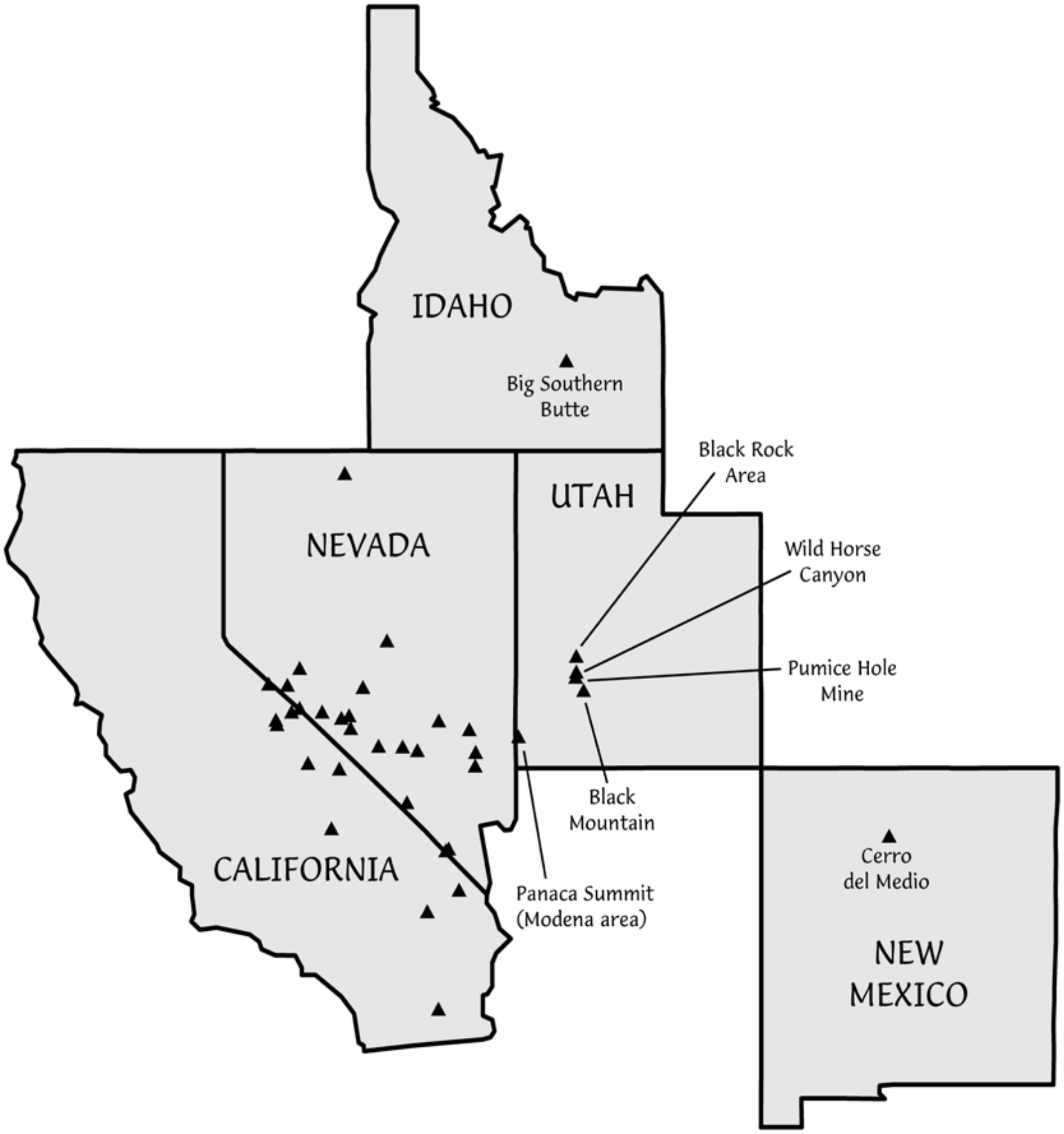


Figure D-1. Geographic distribution of the many obsidian sources that were identified during the trace element analysis of the artifacts. See Figure D-2 for a more detailed view of Nevada and California sources.

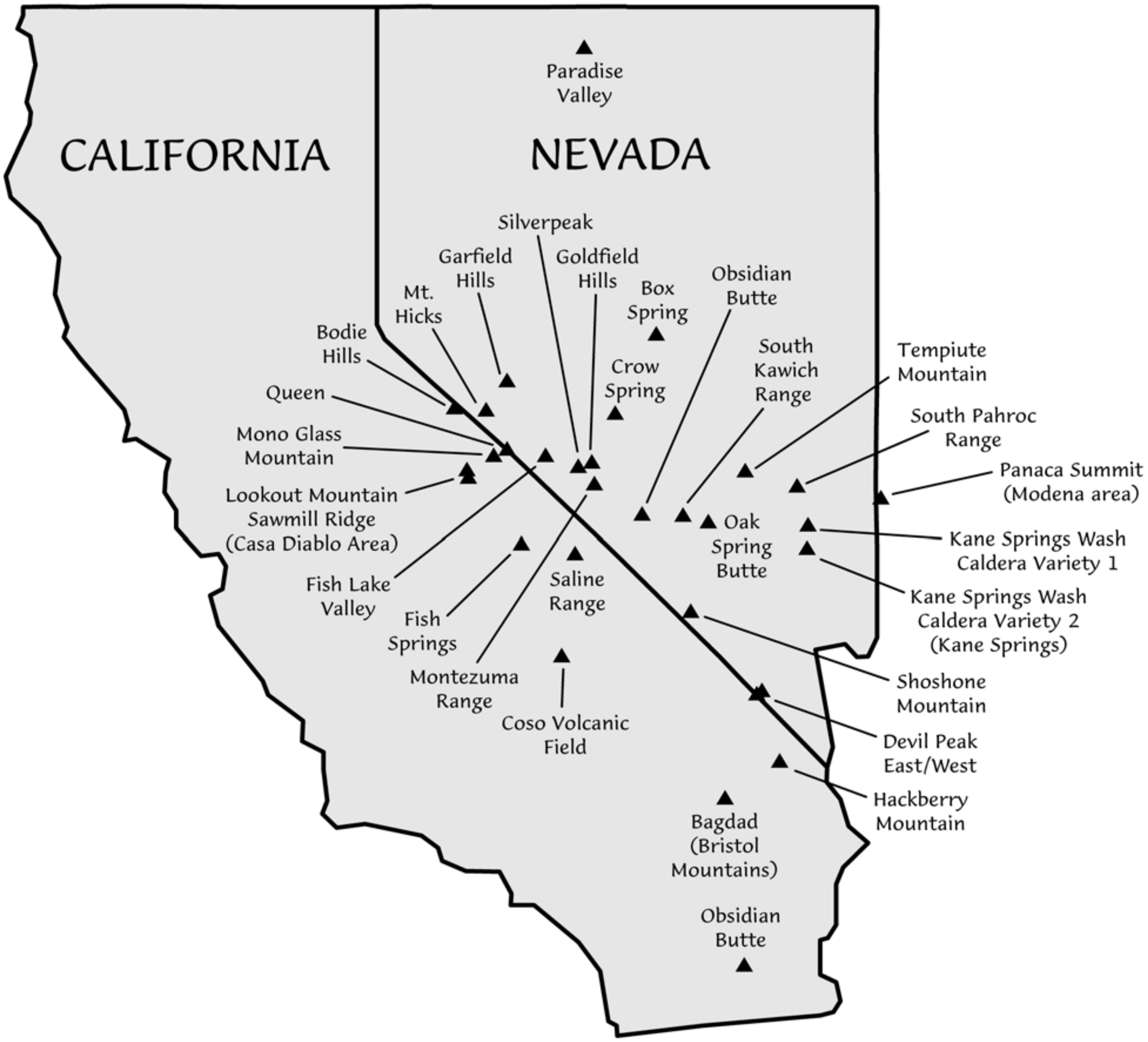


Figure D-2. Locations of the project obsidian sources in Nevada and California.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Wildhorse Spring (26NY1446)	WHS-1	262	5	44	215	61	NM	NM	NM	NM	15	Goldfield Hills, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-2	306	6	41	97	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-3	299	5	39	95	33	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-4	305	5	41	94	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-5	290	5	38	95	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-6	305	6	42	99	35	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-7	327	6	42	99	35	NM	NM	NM	NM	13	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-8	332	8	42	102	36	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-9	321	7	56	98	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-10	318	5	42	100	31	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-11	302	5	41	91	37	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-12	315	5	45	96	38	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-13	147	112	17	156	19	NM	NM	746	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Wildhorse Spring (26NY1446)	WHS-14	331	4	46	97	32	NM	NM	NM	NM	13	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-15	312	6	40	94	30	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-16	308	8	42	95	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-17	138	51	15	97	19	583	356	191	0.81	22	Unknown Type F
		± 4	3	3	4	3	17	11	13	0.10		
Wildhorse Spring (26NY1446)	WHS-18	335	4	42	97	31	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	4	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-19	320	4	53	101	36	NM	NM	NM	NM	14	Montezuma Range, NV
		± 6	4	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-20	316	7	37	95	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	4	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Wildhorse Spring (26NY1446)	WHS-21	310	6	42	95	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 6	3	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-24	302	6	40	94	36	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-25	265	7	44	207	60	NM	NM	NM	NM	15	Goldfield Hills, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-26	320	4	42	97	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-27	294	6	39	95	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-28	276	5	47	213	55	NM	NM	NM	NM	15	Goldfield Hills, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-29	293	5	37	93	31	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-30	299	8	39	90	31	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-31	158	100	25	159	23	811	386	643	1.21	30	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	20	11	14	0.10		(Obsidian Butte)
Wildhorse Spring (26NY1446)	WHS-32	333	6	43	107	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-33	314	7	43	94	36	NM	NM	NM	NM	13	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-34	308	6	41	94	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	4	4	3	NM	NM	NM	NM		
Wildhorse Spring (26NY1446)	WHS-35	175	56	24	123	21	NM	NM	297	NM	27	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	NM	NM		(Airfield Canyon)
Wildhorse Spring (26NY1446)	WHS-36	158	55	25	124	19	NM	NM	283	NM	26	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	12	NM		(Airfield Canyon)
Wildhorse Spring (26NY1446)	WHS-37	165	59	24	131	22	NM	NM	300	NM	27	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	13	NM		(Airfield Canyon)
Wildhorse Spring (26NY1446)	WHS-38	164	19	25	140	29	NM	NM	29	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	12	NM		(Queen Impostor), CA
Wildhorse Spring (26NY1446)	WHS-39	156	111	22	170	24	NM	NM	675	NM	29	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Jerome Spring (26NY11470)	JerSpr-1	141	120	17	162	15	NM	NM	741	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-2	139	121	17	157	15	NM	NM	725	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-3	167	86	24	151	21	NM	NM	540	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Jerome Spring (26NY11470)	JerSpr-4	136	121	16	159	14	NM	NM	771	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-5	145	124	17	163	17	NM	NM	781	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-6	168	58	23	124	22	NM	NM	279	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-7	185	83	24	215	21	NM	NM	663	NM	40	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-8	128	111	15	149	14	NM	NM	749	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-9	164	85	22	138	20	NM	NM	470	NM	28	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-10	164	80	21	137	16	NM	NM	474	NM	30	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-11	132	118	16	153	15	NM	NM	759	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-12	137	128	18	162	14	NM	NM	708	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-13	170	61	22	126	22	NM	NM	309	NM	26	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-14	137	120	17	160	14	NM	NM	684	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-15	136	119	17	161	17	NM	NM	777	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-16	131	116	15	152	16	NM	NM	759	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-17	143	124	17	161	17	NM	NM	768	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	14	NM		
Jerome Spring (26NY11470)	JerSpr-18	139	122	17	157	16	NM	NM	792	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-19	126	109	16	145	14	NM	NM	749	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-20	147	129	18	162	17	NM	NM	784	NM	30	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-21	144	125	17	149	16	NM	NM	759	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	16	NM		
Jerome Spring (26NY11470)	JerSpr-22	134	117	18	151	17	NM	NM	781	NM	30	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Jerome Spring (26NY11470)	JerSpr-23	303	5	41	99	34	NM	NM	0	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Jerome Spring (26NY11470)	JerSpr-24	141	124	16	161	18	NM	NM	832	NM	27	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-25	145	124	16	159	15	NM	NM	763	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-26	140	118	15	157	19	NM	NM	725	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-27	155	21	23	132	28	705	546	9	1.02	18	Saline Range, Variety 1
		± 4	3	3	4	3	17	11	12	0.10		(Queen Impostor), CA
Jerome Spring (26NY11470)	JerSpr-28	153	17	27	167	26	683	590	47	1.25	20	Obsidian Butte, NV, Variety 1
		± 4	3	3	4	3	16	11	12	0.10		
Jerome Spring (26NY11470)	JerSpr-29	137	124	16	163	17	NM	NM	765	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-30	149	131	17	171	15	NM	NM	810	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	16	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-31	137	118	17	160	15	NM	NM	726	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-32	141	125	17	163	17	NM	NM	773	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-33	155	105	19	163	18	NM	NM	630	NM	28	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Jerome Spring (26NY11470)	JerSpr-34	154	108	20	166	18	NM	NM	624	NM	30	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Jerome Spring (26NY11470)	JerSpr-35	162	103	21	166	20	NM	NM	601	NM	28	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Jerome Spring (26NY11470)	JerSpr-36	141	121	19	162	13	NM	NM	809	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-37	187	20	22	137	31	749	440	20	0.96	21	Saline Range, Variety 1
		± 4	3	3	4	3	16	11	12	0.10		(Queen Impostor), CA
Jerome Spring (26NY11470)	JerSpr-38	137	119	15	160	14	NM	NM	759	NM	31	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-39	149	128	17	165	15	NM	NM	799	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-40	151	132	19	170	15	NM	NM	767	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-41	146	128	18	167	15	NM	NM	788	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-42	149	128	18	174	18	NM	NM	809	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-43	144	127	18	167	17	NM	NM	772	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2O^{3\,T}$	Fe:Mn	Geochemical Source
Jerome Spring (26NY11470)	JerSpr-44	164	55	21	133	24	NM	NM	321	NM	NM	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	14	NM		(Airfield Canyon)
Jerome Spring (26NY11470)	JerSpr-45	155	110	23	163	21	NM	NM	625	NM	31	Obsidian Butte, NV, Variety 4
		± 5	3	3	4	3	NM	NM	17	NM		(Obsidian Butte)
Jerome Spring (26NY11470)	JerSpr-46	147	130	17	169	14	NM	NM	767	NM	31	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-47	180	62	23	130	19	NM	NM	282	NM	27	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	13	NM		(Airfield Canyon)
Jerome Spring (26NY11470)	JerSpr-48	133	112	15	152	16	NM	NM	818	NM	31	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-49	139	120	17	162	17	NM	NM	794	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-50	145	130	18	165	17	NM	NM	798	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-51	170	57	23	130	21	NM	NM	298	NM	28	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	28	NM		(Airfield Canyon)
Jerome Spring (26NY11470)	JerSpr-52	151	131	18	175	19	NM	NM	794	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	29	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-53	170	61	21	127	21	NM	NM	287	NM	27	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	27	NM		(Airfield Canyon)
Jerome Spring (26NY11470)	JerSpr-54	154	109	21	165	20	NM	NM	662	NM	32	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	32	NM		(Obsidian Butte)
Jerome Spring (26NY11470)	JerSpr-55	169	57	24	123	21	NM	NM	296	NM	26	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	26	NM		(Airfield Canyon)
Jerome Spring (26NY11470)	JerSpr-56	140	127	16	162	17	NM	NM	778	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	28	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-57	135	123	16	158	15	NM	NM	754	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	29	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-58	149	129	19	173	20	NM	NM	813	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	30	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-59	148	132	14	164	16	NM	NM	761	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	30	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-60	152	132	19	171	15	NM	NM	788	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	29	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-61	151	132	17	165	17	NM	NM	776	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	29	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-62	137	123	17	161	21	NM	NM	795	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	28	NM		(Unknown C)
Jerome Spring (26NY11470)	JerSpr-63	142	129	16	162	17	NM	NM	817	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	28	NM		(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Jerome Spring (26NY11470)	JerSpr-64	154	108	22	159	19	NM	NM	629	NM	29	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	29	NM		
Jerome Spring (26NY11470)	JerSpr-65	141	123	15	159	18	NM	NM	790	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	29	NM		
Jerome Spring (26NY11470)	JerSpr-66	165	58	22	123	20	NM	NM	300	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	27	NM		
Jerome Spring (26NY11470)	JerSpr-67	185	62	21	127	19	NM	NM	267	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	27	NM		
Jerome Spring (26NY11470)	JerSpr-68	147	128	16	166	17	NM	NM	815	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	29	NM		
Jerome Spring (26NY11470)	JerSpr-69	146	129	17	167	13	NM	NM	818	NM	30	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	30	NM		
Jerome Spring (26NY11470)	JerSpr-70	177	59	22	122	22	NM	NM	269	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	27	NM		
Jerome Spring (26NY11470)	JerSpr-71	170	88	23	145	17	NM	NM	563	NM	31	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 5	3	3	4	3	NM	NM	31	NM		
Jerome Spring (26NY11470)	JerSpr-72	148	130	17	164	13	NM	NM	812	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	29	NM		
Jerome Spring (26NY11470)	JerSpr-73	138	120	18	159	17	NM	NM	805	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	28	NM		
Jerome Spring (26NY11470)	JerSpr-74	147	125	17	158	19	NM	NM	806	NM	30	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	30	NM		
Sumner Spring (26NY1440/1413)	SumSpr-1	158	129	18	171	16	NM	NM	795	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	15	NM		
Sumner Spring (26NY1440/1413)	SumSpr-2	187	121	28	162	19	NM	NM	550	NM	25	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
Sumner Spring (26NY1440/1413)	SumSpr-3	189	125	29	160	26	NM	NM	633	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
Sumner Spring (26NY1440/1413)	SumSpr-4	156	123	20	166	18	NM	NM	767	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	14	NM		
Sumner Spring (26NY1440/1413)	SumSpr-5	158	123	20	174	14	NM	NM	792	NM	30	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	15	NM		
Sumner Spring (26NY1440/1413)	SumSpr-7	146	118	16	156	15	NM	NM	702	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
Sumner Spring (26NY1440/1413)	SumSpr-8	193	125	29	165	24	NM	NM	583	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
Sumner Spring (26NY1440/1413)	SumSpr-9	325	6	40	102	32	NM	NM	11	NM	13	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	12	NM		
Sumner Spring (26NY1440/1413)	SumSpr-10	184	7	85	977	60	1533	1422	0	4.06	NM	Oak Spring Butte, NV
		± 4	3	4	7	3	27	14	25	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Sumner Spring (26NY1440/1413)	SumSpr-12	150	120	19	158	15	NM	NM	799	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Sumner Spring (26NY1440/1413)	SumSpr-13	199	122	30	160	25	NM	NM	567	NM	26	Tempiute Mountain, NV
		± 5	3	3	4	3	NM	NM	15	NM		
Sumner Spring (26NY1440/1413)	SumSpr-14	179	7	90	951	68	1397	1404	0	4.05	26	Oak Spring Butte, NV
		± 4	3	4	7	3	24	13	12	0.10		
Sumner Spring (26NY1440/1413)	SumSpr-15	153	97	20	148	17	NM	NM	617	NM	30	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Sumner Spring (26NY1440/1413)	SumSpr-16	148	111	16	148	17	NM	NM	769	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Sumner Spring (26NY1440/1413)	SumSpr-17	148	120	20	156	17	NM	NM	812	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	17	NM		(Unknown C)
Sumner Spring (26NY1440/1413)	SumSpr-18	146	113	17	154	18	NM	NM	817	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Sumner Spring (26NY1440/1413)	SumSpr-19	157	121	18	159	16	NM	NM	838	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Breen Creek	BrnCrk-1	151	117	17	156	19	NM	NM	798	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Breen Creek	BrnCrk-2	141	109	18	149	17	NM	NM	752	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Breen Creek	BrnCrk-3	169	54	23	117	23	NM	NM	321	NM	26	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	14	NM		(Airfield Canyon)
Breen Creek	BrnCrk-4	168	84	21	144	21	NM	NM	491	NM	29	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Breen Creek	BrnCrk-5	176	4	64	698	50	994	938	0	2.68	27	South Kawich Range, NV
		± 4	3	3	5	3	NM	NM	15	NM		
Breen Creek	BrnCrk-6	161	80	21	138	20	NM	NM	454	NM	31	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Breen Creek	BrnCrk-8	150	116	15	151	14	NM	NM	766	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Breen Creek	BrnCrk-9	305	6	42	94	33	NM	NM	0	NM	15	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	15	NM		
Breen Creek	BrnCrk-10	142	110	14	143	15	NM	NM	769	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Breen Creek	BrnCrk-11	154	124	19	158	16	NM	NM	796	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Breen Creek	BrnCrk-12	167	83	21	139	23	NM	NM	492	NM	29	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Breen Creek	BrnCrk-13	148	120	17	161	13	NM	NM	817	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Breen Creek	BrnCrk-14		301	6	39	106	32	NM	NM	0	NM	14	Montezuma Range, NV
		±	5	3	3	4	3	NM	NM	15	NM		
Breen Creek	BrnCrk-15		154	102	20	151	20	NM	NM	663	NM	31	Obsidian Butte, NV, Variety 4
		±	4	3	3	4	3	NM	NM	14	NM		(Obsidian Butte)
Breen Creek	BrnCrk-16		140	108	16	146	17	NM	NM	843	NM	29	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Breen Creek	BrnCrk-17		259	5	46	215	54	NM	NM	NM	NM	15	Goldfield Hills, NV
		±	5	3	3	4	3	NM	NM	NM	NM		
Breen Creek	BrnCrk-18		326	7	40	100	40	NM	NM	NM	NM	14	Montezuma Range, NV
		±	5	3	4	4	3	NM	NM	NM	NM		
Breen Creek	BrnCrk-19		168	6	83	913	64	1394	1429	0	4.04	26	Oak Spring Butte, NV
		±	4	3	4	7	3	26	14	13	0.10		
Breen Creek	BrnCrk-20		168	88	21	142	20	NM	NM	477	NM	29	Obsidian Butte, NV, Variety 3
		±	4	3	3	4	3	NM	NM	15	NM		(Obsidian Butte)
Breen Creek	BrnCrk-21		172	7	84	918	63	1440	1413	12	4.06	27	Oak Spring Butte, NV
		±	4	3	4	7	3	26	13	12	0.10		
Breen Creek	BrnCrk-22		143	120	16	151	17	NM	NM	761	NM	28	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	16	NM		(Unknown C)
Breen Creek	BrnCrk-23		154	122	18	162	18	NM	NM	835	NM	29	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	16	NM		(Unknown C)
Breen Creek	BrnCrk-24		167	86	21	139	18	NM	NM	433	NM	28	Obsidian Butte, NV, Variety 3
		±	4	3	3	4	3	NM	NM	15	NM		(Obsidian Butte)
Breen Creek	BrnCrk-25		323	5	43	96	32	NM	NM	0	NM	14	Montezuma Range, NV
		±	5	4	4	4	3	NM	NM	19	NM		
Breen Creek	BrnCrk-26		143	114	18	144	18	NM	NM	753	NM	29	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	17	NM		(Unknown C)
Breen Creek	BrnCrk-27		173	56	23	125	23	NM	NM	294	NM	27	Obsidian Butte, NV, Variety 2
		±	4	3	3	4	3	NM	NM	13	NM		(Airfield Canyon)
Breen Creek	BrnCrk-28		205	127	26	178	22	NM	NM	564	NM	24	Tempiute Mountain, NV
		±	5	4	4	4	3	NM	NM	18	NM		
Breen Creek	BrnCrk-29		147	114	15	164	17	NM	NM	670	NM	28	Obsidian Butte, NV, Variety 4
		±	5	4	4	4	3	NM	NM	21	NM		(Obsidian Butte)
Indian Spring (26NY378/379)	IndSpr-1		192	72	23	220	21	NM	NM	589	NM	37	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	13	NM		
Indian Spring (26NY378/379)	IndSpr-2		168	6	81	986	64	1300	1439	0	4.03	27	Oak Spring Butte, NV
		±	4	3	3	6	3	23	13	15	0.10		
Indian Spring (26NY378/379)	IndSpr-3		172	5	85	1002	62	1313	1331	0	3.85	27	Oak Spring Butte, NV
		±	4	3	4	6	3	22	13	15	0.10		
Indian Spring (26NY378/379)	IndSpr-4		168	54	25	132	18	NM	NM	311	NM	26	Obsidian Butte, NV, Variety 2
		±	4	3	3	4	3	NM	NM	14	NM		(Airfield Canyon)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Bowman Site (26NY809)	26Ny809; 174		168	3	80	961	63	1434	1445	0	4.13	27	Oak Spring Butte, NV
		±	4	6	4	6	3	25	13	14	0.10		
Bowman Site (26NY809)	26Ny809; 200		185	11	36	152	32	NM	NM	8	NM	47	Unknown 2
		±	4	3	3	4	3	NM	NM	11	NM		
Bowman Site (26NY809)	26Ny809; 202		190	73	20	210	21	NM	NM	624	NM	37	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	13	NM		
Bowman Site (26NY809)	26Ny809; 824a		262	11	52	133	36	NM	NM	0	NM	40	West Sugarloaf, Coso Volcanic Field, CA
		±	5	3	4	4	3	NM	NM	15	NM		
Bowman Site (26NY809)	26Ny809; 824b		197	81	23	223	25	NM	NM	591	NM	39	Shoshone Mountain, NV
		±	5	3	4	4	3	NM	NM	19	NM		
Bowman Site (26NY809)	26Ny809; 925		217	7	45	110	37	NM	NM	12	NM	36	Sugarloaf Mountain, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	11	NM		
Bowman Site (26NY809)	26Ny809; 1082		136	59	16	98	15	NM	NM	469	NM	22	Unknown 7
		±	4	3	2	4	3	NM	NM	13	NM		
Bowman Site (26NY809)	26Ny809; 1108a		203	78	25	224	24	NM	NM	718	NM	37	Shoshone Mountain, NV
		±	5	3	3	4	3	NM	NM	15	NM		
Bowman Site (26NY809)	26Ny809; 1108b		227	7	42	118	38	NM	NM	15	NM	41	Sugarloaf Mountain, Coso Volcanic Field, CA
		±	5	3	3	4	3	NM	NM	12	NM		
Bowman Site (26NY809)	26Ny809; 1234		162	6	87	948	60	550	1490	0	4.20	26	Oak Spring Butte, NV
		±	4	3	4	6	3	NM	NM	12	NM		
Bowman Site (26NY809)	26Ny809; 1239		187	242	24	157	18	NM	NM	704	NM	17	Devil Peak West, NV
		±	4	4	3	4	3	NM	NM	15	NM		
Bowman Site (26NY809)	26Ny809; 1246		204	79	26	221	24	NM	NM	684	NM	38	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	14	NM		
Bowman Site (26NY809)	26Ny809; 1248		196	41	37	155	22	NM	NM	293	NM	45	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	12	NM		
Bowman Site (26NY809)	26Ny809; 1281		178	72	24	120	17	NM	NM	471	NM	29	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	13	NM		
Bowman Site (26NY809)	26Ny809; 1282		179	77	21	115	18	NM	NM	408	NM	28	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	13	NM		
Bowman Site (26NY809)	26Ny809; 1416		183	76	23	203	33	NM	NM	620	NM	37	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	13	NM		
Bowman Site (26NY809)	26Ny809; 1478*		174	89	23	201	20	NM	NM	602	NM	39	Shoshone Mountain, NV
		±	5	3	3	4	3	NM	NM	16	NM		
Bowman Site (26NY809)	26Ny809; 1536		182	73	25	210	23	NM	NM	667	NM	38	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	13	NM		
Bowman Site (26NY809)	26Ny809; 1606		201	79	26	225	25	NM	NM	634	NM	37	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	15	NM		
Bowman Site (26NY809)	26Ny809; 1628		190	76	24	210	27	NM	NM	692	NM	38	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	14	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Moapa Valley (26CK2041)	26Ck2041; 1184	176	17	47	161	31	NM	NM	69	NM	54	Kane Springs Wash Caldera Variety 1, NV
		± 5	3	3	4	3	NM	NM	14	NM		
Moapa Valley (26CK6445)	26Ck6445; 295	190	119	32	157	25	NM	NM	624	NM	25	Tempiute Mountain, NV
		± 5	3	3	4	3	NM	NM	15	NM		
Moapa Valley (26CK6445)	26Ck6445; 467	183	19	47	165	33	NM	NM	95	NM	55	Kane Springs Wash Caldera Variety 1, NV
		± 5	3	3	4	3	NM	NM	14	NM		
Moapa Valley (26CK6445)	26Ck6445; 659	207	39	37	146	23	NM	NM	239	NM	44	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 5	3	3	4	3	NM	NM	15	NM		
Moapa Valley (26CK6445)	26Ck6445; 1722	189	43	26	144	23	NM	NM	299	NM	44	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 5	3	3	4	3	NM	NM	14	NM		
Moapa Valley (26CK6445)	26Ck6445; 2118	200	78	26	116	16	NM	NM	481	NM	29	Panaca Summit (Modena area), NV-UT
		± 5	3	3	4	3	NM	NM	16	NM		
Moapa Valley (26CK6445)	26Ck6445; 3775	204	78	24	120	16	NM	NM	475	NM	30	Panaca Summit (Modena area), NV-UT
		± 5	3	3	4	3	NM	NM	15	NM		
Moapa Valley (26CK6446)	26Ck6446; 1158	175	15	43	156	32	NM	NM	99	NM	54	Kane Springs Wash Caldera Variety 1, NV
		± 5	3	3	4	3	NM	NM	14	NM		
Moapa Valley (26CK6446)	26Ck6446; 2400	185	70	23	116	18	NM	NM	439	NM	28	Panaca Summit (Modena area), NV-UT
		± 5	3	3	4	3	NM	NM	15	NM		
Moapa Valley (26CK6446)	26Ck6446; 2241	173	17	46	157	33	NM	NM	118	NM	52	Kane Springs Wash Caldera Variety 1, NV
		± 5	3	4	4	3	NM	NM	14	NM		
Moapa Valley (26CK6446)	26Ck6446; 2931	194	41	34	150	21	NM	NM	232	NM	45	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 5	3	3	4	3	NM	NM	15	NM		
Moapa Valley (26CK6446)	26Ck6446; 2993	198	74	26	119	16	NM	NM	499	NM	28	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
26NY3393	358-4	147	119	16	159	16	NM	NM	827	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY3393	457a	167	130	14	173	19	NM	NM	828	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 5	3	3	4	3	NM	NM	17	NM		
26NY3393	457b	194	5	90	993	67	1219	1304	0	3.77	27	Oak Spring Butte, NV
		± 5	6	4	9	3	29	15	15	0.10		
26NY3393	458-1	204	81	25	217	24	NM	NM	749	NM	39	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
26NY3393	462	172	86	20	142	19	NM	NM	506	NM	28	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	15	NM		
26NY3393	465-3	205	42	34	149	22	NM	NM	290	NM	45	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY3393	466	180	91	25	148	21	NM	NM	521	NM	29	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	12	NM		
26NY3393	474-1	192	5	95	1065	68	1035	1053	0	3.59	32	Oak Spring Butte, NV
		± 4	4	3	7	3	20	12	15	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
26NY3393	476-4	196	6	92	1105	70	1013	933	0	3.11	32	Oak Spring Butte, NV
		± 4	3	3	7	3	21	13	15	0.10		
26NY3393	477-2	184	6	89	1030	64	1047	1079	NM	3.58	31	Oak Spring Butte, NV
		± 4	3	3	6	3	21	12	15	0.10		
26NY3393	479	161	124	13	164	19	NM	NM	749	NM	29	Obsidian Butte, NV, Variety 5
		± 5	3	3	4	3	NM	NM	NM	NM		(Unknown C)
26NY3393	479-1	196	7	91	1100	68	1068	1020	NM	3.39	32	Oak Spring Butte, NV
		± 4	3	4	8	3	23	13	16	0.10		
26NY3393	480-2	158	128	18	167	17	NM	NM	851	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	NM	NM		(Unknown C)
26NY3393	480-3	196	8	94	1099	66	981	955	NM	3.09	32	Oak Spring Butte, NV
		± 4	3	4	7	3	23	13	13	0.10		
26NY3393	480-4	210	8	95	1159	76	945	998	NM	3.26	32	Oak Spring Butte, NV
		± 5	3	4	9	3	24	13	NM	0.10		
26NY3393	533-1	189	6	90	1028	66	993	1042	NM	3.45	31	Oak Spring Butte, NV
		± 4	3	4	7	3	21	12	NM	0.10		
26NY3393	535-1	160	44	22	126	30	671	550	149	0.94	16	Saline Range, Variety 2, CA
		± 4	3	3	4	3	17	12	13	0.10		
26NY3393	536-6	200	7	95	1113	70	901	905	NM	3.20	31	Oak Spring Butte, NV
		± 4	3	4	8	3	21	12	NM	0.10		
26NY3393	537-1	194	7	90	1069	70	1000	1015	NM	3.37	32	Oak Spring Butte, NV
		± 4	3	3	6	3	20	12	NM	0.10		
26NY3393	540	156	127	18	165	15	NM	NM	837	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
26NY3393	541-1	187	5	89	1103	65	1004	1032	NM	3.41	32	Oak Spring Butte, NV
		± 4	3	3	6	3	20	12	NM	0.10		
26NY3393	544-47	198	7	95	1102	71	1080	1065	NM	3.50	31	Oak Spring Butte, NV
		± 5	3	4	8	3	22	13	NM	0.10		
26NY3393	547-1	169	86	20	148	19	NM	NM	532	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
26NY3393	550-7	184	5	87	1056	67	1007	1029	NM	3.43	31	Oak Spring Butte, NV
		± 4	4	3	7	3	21	12	NM	0.10		
26NY3393	557-1	195	6	97	1135	73	901	966	NM	3.17	32	Oak Spring Butte, NV
		± 5	3	4	9	3	23	13	NM	0.10		
26NY3393	559-6	195	6	96	1117	70	1104	1020	NM	3.38	32	Oak Spring Butte, NV
		± 4	3	4	7	3	21	12	NM	0.10		
26NY3393	561-2	171	84	24	145	22	NM	NM	496	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
26NY3393	562-4	177	22	20	127	30	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
26NY3393	563-23		179	6	88	987	61	NM	NM	NM	NM	32	Oak Spring Butte, NV
		±	4	3	3	6	3	NM	NM	NM	NM		
26NY3393	1050-1		162	103	21	158	17	NM	NM	693	NM	30	Obsidian Butte, NV, Variety 4/ Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
26NY3393	1060-1		198	6	96	1109	69	1035	1040	NM	3.38	31	Oak Spring Butte, NV
		±	5	3	4	8	3	23	13	NM	0.10		
26NY3393	1072-1		181	23	18	133	31	NM	NM	NM	NM	12	Queen, CA-NV
		±	5	3	3	4	3	NM	NM	NM	NM		
26NY3393	1208-1		172	84	20	142	22	NM	NM	511	NM	30	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		±	4	3	3	4	3	NM	NM	13	NM		
26NY3393	1211-1		147	120	16	163	16	NM	NM	830	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
26NY3393	1230-1		194	21	23	135	33	NM	NM	NM	NM	12	Queen, CA-NV
		±	5	3	3	4	3	NM	NM	NM	NM		
26NY3393	1313-1		198	125	25	177	20	NM	NM	604	NM	30	Obsidian Butte, NV, Variety 4/ Variety 5 (Unknown C)
		±	5	3	3	4	3	NM	NM	17	NM		
26NY3393	1321-1		153	125	15	165	18	NM	NM	812	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	16	NM		
26NY3393	2000		214	84	25	222	25	NM	NM	640	NM	36	Shoshone Mountain, NV
		±	5	3	3	4	3	NM	NM	17	NM		
26NY3393	2003-4		151	130	17	164	16	NM	NM	856	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
26NY3393	2003-5		155	100	21	162	17	NM	NM	673	NM	29	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		±	4	3	3	4	3	NM	NM	13	NM		
26NY3393	2004a		154	127	18	165	17	NM	NM	805	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
26NY3393	2004b		149	120	17	160	16	NM	NM	800	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
26NY3393	2004c		161	130	17	172	15	NM	NM	782	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	15	NM		
26NY3393	2004d		157	133	19	166	17	NM	NM	821	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	15	NM		
26NY3393	2004-5		141	114	15	154	13	NM	NM	705	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	13	NM		
26NY3393	2004-7		158	124	17	164	17	NM	NM	791	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
26NY3393	2008-2		153	122	16	163	17	NM	NM	804	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		±	4	3	3	4	3	NM	NM	14	NM		
Johny's Water Cave (26NY8)	26Ny8; 12-17-118		175	5	84	959	60	1500	1415	0	4.12	27	Oak Spring Butte, NV
		±	4	3	4	7	3	29	14	15	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Johny's Water Cave (26NY8)	26Ny8; 12-17-120	174	5	88	992	66	1223	1321	0	3.71	26	Oak Spring Butte, NV
		± 4	3	4	6	3	22	13	15	0.10		
Johny's Water Cave (26NY8)	26Ny8; 12-17-115	157	126	17	169	16	854	401	847	1.21	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	22	11	14	0.10		
Johny's Water Cave (26NY8)	26Ny8; 12-17-119	174	6	81	945	62	1287	1311	0	3.82	26	Oak Spring Butte, NV
		± 4	3	3	6	3	24	13	14	0.10		
Johny's Water Cave (26NY8)	26Ny8; 12-17-114	152	123	16	159	16	1040	442	750	1.42	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	22	11	13	0.10		
Johny's Water Cave (26NY8)	26Ny8; 12-17-117	190	5	92	1022	66	1248	1323	0	3.75	26	Oak Spring Butte, NV
		± 4	3	3	4	3	23	13	15	0.10		
Johny's Water Cave (26NY8)	26Ny8; 12-17-73	186	76	23	205	22	NM	NM	666	NM	37	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
Johny's Water Cave (26NY8)	26Ny8; 12-17-116	184	75	23	208	22	NM	NM	640	NM	38	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 0122	177	62	21	133	19	NM	NM	333	NM	26	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
Range 75W	Range 75W; B-0006	168	85	22	143	21	NM	NM	504	NM	27	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
Range 75E	Range 75E; 7-0002	204	79	23	216	23	NM	NM	650	NM	36	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
Range 75W	Range 75W; 8-0001	164	102	21	164	18	NM	NM	622	NM	30	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 0002	153	126	18	163	13	NM	NM	793	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 0037	176	58	21	124	22	NM	NM	293	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 0192	167	19	25	133	30	NM	NM	32	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	12	NM		
26NY10848	26Ny10848; 0070	151	121	15	162	17	NM	NM	847	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 0185	255	57	15	78	17	695	479	41	0.75	13	Unknown 3
		± 4	3	3	4	3	17	11	12	0.10		
Range 75W	Range 75W; 17-0003	205	83	22	217	21	NM	NM	648	NM	37	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10910	26Ny10910; 0001	115	760	33	365	18	NM	NM	1395	NM	61	Not Obsidian
		± 4	3	3	4	3	NM	NM	14	NM		
26NY10848	26Ny10848; 0067	153	121	17	166	14	NM	NM	777	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10911	26Ny10911; 0001	315	7	42	102	33	NM	NM	0	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	15	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
26NY10942	26Ny10942; 0010		146	119	16	166	15	NM	NM	799	NM	27	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	13	NM		(Unknown C)
26NY10942	26Ny10942; 0074		146	87	13	175	13	961	347	1035	1.46	41	Lookout Mountain,
		±	4	3	3	4	3	23	11	13	0.10		Casa Diablo Area, CA
26NY10942	26Ny10942; 0133		165	17	27	134	28	NM	NM	37	NM	17	Saline Range, Variety 1
		±	4	3	3	4	3	NM	NM	12	NM		(Queen Impostor), CA
26NY10942	26Ny10942; 0135		159	92	19	150	19	NM	NM	609	NM	30	Obsidian Butte, NV, Variety 4
		±	4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
26NY10850	26Ny10850; 0004		176	61	21	129	21	NM	NM	309	NM	25	Obsidian Butte, NV, Variety 2
		±	4	3	3	4	3	NM	NM	13	NM		(Airfield Canyon)
Cliff Spring (26NY377)	26Ny377; 0033		168	5	76	927	60	1535	1197	NM	3.92	26	Oak Spring Butte, NV
		±	4	3	3	6	3	22	13	NM	0.10		
26NY10687	26Ny10687; 3		205	79	21	222	22	NM	NM	659	NM	36	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 69		167	83	21	144	21	NM	NM	487	NM	28	Obsidian Butte, NV, Variety 3
		±	4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
26NY10942	26Ny10942; 11		186	73	7	103	14	NM	NM	136	NM	17	Silverpeak/Fish Lake Valley, NV
		±	4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 19		184	7	91	1045	66	1391	1230	NM	3.90	26	Oak Spring Butte, NV
		±	4	3	4	7	3	24	13	NM	0.10		
26NY10942	26Ny10942; 125		148	123	15	162	15	NM	NM	829	NM	28	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	28	NM		(Unknown C)
26NY10942	26Ny10942; 141		187	72	8	103	17	NM	NM	146	NM	18	Silverpeak/Fish Lake Valley, NV
		±	4	3	3	4	3	NM	NM	18	NM		
26NY10942	26Ny10942; 145		184	120	26	157	22	NM	NM	561	NM	24	Tempiute Mountain, NV
		±	4	3	3	4	3	NM	NM	24	NM		
26NY10942	26Ny10942; 167		314	7	41	100	33	NM	NM	NM	NM	13	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 183		316	7	41	100	33	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	14	NM		
26NY10942	26Ny10942; 196		321	6	39	99	32	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	14	NM		
Range 75W	Range 75W; 17-2		176	6	80	953	62	1594	1328	NM	4.28	25	Oak Spring Butte, NV
		±	4	3	3	6	3	25	13	25	0.10		
26LN3094	26Ln3094; 6		192	120	25	162	24	NM	NM	608	NM	24	Tempiute Mountain, NV
		±	4	3	3	4	3	NM	NM	24	NM		
26LN3094	26Ln3094; 9-1		188	120	27	160	20	NM	NM	622	NM	23	Tempiute Mountain, NV
		±	4	3	3	4	3	NM	NM	23	NM		
26LN3094	26Ln3094; 11		200	127	28	165	24	NM	NM	633	NM	24	Tempiute Mountain, NV
		±	4	3	3	4	3	NM	NM	24	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
26LN3110	26Ln3110; 1	198	126	20	166	26	NM	NM	646	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	24	NM		
26CK5522	26Ck5270; 2	186	17	45	171	29	NM	NM	66	NM	49	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	49	NM		
26CK5522	26Ck5522; 124	199	6	87	1196	71	1217	920	NM	3.42	31	Oak Spring Butte, NV
		± 4	3	3	7	3	21	12	31	0.10		
26NY10942	26Ny10942; 112	138	113	16	149	15	NM	NM	758	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	29	NM		
26NY10848	26Ny10848; 64	171	85	21	148	18	NM	NM	493	NM	28	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	28	NM		
Range 71S	Range 71S; 24-1	166	106	18	162	15	NM	NM	646	NM	28	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	28	NM		
26NY376	26Ny376; 5-440-16	169	101	21	158	20	NM	NM	632	NM	27	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 36	172	22	26	138	30	NM	NM	25	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 40	317	7	36	99	32	NM	NM	0	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	15	NM		
26NY10848	26Ny10848; 55	156	100	20	160	21	NM	NM	632	NM	28	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 91	180	61	22	129	21	NM	NM	299	NM	26	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
Range 71S	Range 71S; 6-1	304	6	39	101	34	NM	NM	0	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	15	NM		
Range 71S	Range 71S; 25-3	308	6	40	107	31	NM	NM	0	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Range 75W	Range 75W; B-4	145	124	17	160	14	NM	NM	841	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	14	NM		
Range 75W	Range 75W; 17-3A	153	128	13	166	18	NM	NM	846	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	14	NM		
26NY10698	26Ny10698; 2	169	87	22	150	21	NM	NM	530	NM	29	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY1492	26Ny1492; 33	181	57	22	130	23	NM	NM	325	NM	25	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY364	26Ny364; 29	163	76	21	140	20	NM	NM	456	NM	28	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
McKinnis Site (26NY218)	26Ny218; MK021-1476	205	85	23	217	23	NM	NM	712	NM	36	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY5688	26Ny5688; 5688	184	58	22	125	18	NM	NM	313	NM	26	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$\mathrm{Fe}^2\mathrm{O}^{3\,\mathrm{T}}$	Fe:Mn	Geochemical Source
26LN3094	26Ln3094; 2	191	123	27	161	21	NM	NM	636	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
26LN3094	26Ln3094; 8	202	80	25	217	18	NM	NM	713	NM	37	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
26LN3097	26Ln3097; 6	178	17	46	174	29	702	260	72	1.33	51	Kane Springs Wash Caldera
		± 4	3	3	4	3	17	11	13	0.10		Variety 1, NV
26LN3117	26Ln3117; 1	191	123	30	161	27	NM	NM	636	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
26LN3124	26Ln3124; 4	204	125	31	167	26	NM	NM	613	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
26LN3086	26Ln3086; 1	197	123	28	162	25	NM	NM	620	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26LN3159	26Ln3159; 1	196	122	25	163	23	NM	NM	630	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
26LN1492	26Ln1492; 30	179	85	21	150	18	NM	NM	530	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	15	NM		(Obsidian Butte)
Range 71N	Range 71N; 5-3	145	118	16	158	15	NM	NM	826	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	14	NM		(Unknown C)
26NY375	26Ny375; 5-453-5	201	11	26	91	35	NM	NM	7	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	12	NM		
Cliff Spring (26NY377)	26Ny377; 42	164	6	77	920	61	1378	1320	23	3.85	25	Oak Spring Butte, NV
		± 5	3	3	7	3	28	15	12	0.10		
Cliff Spring (26NY377)	26Ny377; 45	171	83	20	144	16	NM	NM	515	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	14	NM		(Obsidian Butte)
Cliff Spring (26NY377)	26Ny377; 47	230	13	25	95	38	NM	NM	0	NM	8	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	15	NM		
Cliff Spring (26NY377)	26Ny377; 48	188	40	17	112	21	841	389	178	0.90	20	Wild Horse Canyon, UT
		± 4	3	3	4	3	19	11	13	0.10		
Cliff Spring (26NY377)	26Ny377; 49	195	124	30	157	32	NM	NM	608	NM	25	Tempiute Mountain, NV
		± 5	3	3	4	3	NM	NM	16	NM		
McKinnis Site (26NY218)	26Ny218; MCK-274	176	7	77	953	61	1511	1221	0	4.07	26	Oak Spring Butte, NV
		± 4	3	3	6	3	24	13	17	0.10		
26LN3094	26Ln3094; 10	179	6	82	960	60	1505	1300	NM	3.99	27	Oak Spring Butte, NV
		± 4	3	3	6	3	25	13	NM	0.10		
Range 71S	Range 71N; F-1	144	117	15	154	14	NM	NM	742	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Range 71S	Range 71S; 11-6	144	51	9	99	17	713	376	201	0.87	21	Unknown Type F
		± 4	3	3	4	3	18	11	13	0.10		
26NY10703	26Ny10703; 1	0	15	0	19	0	NM	NM	NM	NM	NM	Not Obsidian
		± 5	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Geochemical Source
26NY10850	26Ny10850; 1	167	99	21	156	17	NM	NM	700	NM	30	Obsidian Butte, NV, Variety 4/ Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10859	26Ny10859; 1	154	124	17	164	12	NM	NM	764	NM	31	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 69	142	50	11	97	16	631	373	193	0.84	22	Unknown Type F
		± 4	3	3	4	3	16	11	13	0.10		
26NY10942	26Ny10942; 109	180	67	8	96	14	NM	NM	116	NM	18	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 139	309	6	40	100	29	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 166	153	118	17	158	18	NM	NM	848	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 189	318	5	39	98	32	NM	NM	NM	NM	15	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Range 71N	Range 71N; D-3	151	125	16	161	14	NM	NM	823	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	14	NM		
Range 76	Range 76; INT2-9	152	124	17	166	16	NM	NM	788	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY363	26Ny363; 94	67	520	37	295	20	NM	NM	NM	NM	NM	Not Obsidian
		± 4	5	3	4	3	NM	NM	NM	NM		
26NY1518	26Ny1518; 5-906-1	13	18	4	121	0	NM	NM	NM	NM	NM	Not Obsidian
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY5693	26Ny5693; 1-1	169	18	27	139	29	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10657	26Ny10657; 2	179	58	21	129	21	NM	NM	330	NM	24	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10680	26Ny10680; B4	102	649	28	317	20	NM	NM	NM	NM	NM	Not Obsidian
		± 4	5	3	4	3	NM	NM	NM	NM		
26NY10686	26Ny10686; 1	95	703	33	331	18	NM	NM	NM	NM	NM	Not Obsidian
		± 4	5	3	4	3	NM	NM	NM	NM		
Range 75W	Range 75W; D-3	173	86	20	148	18	NM	NM	502	NM	33	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
McKinnis Site (26NY218)	26Ny218; MK102-246	153	123	15	166	16	NM	NM	846	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY8787	26Ny8787; 19	195	75	23	213	23	NM	NM	674	NM	35	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10675	26Ny10675; 4	177	57	23	127	23	NM	NM	325	NM	26	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10728	26Ny10728; 1	195	80	25	208	22	NM	NM	660	NM	38	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
26NY10821	26Ny10821; 1	198	127	28	163	23	NM	NM	611	NM	25	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10845	26Ny10845; 1	209	14	20	94	26	NM	455	NM	0.85	17	Crow Spring, NV
		± 4	3	3	4	3	NM	11	NM	0.10		
26NY10848	26Ny10848; 24	175	20	19	123	27	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10848	26Ny10848; 62	318	6	36	102	34	NM	NM	NM	NM	14	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
26NY10848	26Ny10848; 66	182	69	7	97	15	NM	NM	147	NM	18	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 17	146	116	16	157	16	NM	NM	778	NM	28	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
26NY10942	26Ny10942; 44	203	70	23	210	22	NM	NM	642	NM	36	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 53	313	5	39	9	34	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 169	176	5	79	970	61	1427	1300	NM	4.16	26	Oak Spring Butte, NV
		± 4	4	3	6	3	23	13	NM	0.10		
26NY10942	26Ny10942; 193	158	25	10	81	16	NM	NM	59	NM	15	Mt. Hicks, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 206	323	5	39	96	31	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 207	313	5	40	106	33	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 51	190	124	30	161	25	NM	NM	618	NM	23	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26CK3905	26Ck3905; 500-1	201	83	21	217	22	NM	NM	710	NM	35	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26CK3906	26Ck3906; 1	198	77	23	230	21	NM	NM	686	NM	34	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26CK4856	26Ck4856; 120	196	41	35	146	22	NM	NM	293	NM	41	Kane Springs Wash Caldera Variety 2
		± 4	3	3	4	3	NM	NM	13	NM		(Kane Springs), NV
26CK5522	26Ck5522; 85	6	15	0	16	0	NM	NM	NM	NM	NM	Not Obsidian
		± 17	3	3	4	3	NM	NM	NM	NM		
26LN3087	26Ln3087; 1	206	78	24	223	24	NM	NM	679	NM	36	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26LN3094	26Ln3094; 3	183	6	82	987	59	1537	1384	0	4.14	25	Oak Spring Butte, NV
		± 4	3	3	6	3	24	13	15	0.10		
26LN3106	26Ln3106; 2	202	126	29	165	24	NM	NM	653	NM	23	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
26LN3118	26Ln3118; 1	176	7	77	948	58	1592	1399	8	4.37	27	Oak Spring Butte, NV
		± 4	3	3	6	3	28	13	15	0.10		
26LN3123	26Ln3123; 3	195	123	28	164	24	NM	NM	673	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26LN3133	26Ln3133; 2	212	127	28	160	25	NM	NM	644	NM	23	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26LN3137	26Ln3137; 2	199	81	21	215	24	NM	NM	700	NM	37	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26LN3278	26Ln3278; 1	200	80	25	216	28	NM	NM	676	NM	36	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26LN3285	26Ln3285; 2	207	80	22	220	23	NM	NM	683	NM	34	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
McKinnis Site (26NY218)	26Ny218; MK073-1191	191	74	21	204	21	NM	NM	637	NM	35	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
McKinnis Site (26NY218)	26Ny218; MK102	103	22	13	67	13	800	90	38	1.05	132	Not Obsidian
		± 4	3	3	4	3	18	11	12	0.10		
26NY382	26Ny382; 5-414-4	209	128	31	163	22	NM	NM	620	NM	23	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY1518	26Ny1518; 5-968-1	176	55	22	123	21	NM	NM	288	NM	25	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	13	NM		(Airfield Canyon)
Range 71N	Range 71N; 12-1	154	123	18	163	15	NM	NM	789	NM	27	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Range 71S	Range 71S; INT4-8	171	19	25	135	29	NM	NM	11	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	12	NM		(Queen Impostor), CA
Range 71S	Range 71S; 21-8	258	8	49	136	40	NM	NM	14	NM	39	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	13	NM		Coso Volcanic Field, CA
Range 75W	Range 75W; 13-3	188	121	29	160	22	NM	NM	575	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
Range 76	Range 76; INT2-6	180	86	23	147	21	NM	NM	487	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Range 76	Range 76; INT5-2	155	119	15	158	15	NM	NM	786	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Range 71N	Range 71N; 2-1	185	57	21	133	21	NM	NM	281	NM	27	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	13	NM		(Airfield Canyon)
26NY10643	26Ny10643; 3	178	22	21	130	29	NM	NM	41	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	12	NM		
26NY10653	26Ny10653; 2	149	118	17	162	13	NM	NM	790	NM	27	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
26NY10704	26Ny10704; 1	144	42	19	120	26	NM	487	180	0.93	17	Saline Range, Variety 2, CA
		± 4	3	3	4	3	NM	11	13	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
26NY10845	26Ny10845; 6	147	118	15	155	12	NM	NM	794	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10846	26Ny10846; 3	149	118	17	157	16	NM	NM	730	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 3	205	85	23	220	22	NM	NM	726	NM	35	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 4	194	12	17	88	27	NM	NM	14	NM	15	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 11	150	116	15	153	15	NM	NM	810	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 16	152	117	16	158	12	NM	NM	835	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 41	174	57	22	123	18	NM	NM	272	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10848	26Ny10848; 99	168	56	21	117	20	NM	NM	274	NM	27	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10850	26Ny10850; 2	179	116	27	153	21	NM	NM	629	NM	24	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10850	26Ny10850; 5	176	19	42	163	30	NM	250	87	1.33	52	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	11	13	0.10		
26NY10859	26Ny10859; 2	147	118	16	157	13	NM	NM	719	NM	27	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10910	26Ny10910; 2	210	13	19	92	25	NM	NM	15	NM	16	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 70	164	15	24	129	30	NM	NM	33	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 99	311	0	41	99	30	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	5	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 106	59	675	28	270	17	NM	NM	NM	NM	67	Not Obsidian
		± 4	6	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 107	174	99	23	156	19	NM	NM	598	NM	27	Obsidian Butte, NV, Variety 4 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 129	169	18	26	130	28	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 143	166	81	20	140	18	NM	NM	480	NM	27	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	13	NM		
26NY10942	26Ny10942; 152	314	5	38	98	31	NM	NM	NM	NM	13	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
26NY10942	26Ny10942; 172	298	4	36	96	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$\mathrm{Fe^2O^{3T}}$	Fe:Mn	Geochemical Source
26NY10942	26Ny10942; 178	160	17	23	134	30	NM	NM	26	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	12	NM		(Queen Impostor), CA
Range 71S	Range 71S; 7-4	302	7	35	92	28	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10942	26NY10942, 24	130	187	7	89	7	858	490	1274	0.94	19	Unknown Type G (Gatecliff Group 1)?
		± 4	3	3	4	3	22	11	13	0.10		
McKinnis Site (26NY218)	MK74, 268	177	6	88	981	63	1550	1385	0	4.14	25	Oak Spring Butte, NV
		± 4	3	3	4	3	22	13	19	0.10		
Big Smoky District (Joshua Tree NP)	6056	312	5	47	103	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6060a	171	62	16	84	13	NM	NM	219	NM	14	Garfield Hills, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Big Smoky District (Joshua Tree NP)	6060b	173	68	10	95	15	NM	NM	141	NM	18	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Big Smoky District (Joshua Tree NP)	6183	199	11	20	89	27	NM	NM	NM	NM	15	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6183a	317	5	46	101	36	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6183b	168	63	8	90	12	NM	NM	151	NM	17	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Big Smoky District (Joshua Tree NP)	6183c	220	10	22	92	31	NM	NM	NM	NM	15	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6243a	209	13	25	94	33	NM	NM	NM	NM	14	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6243b	125	198	11	88	10	NM	NM	1244	NM	18	Unknown 14
		± 4	3	3	4	3	NM	NM	14	NM		
Big Smoky District (Joshua Tree NP)	6425a	41	225	8	70	1	NM	NM	NM	NM	45	Not Obsidian
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425b	84	591	39	330	23	NM	NM	NM	NM	74	Not Obsidian
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425c	317	5	42	96	36	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425d	167	78	25	139	17	NM	NM	NM	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	NM	NM		(Obsidian Butte)
Big Smoky District (Joshua Tree NP)	6425e	147	120	19	165	17	NM	NM	808	NM	34	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Big Smoky District (Joshua Tree NP)	6425f	312	5	37	91	31	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425g	209	10	20	90	29	NM	NM	NM	NM	17	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Big Smoky District (Joshua Tree NP)	6425h		297	3	43	94	36	NM	NM	NM	NM	13	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425i		157	21	23	123	34	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425j		291	6	43	98	31	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425k		164	18	18	121	30	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425l		324	4	44	99	39	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6425m		177	66	12	95	17	NM	NM	137	NM	19	Silverpeak/Fish Lake Valley, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Big Smoky District (Joshua Tree NP)	6425n		213	9	23	93	27	NM	NM	108	NM	17	Crow Spring, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Big Smoky District (Joshua Tree NP)	6425o		164	20	23	125	36	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6473a		295	4	38	101	32	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6473b		306	4	41	95	33	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6478a		163	21	21	126	33	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6478b		142	121	18	159	17	NM	NM	752	NM	31	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Big Smoky District (Joshua Tree NP)	6478c		175	21	24	126	34	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6511a		296	3	42	93	32	NM	NM	NM	NM	14	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Big Smoky District (Joshua Tree NP)	6511b		168	60	15	81	13	NM	NM	208	NM	13	Garfield Hills, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Big Smoky District (Joshua Tree NP)	6511c		203	10	23	90	29	NM	NM	66	NM	16	Crow Spring, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Big Smoky District (Joshua Tree NP)	6511d		217	7	25	87	30	NM	NM	33	NM	14	Crow Spring, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Big Smoky District (Joshua Tree NP)	6511e		154	16	25	134	27	NM	NM	NM	NM	18	Saline Range, Variety 1
		±	4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Big Smoky District (Joshua Tree NP)	6690		196	10	25	86	37	NM	NM	NM	NM	8	Fish Springs, CA
		±	4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 172		255	56	17	75	20	568	383	71	0.74	14	Unknown 3
		±	4	3	3	4	3	17	12	10	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Mud Lake (26NY1101)	26Ny1101, 179	170	22	23	125	29	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 195	163	20	22	115	28	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 200	289	4	42	91	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 211	321	5	46	101	31	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 212	169	57	24	126	23	NM	NM	313	NM	30	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	10	NM		(Airfield Canyon)
Mud Lake (26NY1101)	26Ny1101, 213	98	699	35	333	17	NM	NM	NM	NM	NM	Not Obsidian
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 214	138	110	20	152	15	NM	NM	766	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Mud Lake (26NY1101)	26Ny1101, 215	172	60	25	124	22	NM	NM	276	NM	24	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	10	NM		(Airfield Canyon)
Mud Lake (26NY1101)	26Ny1101, 216	165	19	32	124	36	NM	NM	49	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Mud Lake (26NY1101)	26Ny1101, 220	160	83	25	138	23	NM	NM	487	NM	31	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Mud Lake (26NY1101)	26Ny1101, 221	167	84	26	140	22	NM	NM	469	NM	28	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Mud Lake (26NY1101)	26Ny1101, 222	332	6	44	104	35	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 223	186	121	33	160	23	755	463	572	1.35	25	Tempiute Mountain, NV
		± 4	3	3	4	3	21	12	12	0.10		
Mud Lake (26NY1101)	26Ny1101, 224	317	3	45	102	38	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 225	198	10	25	99	28	NM	NM	22	NM	19	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Mud Lake (26NY1101)	26Ny1101, 230	151	121	22	159	16	NM	NM	718	NM	32	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Mud Lake (26NY1101)	26Ny1101, 231	148	23	10	75	13	NM	NM	43	NM	16	Mt. Hicks, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Mud Lake (26NY1101)	26Ny1101, 232	184	121	34	157	24	763	457	577	1.41	25	Tempiute Mountain, NV
		± 4	3	3	4	3	20	12	12	0.10		
Mud Lake (26NY1101)	26Ny1101, 234	158	19	30	127	29	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Mud Lake (26NY1101)	26Ny1101, 239	178	93	26	145	22	NM	NM	466	NM	30	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	11	NM		(Obsidian Butte)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Mud Lake (26NY1101)	26Ny1101, 244	321	4	44	106	35	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 245	310	3	41	99	32	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 251	302	6	41	94	32	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 253	158	18	24	123	28	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mud Lake (26NY1101)	26Ny1101, 255	163	81	24	139	19	NM	NM	460	NM	33	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	11	NM		(Obsidian Butte)
Mud Lake (26NY1101)	26Ny1101, 459	185	95	12	97	13	NM	NM	589	NM	15	Bodie Hills, CA
		± 4	3	3	4	3	NM	NM	12	NM		
Mud Lake (26NY1101)	26Ny1101, 463	140	109	17	155	16	NM	NM	788	NM	33	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Mud Lake (26NY1101)	26Ny1101, 464	141	113	21	148	15	NM	NM	762	NM	27	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Mud Lake (26NY1101)	26Ny1101, 465	161	19	34	128	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Mud Lake (26NY1101)	26Ny1101, 466	144	122	20	154	13	NM	NM	768	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Mud Lake (26NY1101)	26Ny1101, 467	152	103	24	157	18	NM	NM	622	NM	33	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Mud Lake (26NY1101)	26Ny1101, 468	140	119	20	162	18	NM	NM	736	NM	32	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Mud Lake (26NY1101)	26Ny1101, 470	264	6	50	218	61	542	700	13	1.39	16	Goldfield Hills, NV
		± 4	3	3	4	3	20	15	10	0.10		
Mud Lake (26NY1101)	26Ny1101, 471	155	20	12	79	17	NM	NM	41	NM	18	Mt. Hicks, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Mud Lake (26NY1101)	26Ny1101, 472	171	21	23	129	32	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
26NY10723	26NY10723, 1	167	94	22	152	21	NM	NM	536	NM	31	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
26NY10725	26NY10725, 2	189	83	23	211	25	NM	NM	661	NM	42	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
26NY10844	26NY10844, 6	184	75	25	194	23	NM	NM	648	NM	43	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
26NY10848	26NY10848, 83	207	12	22	88	29	NM	NM	36	NM	16	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	10	NM		
26NY10849	26NY10849, 2	159	20	27	128	26	NM	NM	46	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
26NY10927	26NY10927, 27	308	7	45	101	36	NM	NM	13	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	10	NM		
26NY10927	26NY10927, 35	161	79	26	148	23	NM	NM	532	NM	31	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	12	NM		
26NY10927	26NY10927, 182	170	20	22	120	27	NM	NM	51	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	10	NM		
Nellis AFB Nellis AFB	Nellis AFB, No Number	204	88	28	220	23	NM	NM	670	NM	38	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mt. Jefferson Desert (AMNH Collection)	20.4/1142	323	7	44	104	39	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mt. Jefferson Desert (AMNH Collection)	20.4/1144	160	23	23	122	38	NM	NM	30	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/3286	330	6	44	102	43	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mt. Jefferson Desert (AMNH Collection)	20.4/1107	161	60	20	79	19	NM	NM	230	NM	13	Garfield Hills, NV
		± 4	3	3	4	3	NM	NM	11	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/3033	220	25	53	349	38	NM	NM	149	NM	62	Box Spring, NV
		± 4	3	3	4	3	NM	NM	11	NM		
Mt. Jefferson Desert (AMNH Collection)	20.4/1145	176	62	17	83	15	NM	NM	211	NM	13	Garfield Hills, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/1789	328	6	71	75	16	NM	NM	NM	NM	70	Paradise Valley, NV
		± 4	3	3	4	3	NM	13	NM	0.10		
Mt. Jefferson Desert (AMNH Collection)	20.5/3242	175	28	82	970	74	1324	1265	NM	3.86	27	Oak Spring Butte, NV
		± 4	3	3	4	3	37	14	NM	0.10		
Mt. Jefferson Desert (AMNH Collection)	20.5/3246	195	10	26	91	25	NM	NM	29	NM	16	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/1129	198	26	54	332	37	NM	NM	165	NM	61	Box Spring, NV
		± 4	3	3	4	3	NM	NM	11	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/1220	160	53	25	114	24	NM	NM	317	NM	34	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	11	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/2961	154	25	14	83	19	NM	NM	43	NM	16	Mt. Hicks, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/3237	131	68	10	80	19	NM	NM	800	NM	19	Unknown 11
		± 4	3	3	4	3	NM	NM	15	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/1424	134	75	12	87	17	NM	NM	826	NM	20	Unknown 11
		± 4	3	3	4	3	NM	NM	12	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/1839	213	23	53	354	37	NM	NM	154	NM	60	Box Spring, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/1221	110	181	12	88	10	NM	NM	1285	NM	20	Unknown G (Gatecliff Group 1)
		± 4	3	3	4	3	NM	NM	15	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Mt. Jefferson Desert (AMNH Collection)	20.5/1223	125	201	10	84	9	NM	NM	1243	NM	21	Unknown G (Gatecliff Group 1)
		± 4	3	3	4	3	NM	NM	13	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/3083	218	28	54	350	32	NM	NM	143	NM	61	Box Spring, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Mt. Jefferson Desert (AMNH Collection)	20.4/7309	303	6	43	97	34	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/2902	291	3	41	105	36	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mt. Jefferson Desert (AMNH Collection)	20.5/3123	185	118	32	157	29	682	415	592	1.31	27	Tempiute Mountain, NV
		± 4	3	3	4	3	20	12	11	0.10		
Mt. Jefferson Desert (AMNH Collection)	20.5/1800	212	25	53	353	40	NM	NM	141	NM	66	Box Spring, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Alta Toquima Village (AMNH Collection)	20.4/6346	161	22	20	126	37	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6391	178	113	29	153	27	NM	NM	552	NM	27	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/6424	160	22	22	123	37	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6500	295	6	44	96	36	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6539	156	22	24	127	38	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6614	187	28	48	327	32	NM	NM	145	NM	59	Box Spring, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/6660	123	202	13	82	10	NM	NM	1356	NM	18	Unknown G (Gatecliff Group 1)
		± 4	3	3	4	3	NM	NM	18	NM		
Alta Toquima Village (AMNH Collection)	20.4/6781	146	117	20	161	19	NM	NM	733	NM	32	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/6784	162	20	25	130	36	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6791	196	12	20	88	33	NM	NM	28	NM	18	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/6806	128	203	14	94	12	NM	NM	1301	NM	20	Unknown G (Gatecliff Group 1)
		± 4	3	3	4	3	NM	NM	18	NM		
Alta Toquima Village (AMNH Collection)	20.4/6850	170	23	23	126	38	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6917	157	25	22	122	36	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6959	173	23	23	124	35	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Alta Toquima Village (AMNH Collection)	20.4/6965		137	86	13	170	14	952	300	941	1.29	49	Lookout Mountain,
		±	4	3	3	4	3	30	14	12	0.10		Casa Diablo Area, CA
Alta Toquima Village (AMNH Collection)	20.4/6986		169	20	22	126	36	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/7047		191	13	23	86	30	NM	NM	58	NM	15	Crow Spring, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/7048		164	56	26	122	22	NM	NM	303	NM	29	Obsidian Butte, NV, Variety 2
		±	4	3	3	4	3	NM	NM	12	NM		(Airfield Canyon)
Alta Toquima Village (AMNH Collection)	20.5/34		162	23	22	124	38	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/224		160	19	23	125	35	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/331		156	23	24	124	35	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/365		153	23	17	77	22	NM	NM	63	NM	16	Mt. Hicks, NV
		±	4	3	3	4	3	NM	NM	15	NM		
Alta Toquima Village (AMNH Collection)	20.5/588		166	21	25	123	33	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/590		150	18	23	120	34	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/715		175	22	23	133	34	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/826		166	65	18	87	14	NM	NM	241	NM	13	Garfield Hills, NV
		±	4	3	3	4	3	NM	NM	15	NM		
Alta Toquima Village (AMNH Collection)	20.5/2523		159	22	22	128	36	NM	NM	NM	NM	13	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/5838		172	23	22	124	35	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/889		147	5	20	82	25	457	281	3	0.82	30	Mono Glass Mountain, CA
		±	4	3	3	4	3	25	13	10	0.10		
Alta Toquima Village (AMNH Collection)	20.5/2314		154	124	19	153	14	NM	NM	720	NM	27	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	16	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.4/5		174	62	17	89	14	NM	NM	257	NM	14	Garfield Hills, NV
		±	4	3	3	4	3	NM	NM	11	NM		
Alta Toquima Village (AMNH Collection)	20.4/18		310	5	47	103	36	NM	NM	NM	NM	13	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6345		0	2	1	7	1	NM	NM	NM	NM	NM	Not Obsidian
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6516		164	17	21	120	31	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Alta Toquima Village (AMNH Collection)	20.4/6537		172	20	22	125	36	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6685		162	21	25	118	36	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6798		165	20	23	126	34	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6816		151	122	20	158	22	NM	NM	828	NM	33	Obsidian Butte, NV, Variety 5
		±	4	3	3	4	3	NM	NM	14	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.4/6831		207	14	21	90	31	NM	NM	NM	NM	18	Crow Spring, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6833		135	179	12	71	11	NM	NM	1277	NM	16	Unknown G (Gatecliff Group 1)
		±	4	3	3	4	3	NM	NM	14	NM		
Alta Toquima Village (AMNH Collection)	20.4/6910		325	10	46	102	36	NM	NM	NM	NM	15	Montezuma Range, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6934		156	20	23	122	33	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6944		174	80	25	143	23	NM	NM	488	NM	32	Obsidian Butte, NV, Variety 3
		±	4	3	3	4	3	NM	NM	15	NM		(Obsidian Butte)
Alta Toquima Village (AMNH Collection)	20.4/6987		176	19	22	121	33	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/118		156	20	22	114	38	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/273		186	62	26	123	21	783	395	306	NM	30	Obsidian Butte, NV, Variety 2
		±	4	3	3	4	3	25	14	15	NM		(Airfield Canyon)
Alta Toquima Village (AMNH Collection)	20.5/328		231	22	52	351	38	NM	NM	160	NM	62	Box Spring, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Alta Toquima Village (AMNH Collection)	20.5/370		265	10	54	94	30	522	451	NM	1.10	20	Black Rock Area, UT
		±	4	3	3	4	3	26	14	NM	0.10		
Alta Toquima Village (AMNH Collection)	20.5/374		166	85	23	137	27	NM	NM	511	NM	35	Obsidian Butte, NV, Variety 3
		±	4	3	3	4	3	NM	NM	10	NM		(Obsidian Butte)
Alta Toquima Village (AMNH Collection)	20.5/669		181	40	20	106	23	784	370	184	0.95	20	Wild Horse Canyon, UT
		±	4	3	3	4	3	29	14	15	0.10		
Alta Toquima Village (AMNH Collection)	20.5/2179		168	21	20	127	34	NM	NM	NM	NM	13	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/2243		163	19	26	122	32	NM	NM	NM	NM	12	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/2257		167	21	26	125	35	NM	NM	NM	NM	11	Queen, CA-NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/2418		246	14	55	96	21	NM	414	NM	1.10	21	Black Rock Area, UT
		±	4	3	3	4	3	NM	14	NM	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Alta Toquima Village (AMNH Collection)	20.5/2525	167	61	18	81	16	NM	NM	243	NM	14	Garfield Hills, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Alta Toquima Village (AMNH Collection)	20.5/2566	174	20	21	127	32	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/2577	162	26	23	119	35	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/3403	167	17	22	124	35	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/4070	147	26	13	75	18	NM	NM	85	NM	17	Mt. Hicks, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Alta Toquima Village (AMNH Collection)	20.5/655	138	118	20	149	19	NM	NM	762	NM	33	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.5/2201	146	120	21	153	16	NM	NM	719	NM	NM	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.4/7321	203	24	51	335	39	NM	NM	134	NM	65	Box Spring, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.5/2315	154	53	13	76	13	NM	NM	217	NM	13	Garfield Hills, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/159	199	10	23	94	27	NM	NM	36	NM	16	Crow Spring, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/6824	313	6	44	99	35	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/7166	152	125	19	163	18	NM	NM	813	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.5/780	367	3	68	75	10	408	166	NM	1.17	63	Paradise Valley, NV
		± 4	3	3	4	3	25	12	NM	0.10		
Alta Toquima Village (AMNH Collection)	20.5/2696	199	127	33	159	28	NM	NM	601	NM	23	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Alta Toquima Village (AMNH Collection)	20.4/12	138	114	20	147	NA	NM	NM	NM	NM	33	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	NM	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.4/21	219	24	53	342	38	NM	NM	136	NM	NM	Box Spring, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.4/171	299	6	40	96	38	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6601	321	4	37	94	33	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/6821	305	5	42	102	39	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/7119	148	24	16	74	15	NM	NM	58	NM	15	Mt. Hicks, NV
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-1. Results of XRF Studies: Central Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Alta Toquima Village (AMNH Collection)	20.4/7148	309	4	40	94	30	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.4/7192	182	120	26	146	27	NM	NM	595	NM	27	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Alta Toquima Village (AMNH Collection)	20.4/7202	178	20	23	128	37	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/97	223	33	52	342	41	NM	NM	173	NM	NM	Box Spring, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Alta Toquima Village (AMNH Collection)	20.5/555	290	3	51	100	33	NM	NM	NM	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Alta Toquima Village (AMNH Collection)	20.5/2609	180	58	25	119	20	NM	NM	286	NM	28	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	NM	NM		(Airfield Canyon)
Alta Toquima Village (AMNH Collection)	20.5/2717	145	118	17	153	18	NM	NM	777	NM	36	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	15	NM		(Unknown C)
Alta Toquima Village (AMNH Collection)	20.5/2739	225	25	55	346	40	NM	NM	162	NM	65	Box Spring, NV
		± 4	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Conaway Shelter (26LN126)	B57; 98/252	233	7	63	148	52	458	269	3	1.18	33	Unknown Type A
		± 4	3	3	4	3	20	12	10	0.10		
Conaway Shelter (26LN126)	B57; 120/1	241	7	61	133	47	496	318	23	1.25	35	Unknown Type A
		± 4	3	3	4	3	20	12	10	0.10		
Conaway Shelter (26LN126)	B60; 114/159	162	17	48	171	37	NM	NM	99	NM	56	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	10	NM		Variety 1, NV
Conaway Shelter (26LN126)	B60; 114/161	191	78	27	115	22	NM	NM	525	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 18/6	185	72	27	118	19	NM	NM	543	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
Conaway Shelter (26LN126)	B62; 46/77	185	NA	26	122	18	NM	NM	462	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 56/1	188	79	27	117	18	NM	NM	481	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 58/33	195	39	26	151	25	NM	NM	278	NM	NM	Kane Springs Wash Caldera Variety 2
		± 4	3	3	4	3	NM	NM	12	NM		(Kane Springs), NV
Conaway Shelter (26LN126)	B62; 61/37	189	75	28	117	19	NM	NM	450	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 69/30	173	71	29	115	19	NM	NM	497	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 79/3	170	18	48	167	31	NM	NM	78	NM	57	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	11	NM		Variety 1, NV
Conaway Shelter (26LN126)	B62; 96/61	173	71	28	120	20	NM	NM	521	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 98/250	247	6	63	138	53	490	294	17	1.20	41	Unknown Type A
		± 4	3	3	4	3	19	12	10	0.10		
Conaway Shelter (26LN126)	B62; 98/253	182	20	48	178	35	NM	NM	104	NM	56	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	10	NM		Variety 1, NV
Conaway Shelter (26LN126)	B62; 98/254	191	20	52	181	34	NM	NM	100	NM	55	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	11	NM		Variety 1, NV
Conaway Shelter (26LN126)	B62; 98/260	195	45	37	152	25	NM	NM	287	NM	NM	Kane Springs Wash Caldera Variety 2
		± 4	3	3	4	3	NM	NM	11	NM		(Kane Springs), NV
Conaway Shelter (26LN126)	B62; 106/126	176	18	48	173	29	NM	NM	86	NM	57	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	10	NM		Variety 1, NV
Conaway Shelter (26LN126)	B62; 106/127	241	8	62	152	55	417	276	3	1.21	35	Unknown Type A
		± 4	3	3	4	3	18	12	10	0.10		
Conaway Shelter (26LN126)	B62; 106/129	162	16	45	161	31	NM	NM	104	NM	57	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	10	NM		Variety 1, NV
Conaway Shelter (26LN126)	B62; 106/130	201	36	37	146	27	NM	NM	258	NM	NM	Kane Springs Wash Caldera Variety 2
		± 4	3	3	4	3	NM	NM	12	NM		(Kane Springs), NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Geochemical Source
Conaway Shelter (26LN126)	B62; 106/132	176	17	49	166	35	NM	NM	116	NM	61	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 108/29	193	37	37	148	28	NM	NM	250	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 114/158	121	130	32	227	24	1128	359	1275	1.32	33	Unknown 15
		± 4	3	3	4	3	25	12	15	0.10		
Conaway Shelter (26LN126)	B62; 124/83	173	18	47	176	32	NM	NM	102	NM	59	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 124/85	201	80	31	127	18	NM	NM	503	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Conaway Shelter (26LN126)	B62; 124/86	180	21	48	169	35	NM	NM	103	NM	57	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 124/87	179	17	48	170	34	NM	NM	101	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 124/88	135	119	34	300	31	NM	NM	1479	NM	31	Unknown Type B
		± 4	3	3	4	3	NM	NM	15	NM		
Conaway Shelter (26LN126)	B62; 125/268	175	17	45	171	35	NM	NM	91	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	11	NM		
Conaway Shelter (26LN126)	B62; 125/270	183	20	50	175	35	NM	NM	93	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 125/271	175	19	49	171	35	NM	NM	87	NM	54	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 125/272	194	74	26	109	16	NM	NM	507	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Conaway Shelter (26LN126)	B62; 130	188	74	31	119	22	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 144/8	192	80	27	126	19	NM	NM	520	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B62; 166/3	170	16	47	166	31	NM	NM	100	NM	55	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B62; 170/5	0	16	1	11	1	NM	NM	NM	NM	NM	Not Obsidian
		± 4	3	3	4	3	NM	NM	NM	NM		
Conaway Shelter (26LN126)	B64; 10/5	189	112	29	98	26	NM	NM	507	NM	14	South Pahroc, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B66; 114/156	181	40	34	147	28	NM	NM	277	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B66; 124/93	178	75	29	129	17	NM	NM	539	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Conaway Shelter (26LN126)	B67; 114/157	174	74	29	109	21	NM	NM	494	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Conaway Shelter (26LN126)	B67; 114/160	201	40	37	158	24	NM	NM	283	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B67; 142/5	180	19	48	171	25	NM	NM	109	NM	69	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B67; 152/1	171	19	47	166	29	NM	NM	98	NM	67	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B67; 152/3	185	41	37	146	26	NM	NM	276	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	11	NM		
Conaway Shelter (26LN126)	B67; 156/2	188	74	30	117	17	NM	NM	495	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Conaway Shelter (26LN126)	B67; 160/121	194	39	37	150	23	NM	NM	232	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B67; 166/2	186	42	37	147	22	NM	NM	276	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
Conaway Shelter (26LN126)	B67; 170/1	194	43	38	153	25	NM	NM	277	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B1; 7/17	201	80	27	122	17	NM	NM	533	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	18	NM		
O'Malley Shelter (26LN418)	B1; 7/19	207	83	28	121	20	NM	NM	535	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B1; 25/79	149	125	20	160	19	NM	NM	786	NM	28	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B1; 27/61	206	79	25	124	20	NM	NM	533	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B1; 188/1	201	36	38	142	26	NM	NM	225	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B1; 131/4	188	77	27	121	24	NM	NM	523	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	13	NM		
O'Malley Shelter (26LN418)	B2; 104/3	200	77	28	117	19	NM	NM	523	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	14	NM		
O'Malley Shelter (26LN418)	B3; 54/2	196	74	30	122	20	NM	NM	548	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B3; 78/1	135	121	37	301	31	1502	419	1409	1.68	35	Unknown Type B
		± 4	3	3	4	3	26	14	15	0.10		
O'Malley Shelter (26LN418)	B3; 83/1	135	119	36	303	29	1337	444	1463	1.57	30	Unknown Type B
		± 4	3	3	4	3	26	14	15	0.10		
O'Malley Shelter (26LN418)	B3; 85/1	131	95	28	194	22	1258	314	1143	1.24	32	Unknown Type C
		± 4	3	3	4	3	24	12	13	0.10		
O'Malley Shelter (26LN418)	B3; 108/6	189	74	28	115	14	NM	NM	476	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B3; 200/10	131	93	27	194	25	995	297	1195	1.25	31	Unknown Type C
		± 4	3	3	4	3	22	12	13	0.10		
O'Malley Shelter (26LN418)	B4; 13/38	203	45	39	156	26	NM	NM	301	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B4; 21/78	202	80	26	121	17	NM	NM	510	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B4; 22/44	186	41	32	149	27	NM	NM	269	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B4; 22/45	209	81	NA	121	21	NM	NM	528	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	13	NM		
O'Malley Shelter (26LN418)	B4; 25/87	202	82	31	125	19	NM	NM	552	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B4; 27/64	184	74	27	116	19	NM	NM	526	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	13	NM		
O'Malley Shelter (26LN418)	B4; 31/49	172	73	30	106	23	NM	NM	544	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 59/3	148	133	40	325	32	1683	500	1456	1.79	28	Unknown Type B
		± 4	3	3	4	3	27	14	13	0.10		
O'Malley Shelter (26LN418)	B4;78/2	149	103	27	219	21	1209	379	1102	1.41	33	Unknown Type C
		± 4	3	3	4	3	22	12	13	0.10		
O'Malley Shelter (26LN418)	B4; 88/2	152	105	31	207	22	1311	384	1144	1.50	31	Unknown Type C
		± 4	3	3	4	3	25	13	14	0.10		
O'Malley Shelter (26LN418)	B4; 99/1	196	77	27	117	16	NM	NM	484	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 108/5	182	75	26	118	15	NM	NM	451	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 113/2	131	122	34	300	29	1449	449	1418	1.64	35	Unknown Type B
		± 4	3	3	4	3	25	13	15	0.10		
O'Malley Shelter (26LN418)	B4; 121/1	194	80	28	119	18	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B4; 131/3	143	104	29	203	25	1276	366	1176	1.45	34	Unknown Type C
		± 4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B4; 132/2	195	77	25	120	19	NM	NM	474	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 141/4	194	77	28	118	20	NM	NM	540	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 146/2	204	80	25	120	17	NM	NM	528	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 150/2	194	74	29	118	22	NM	NM	528	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B4; 153/1	196	73	30	122	18	NM	NM	502	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B4; 153/7	180	73	28	123	19	NM	NM	553	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 153/8	183	71	26	116	22	NM	NM	523	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 155/1	153	7	34	150	40	NM	NM	0	NM	18	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B4; 171/4	164	111	29	207	25	1349	398	1129	1.51	32	Unknown Type C
		± 4	3	3	4	3	23	12	15	0.10		
O'Malley Shelter (26LN418)	B4; 173/1	175	21	50	166	33	NM	NM	111	NM	65	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B4; 178/1	194	79	33	113	14	NM	NM	507	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 200/5	184	72	28	113	16	NM	NM	477	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 210/1	166	5	39	156	41	NM	NM	19	NM	18	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B4; 212/1	203	82	28	124	19	NM	NM	516	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 219/6	158	112	27	207	26	1377	382	1220	1.51	29	Unknown Type C
		± 4	3	3	4	3	26	14	13	0.10		
O'Malley Shelter (26LN418)	B4; 258/2	133	93	29	185	24	1068	333	1223	1.31	31	Unknown Type C
		± 4	3	3	4	3	23	12	15	0.10		
O'Malley Shelter (26LN418)	B4; 262/2	199	80	30	120	18	NM	NM	552	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 262/3	184	79	27	116	20	NM	NM	514	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B4; 288/1	198	43	33	151	22	NM	NM	268	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B4; 296/1	192	40	38	153	27	NM	NM	305	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B6; 189/4	195	80	26	120	21	NM	NM	553	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B7; 168/9	182	37	24	106	19	NM	NM	166	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B8; 26/33	189	41	23	110	26	NM	NM	152	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B8; 132/1	185	78	25	118	21	NM	NM	517	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B8; 135/3	197	35	24	141	25	NM	NM	235	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B8; 153/12	183	19	51	178	32	NM	NM	83	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B8; 200/2	191	79	28	125	22	NM	NM	535	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B9; 7/21	202	82	33	120	17	NM	NM	483	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B9; 66/1	195	76	28	118	20	NM	NM	516	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B10; 5/17	200	80	31	119	19	NM	NM	491	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B10; 6/15	197	70	26	123	21	NM	NM	539	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B10; 22/38	193	41	35	145	24	NM	NM	260	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B10; 22/40	190	79	27	117	21	NM	NM	503	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B10; 25/83	170	8	42	172	44	NM	NM	NM	NM	18	Unknown Type E
		± 4	3	3	4	3	NM	NM	NM	NM		
O'Malley Shelter (26LN418)	B10; 27/62	161	8	40	155	41	NM	NM	11	NM	19	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B10; 113/5	142	99	28	185	22	1158	348	1198	1.32	33	Unknown Type C
		± 4	3	3	4	3	25	13	13	0.10		
O'Malley Shelter (26LN418)	B10; 188/2	188	20	51	176	35	NM	NM	99	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B11; 120/6	142	97	25	189	26	1088	325	1225	1.29	29	Unknown Type C
		± 4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B12; 146/4	169	9	44	241	45	668	582	12	1.53	19	Unknown Type D
		± 4	3	3	4	3	19	14	10	0.10		
O'Malley Shelter (26LN418)	B12; 146/45	153	8	45	244	45	618	511	12	1.38	21	Unknown Type D
		± 4	3	3	4	3	20	13	10	0.10		
O'Malley Shelter (26LN418)	B12; 189/7	144	100	30	197	23	1282	377	1242	1.45	31	Unknown Type C
		± 4	3	3	4	3	24	12	18	0.10		
O'Malley Shelter (26LN418)	B13; 22/39	201	81	20	116	16	NM	NM	521	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B13; 113/1	184	76	27	116	18	NM	NM	503	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B13; 173/1	190	74	29	115	20	NM	NM	523	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B14; 27/63	193	78	27	117	14	NM	NM	525	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B14; 146/3	197	78	26	125	19	NM	NM	519	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B14; 189/5	183	6	37	158	38	NM	NM	10	NM	17	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B14; 216/1	196	46	29	158	26	NM	NM	301	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B15; 337/8	146	101	29	198	21	1260	385	1070	1.46	34	Unknown Type C
		± 4	3	3	4	3	24	12	12	0.10		
O'Malley Shelter (26LN418)	B16; 241/1	168	6	34	155	37	NM	NM	NM	NM	16	Unknown Type E
		± 4	3	3	4	3	NM	NM	NM	NM		
O'Malley Shelter (26LN418)	B16; 334/4	205	34	32	135	22	NM	NM	239	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B16; 334/11	156	100	24	195	24	1176	335	1136	1.36	NM	Unknown Type C
		± 4	3	3	4	3	22	12	13	0.10		
O'Malley Shelter (26LN418)	B16; 334/16	133	98	23	189	20	1201	349	1064	1.37	31	Unknown Type C
		± 4	3	3	4	3	24	12	12	0.10		
O'Malley Shelter (26LN418)	B16; 337/7	187	42	31	145	19	NM	NM	263	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B16; 358/2	193	73	27	115	16	NM	NM	456	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B16; 358/3	187	76	30	119	19	NM	NM	502	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B16; 358/7	195	76	26	117	17	NM	NM	479	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B16; 358/14	199	81	28	121	14	NM	NM	500	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B16; 361/3	144	102	27	205	20	1209	377	1102	1.40	34	Unknown Type C
		± 4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B16; 369/2	202	81	27	120	16	NM	NM	475	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B17; 334/48	194	75	27	122	17	NM	NM	497	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B18; 229/1	186	73	25	117	15	NM	NM	479	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 234/1	148	101	32	201	22	1254	376	1125	1.48	30	Unknown Type C
		± 4	3	3	4	3	24	12	12	0.10		
O'Malley Shelter (26LN418)	B18; 235/7	162	8	47	238	45	618	562	3	1.43	22	Unknown Type D
		± 4	3	3	4	3	18	14	10	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B18; 237/6		130	123	35	305	29	1685	450	1487	1.75	32	Unknown Type B
		±	4	3	3	4	3	26	14	15	0.10		
O'Malley Shelter (26LN418)	B18; 248/1		186	74	28	119	18	NM	NM	544	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 252/2		183	6	38	158	41	656	476	11	1.07	16	Unknown Type E
		±	4	3	3	4	3	18	13	10	0.10		
O'Malley Shelter (26LN418)	B18; 334/1		191	77	28	121	16	NM	NM	470	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 334/10		195	73	26	120	15	NM	NM	495	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B18; 334/14		204	80	25	119	16	NM	NM	452	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B18; 337/3		162	9	40	230	46	654	531	3	1.36	20	Unknown Type D
		±	4	3	3	4	3	19	14	10	0.10		
O'Malley Shelter (26LN418)	B18; 337/6		189	76	25	111	20	NM	NM	519	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 338/1		150	97	30	191	21	1268	380	1069	1.42	34	Unknown Type C
		±	4	3	3	4	3	24	12	12	0.10		
O'Malley Shelter (26LN418)	B18; 338/2		200	80	27	118	12	NM	NM	492	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 357/2		182	79	28	120	19	NM	NM	558	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 361/4		183	73	31	116	20	NM	NM	539	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B18; 443/28		144	130	37	314	34	1687	449	1562	1.74	32	Unknown Type B
		±	4	3	3	4	3	27	14	15	0.10		
O'Malley Shelter (26LN418)	B19; 147/2		184	21	46	177	33	NM	NM	102	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B19; 233/3		141	122	35	308	29	1650	488	1407	1.79	31	Unknown Type B
		±	4	3	3	4	3	26	13	15	0.10		
O'Malley Shelter (26LN418)	B19; 334/2		195	75	29	118	15	NM	NM	491	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B19; 337/9		188	82	28	118	18	NM	NM	491	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B19; 358/12		195	77	28	118	19	NM	NM	479	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B19; 361/1		193	77	27	115	15	NM	NM	520	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B19; 369/5		192	69	27	125	16	NM	NM	481	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B20; 242/2		196	76	27	126	16	NM	NM	490	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B20; 246/1		170	17	51	166	28	NM	NM	117	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B20; 251/3		199	79	29	118	17	NM	NM	466	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B20; 253/3		188	79	29	122	16	NM	NM	464	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B20; 375/3		194	44	38	144	22	NM	NM	268	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B20; 391/21		196	79	27	119	20	NM	NM	525	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B20; 418/21		170	15	47	168	35	NM	NM	108	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B21; 182/1		190	41	34	150	22	NM	NM	268	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B22; 324/1		191	75	28	115	16	NM	NM	457	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B22; 331/4		211	40	36	156	22	NM	NM	291	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B23; 104/2		180	75	27	115	18	NM	NM	509	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B24; 445/8		148	101	27	187	20	1219	362	1075	1.45	32	Unknown Type C
		±	4	3	3	4	3	23	12	12	0.10		
O'Malley Shelter (26LN418)	B25; 304/5		186	73	20	117	15	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B27; 117/1		190	43	27	148	23	NM	NM	285	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B27; 304/1		200	78	28	114	14	NM	NM	451	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B27; 422/5		181	71	26	108	14	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B27; 441/10		198	75	26	119	15	NM	NM	447	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B28; 89/3		188	77	26	115	17	NM	NM	489	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B28; 242/1		196	82	28	121	17	NM	NM	506	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B28; 250/3		195	44	36	155	23	NM	NM	291	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B28; 268/1		189	82	17	116	19	NM	NM	491	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B28; 268/2		197	73	30	116	16	NM	NM	474	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B28; 375/2		258	7	67	149	53	NM	NM	8	NM	38	Unknown Type A
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B28; 425/1		195	78	27	116	17	NM	NM	510	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B28; 441/16		198	79	27	119	18	NM	NM	500	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B29; 82/7		189	74	27	117	14	NM	NM	459	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B29; 209/1		140	96	26	188	19	1182	334	1058	1.33	34	Unknown Type C
		±	4	3	3	4	3	22	12	13	0.10		
O'Malley Shelter (26LN418)	B29; 256/1		187	73	27	109	16	NM	NM	522	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B29; 379/14		191	76	30	113	17	NM	NM	453	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B29; 385/26		198	79	27	123	16	NM	NM	479	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B29; 417/3		181	72	30	114	18	NM	NM	525	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B30; 42/1		190	73	28	127	19	NM	NM	508	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B30; 261/3		201	79	25	119	10	NM	NM	502	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B30; 266/2		182	73	27	120	18	NM	NM	503	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B30; 278/1		206	80	27	116	15	NM	NM	475	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B30; 391/15		195	80	29	112	15	NM	NM	463	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B30; 391/18		138	100	28	192	21	1101	352	1081	1.33	31	Unknown Type C
		±	4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B30; 402/3		159	109	26	202	21	1151	354	1208	1.37	29	Unknown Type C
		±	4	3	3	4	3	28	14	13	0.10		
O'Malley Shelter (26LN418)	B31; 65/1		181	41	37	148	23	NM	NM	269	NM	NM	Kane Springs Wash Caldera Variety 2
		±	4	3	3	4	3	NM	NM	11	NM		(Kane Springs), NV
O'Malley Shelter (26LN418)	B31; 117/2		163	9	47	232	43	681	538	8	1.37	19	Unknown Type D
		±	4	3	3	4	3	20	14	10	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B31; 191/2	137	122	37	285	25	1506	438	1332	1.67	32	Unknown Type B
		± 4	3	3	4	3	26	14	15	0.10		
O'Malley Shelter (26LN418)	B31; 191/3	194	75	25	109	18	NM	NM	518	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B32; 240/4	191	77	30	118	19	NM	NM	491	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B32; 357/1	186	71	28	117	20	NM	NM	502	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B33; 7/20	194	76	29	117	12	NM	NM	485	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B33; 22/36	137	94	29	189	20	1100	338	1140	1.30	34	Unknown Type C
		± 4	3	3	4	3	23	12	15	0.10		
O'Malley Shelter (26LN418)	B33; 27/60	175	11	37	157	40	NM	NM	3	NM	16	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B33; 54/1	187	74	26	118	17	NM	NM	497	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B33; 64/1	137	99	26	185	24	1172	339	1102	1.31	32	Unknown Type C
		± 4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B33; 75/97	166	5	36	148	35	NM	NM	21	NM	18	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B34; 272/1	152	103	30	189	23	NM	NM	1130	NM	29	Unknown Type C
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B35; 108/3	134	91	30	189	22	1092	321	1166	1.29	32	Unknown Type C
		± 4	3	3	4	3	22	11	12	0.10		
O'Malley Shelter (26LN418)	B36; 239/2	189	72	23	111	13	NM	NM	473	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B36; 334/3	191	79	27	117	16	NM	NM	472	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B36; 334/6	157	7	45	232	44	NM	NM	7	NM	19	Unknown Type D
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B36; 354/1	171	20	47	168	25	NM	NM	91	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B37; 24/34	188	80	26	121	18	NM	NM	525	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B37; 32/119	139	133	37	319	33	NM	450	1438	1.79	29	Unknown Type B
		± 4	3	3	4	3	NM	14	15	0.10		
O'Malley Shelter (26LN418)	B37; 208/3	142	100	26	185	21	1109	337	1182	1.30	34	Unknown Type C
		± 4	3	3	4	3	22	11	15	0.10		
O'Malley Shelter (26LN418)	B37; 267/6	166	7	35	172	38	NM	NM	39	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B38; 312/1	163	7	35	159	36	NM	NM	27	NM	17	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B38; 338/11	127	94	26	181	21	1025	306	1218	1.18	34	Unknown Type C
		± 4	3	3	4	3	22	12	15	0.10		
O'Malley Shelter (26LN418)	B39; 48/33	197	77	25	122	15	NM	NM	503	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B39; 404/8	197	78	25	121	14	NM	NM	473	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B40; 444/56	182	78	29	116	16	NM	NM	518	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B40; 446/3	130	121	36	293	22	NM	NM	1312	NM	26	Unknown Type B
		± 4	3	3	4	3	NM	NM	13	NM		
O'Malley Shelter (26LN418)	B41; 177/2	198	80	28	125	17	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B42; 431/16	173	71	28	115	21	NM	NM	540	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B42; 449/1	140	127	32	297	31	1765	495	1315	1.84	30	Unknown Type B
		± 4	3	3	4	3	27	13	15	0.10		
O'Malley Shelter (26LN418)	B42; 450/2	146	96	25	192	21	1138	329	1181	1.32	33	Unknown Type C
		± 4	3	3	4	3	22	12	13	0.10		
O'Malley Shelter (26LN418)	B43; 79/3	182	78	30	122	21	NM	NM	550	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B43; 172/1	190	76	28	115	22	NM	NM	522	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B43; 182/2	193	40	34	152	21	NM	NM	287	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B43; 213/1	192	79	30	119	17	NM	NM	498	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B43; 291/12	190	78	29	115	15	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B43; 296/4	194	77	26	119	15	NM	NM	453	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B43; 308/2	200	78	28	115	14	NM	NM	478	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B44; 60/3	196	75	27	113	15	NM	NM	493	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B44; 89/5	192	76	28	116	19	NM	NM	510	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B44; 108/4	188	75	26	119	24	NM	NM	528	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2O^{3\,T}$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B45; 155/4	189	73	28	116	16	NM	NM	502	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B46; 241/2	179	18	50	176	36	NM	NM	86	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B46; 250/1	199	78	27	113	17	NM	NM	458	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B46; 380/1	181	80	28	120	19	NM	NM	544	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B47; 108/27	193	80	27	119	18	NM	NM	462	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B47; 117/5	189	79	26	115	15	NM	NM	473	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B48; 31/47	130	121	37	291	28	1484	438	1441	1.66	32	Unknown Type B
		± 4	3	3	4	3	25	13	15	0.10		
O'Malley Shelter (26LN418)	B49; 74/6	187	74	30	115	17	NM	NM	481	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B49; 83/7	185	75	27	117	15	NM	NM	492	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B49; 219/7	156	106	29	211	24	1212	374	1162	1.45	34	Unknown Type C
		± 4	3	3	4	3	23	12	12	0.10		
O'Malley Shelter (26LN418)	B51; 147/1	175	70	25	117	15	NM	NM	485	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B51; 352/1	190	72	29	115	16	NM	NM	492	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B51; 354/2	185	44	32	149	21	NM	NM	280	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B52; 445/3	143	97	24	192	22	1184	370	1159	1.38	30	Unknown Type C
		± 4	3	3	4	3	23	15	13	0.10		
O'Malley Shelter (26LN418)	B53; 378/2	189	20	50	180	35	NM	NM	89	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B54; 116/2	187	81	30	112	12	NM	NM	477	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B54; 153/9	190	82	27	125	19	NM	NM	500	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B54; 219/4	162	4	46	226	37	681	562	14	1.49	20	Unknown Type D
		± 4	3	3	4	3	18	14	10	0.10		
O'Malley Shelter (26LN418)	B54; 268/38	194	76	28	115	18	NM	NM	473	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B54; 364/1	189	73	25	108	16	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B54; 446/5	141	101	26	194	18	1295	349	1091	1.40	34	Unknown Type C
		± 4	3	3	4	3	23	12	12	0.10		
O'Malley Shelter (26LN418)	B55; 189/3	202	79	20	117	17	NM	NM	489	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B56; 83/4	195	75	26	115	15	NM	NM	461	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B56; 87/11	194	33	36	141	25	NM	NM	220	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B56; 173/4	192	75	25	114	13	NM	NM	462	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B56; 176/1	198	70	27	118	12	NM	NM	449	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B56; 176/2	188	72	27	111	17	NM	NM	500	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B56; 200/3	184	19	45	166	27	NM	NM	112	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B56; 204/2	195	74	27	121	18	NM	NM	480	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B56; 219/3	181	72	30	126	15	NM	NM	458	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B56; 291/9	183	69	27	114	15	NM	NM	451	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B56; 291/13	181	75	25	119	18	NM	NM	501	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B56; 298/2	182	72	28	118	23	NM	NM	514	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B56; 318/1	184	72	26	116	18	NM	NM	513	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B58; 129/1	194	80	26	120	12	NM	NM	485	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B58; 306/2	177	9	37	164	40	NM	NM	NM	NM	17	Unknown Type E
		± 4	3	3	4	3	NM	NM	NM	NM		
O'Malley Shelter (26LN418)	B59; 204/4	190	34	38	140	24	NM	NM	238	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B59; 257/6	188	42	33	147	24	NM	NM	268	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B59; 279/1	196	79	30	122	18	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B59; 332/5	147	100	27	198	17	NM	NM	1125	NM	29	Unknown Type C
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B59; 332/7	196	77	27	124	18	NM	NM	508	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B59; 370/1	145	99	27	188	20	NM	NM	1058	NM	34	Unknown Type C
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B59; 395/3	203	81	29	125	19	NM	NM	536	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B59; 399/1	191	78	27	125	16	NM	NM	504	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B59; 406/6	203	79	27	120	15	NM	NM	470	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B59; 412/2	199	73	28	118	17	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B59; 414/2	200	75	31	128	20	NM	NM	511	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B59; 445/7	191	77	28	126	14	NM	NM	454	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B61; 124/89	188	20	52	176	37	NM	NM	104	NM	68	Kane Springs Wash Caldera
		± 4	3	3	4	3	NM	NM	11	NM		Variety 1, NV
O'Malley Shelter (26LN418)	B63; 291/2	188	77	27	120	16	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B65; 85/2	171	74	29	121	18	NM	NM	492	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B65; 103/1	188	73	26	115	18	NM	NM	505	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B65; 201/3	200	75	30	119	14	NM	NM	479	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B65; 204/?	193	75	25	114	18	NM	NM	455	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B65; 249/3	184	78	26	120	20	NM	NM	533	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B65; 392/1	178	75	28	113	17	NM	NM	484	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B65; 379/11	196	74	27	119	16	NM	NM	468	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B65; 413/1	180	74	27	126	16	NM	NM	488	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 84/1	127	122	36	299	29	NM	NM	1486	NM	35	Unknown Type B
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B68; 180/1	165	7	53	244	43	NM	NM	27	NM	21	Unknown Type D
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B68; 203/3	190	73	27	115	14	NM	NM	484	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B68; 209/4	143	98	28	192	22	NM	NM	1060	NM	33	Unknown Type C
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 270/9	187	77	29	120	13	NM	NM	471	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B68; 323/15	188	75	28	121	16	NM	NM	472	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B68; 323/18	130	116	35	295	29	NM	NM	1392	NM	35	Unknown Type B
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B68; 379/13	193	78	29	119	17	NM	NM	512	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 402/2	201	78	25	128	15	NM	NM	521	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 404/9	189	76	26	115	14	NM	NM	460	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 423/3	185	43	24	155	25	NM	NM	294	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B68; 432/18	199	79	26	119	17	NM	NM	520	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 441/8	184	75	25	115	12	NM	NM	493	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B68; 445/6	188	73	28	117	8	NM	NM	473	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B69; 48/37	189	78	26	124	16	NM	NM	517	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B69; 334/12	0	4	1	7	1	NM	NM	NM	NM	NM	Not Obsidian
		± 4	3	3	4	3	NM	NM	NM	NM		
O'Malley Shelter (26LN418)	B69; 375/1	188	80	16	113	15	NM	NM	475	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B69; 426/1	192	77	24	118	17	NM	NM	502	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B70; 392/10	175	74	25	112	17	NM	NM	494	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 1/5	197	79	26	124	19	NM	NM	519	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 1/18	185	70	25	118	18	NM	NM	498	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 2/41	151	100	27	199	19	1182	378	1064	1.41	34	Unknown Type C
		± 4	3	3	4	3	23	12	12	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B71; 2/47		135	128	36	302	31	1708	473	1531	1.79	30	Unknown Type B
		±	4	3	3	4	3	28	14	18	0.10		
O'Malley Shelter (26LN418)	B71; 2/48		202	81	25	125	16	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 2/66		134	124	34	300	28	1457	444	1474	1.62	30	Unknown Type B
		±	4	3	3	4	3	25	13	15	0.10		
O'Malley Shelter (26LN418)	B71; 11/8		162	106	31	210	25	1389	446	1172	1.64	34	Unknown Type C
		±	4	3	3	4	3	27	14	15	0.10		
O'Malley Shelter (26LN418)	B71; 14/10		166	7	45	245	44	664	579	23	1.45	21	Unknown Type D
		±	4	3	3	4	3	19	14	10	0.10		
O'Malley Shelter (26LN418)	B71; 15/8		188	78	26	116	14	NM	NM	497	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 24/31a		153	106	26	193	22	1250	372	1166	1.47	33	Unknown Type C
		±	4	3	3	4	3	24	12	15	0.10		
O'Malley Shelter (26LN418)	B71; 24/31b		125	124	34	292	30	1438	412	1455	1.54	32	Unknown Type B
		±	4	3	3	4	3	25	13	15	0.10		
O'Malley Shelter (26LN418)	B71; 24/36		193	80	28	118	17	NM	NM	497	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 24/40		189	81	28	122	15	NM	NM	497	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 27/54		188	77	29	116	19	NM	NM	508	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 29/12		201	36	38	149	23	NM	NM	242	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 32/106		138	96	27	186	18	1290	376	1132	1.43	30	Unknown Type C
		±	4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B71; 32/109		167	70	25	112	20	NM	NM	530	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	13	NM		
O'Malley Shelter (26LN418)	B71; 32/111		203	80	33	122	19	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 32/112		183	70	26	119	19	NM	NM	541	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 32/113		180	77	28	113	18	NM	NM	509	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 35/1		201	74	26	118	14	NM	NM	483	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 37/6		115	111	34	288	27	1341	370	1457	1.44	32	Unknown Type B
		±	4	3	3	4	3	25	13	15	0.10		
O'Malley Shelter (26LN418)	B71; 37/8		184	74	27	116	16	NM	NM	507	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B71; 40/1	204	78	26	120	18	NM	NM	488	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 40/2	157	8	42	252	45	NM	NM	0	NM	20	Unknown Type D
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 40/6	123	114	33	303	29	1318	432	1573	1.53	31	Unknown Type B
		± 4	3	3	4	3	24	13	15	0.10		
O'Malley Shelter (26LN418)	B71; 41/9	177	21	50	172	31	NM	NM	79	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B71; 42/1	202	83	28	119	19	NM	NM	509	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 44/93	135	92	27	186	21	1062	328	1167	1.25	33	Unknown Type C
		± 4	3	3	4	3	22	12	15	0.10		
O'Malley Shelter (26LN418)	B71; 45/53	204	75	26	120	12	NM	NM	454	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 45/55	198	78	28	128	21	NM	NM	507	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 45/60	197	77	28	128	18	NM	NM	466	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 45/65	130	121	34	292	31	1360	416	1479	1.57	30	Unknown Type B
		± 4	3	3	4	3	25	13	15	0.10		
O'Malley Shelter (26LN418)	B71; 46/12	166	8	33	157	39	NM	NM	18	NM	16	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B71; 107/1	196	79	30	125	17	NM	NM	520	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 143/2	186	37	32	142	26	NM	NM	278	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 143/3	188	75	24	117	13	NM	NM	508	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 145/1	132	122	36	288	39	1476	443	1551	1.61	31	Unknown Type B
		± 4	3	3	4	3	25	13	18	0.10		
O'Malley Shelter (26LN418)	B71; 145/2	139	96	23	191	21	1127	344	1092	1.33	35	Unknown Type C
		± 4	3	3	4	3	22	12	13	0.10		
O'Malley Shelter (26LN418)	B71; 206/1	172	70	28	109	20	NM	NM	522	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
O'Malley Shelter (26LN418)	B71; 208/2	200	39	36	147	27	NM	NM	253	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 208/4	195	78	27	121	18	NM	NM	514	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 208/6	178	73	27	121	20	NM	NM	530	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
O'Malley Shelter (26LN418)	B71; 208/10		188	37	32	145	28	NM	NM	242	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 230/1		147	97	29	194	26	1107	351	1153	1.34	31	Unknown Type C
		±	4	3	3	4	3	23	12	15	0.10		
O'Malley Shelter (26LN418)	B71; 254/2		174	19	50	171	34	NM	NM	117	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B71; 269/3		186	75	27	114	15	NM	NM	471	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 291/1		139	86	24	194	22	1065	346	1122	1.32	33	Unknown Type C
		±	4	3	3	4	3	22	12	12	0.10		
O'Malley Shelter (26LN418)	B71; 333/1		142	98	28	196	22	1160	340	1200	1.30	33	Unknown Type C
		±	4	3	3	4	3	23	12	13	0.10		
O'Malley Shelter (26LN418)	B71; 333/3		201	81	30	115	19	NM	NM	505	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 333/4		190	71	26	114	19	NM	NM	512	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 333/5		201	80	28	120	19	NM	NM	495	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 333/6		194	77	30	116	19	NM	NM	471	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 423/1		184	76	27	112	17	NM	NM	512	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 445/1		197	80	27	122	18	NM	NM	458	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 452/5		190	77	27	116	17	NM	NM	477	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 452/11		135	97	27	190	22	1121	325	1242	1.27	33	Unknown Type C
		±	4	3	3	4	3	22	12	15	0.10		
O'Malley Shelter (26LN418)	B71; 452/24		179	17	49	174	36	NM	NM	86	NM	NM	Kane Springs Wash Caldera Variety 1, NV
		±	4	3	3	4	3	NM	NM	10	NM		
O'Malley Shelter (26LN418)	B71; 492/2		182	21	82	992	71	1058	1160	3	3.81	29	Oak Spring Butte, NV
		±	4	3	3	4	3	27	22	10	0.10		
O'Malley Shelter (26LN418)	B71; 496/4		170	72	24	116	19	NM	NM	522	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
O'Malley Shelter (26LN418)	B71; 499/4		192	76	28	114	15	NM	NM	459	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
O'Malley Shelter (26LN418)	B71; 505/3		200	43	37	152	24	NM	NM	281	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	27-379		190	41	29	150	27	NM	NM	267	NM	NM	Kane Springs Wash Caldera Variety 2 (Kane Springs), NV
		±	4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-373	205	73	25	121	15	NM	NM	472	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-379	180	7	41	166	43	NM	NM	15	NM	15	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-381	190	41	20	114	26	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-390	180	37	21	111	23	NM	NM	183	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-399	185	72	27	107	18	NM	NM	505	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-492	185	40	20	108	22	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-541	185	41	22	113	23	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-673	183	39	22	103	21	NM	NM	183	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-754	195	77	29	118	20	NM	NM	500	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-994	189	41	20	112	21	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-1084	191	42	20	112	17	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-1282	183	40	21	112	21	NM	NM	156	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-1346	270	11	53	96	26	NM	NM	8	NM	NM	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-1347	188	40	19	111	24	NM	NM	167	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-1459	184	39	20	113	23	NM	NM	143	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-1494	181	40	21	105	24	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-1534	181	37	20	103	21	NM	NM	185	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-1678	190	40	23	110	22	NM	NM	179	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-1724	190	39	20	113	20	NM	NM	167	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-1767	188	36	21	110	22	NM	NM	188	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-1993	183	40	22	108	23	NM	NM	173	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2042	185	41	25	109	23	NM	NM	180	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2187	173	35	21	103	23	NM	NM	167	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2257	153	95	28	202	24	1257	375	1118	1.34	33	Unknown Type C
		± 4	3	3	4	3	22	12	15	0.10		
Evans Mound (42IN40)	37-2298	190	40	21	112	19	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2299	191	80	26	120	17	NM	NM	472	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2306	172	37	21	109	24	NM	NM	160	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2332	186	71	29	113	18	NM	NM	491	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-2333	192	40	20	112	25	NM	NM	180	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2334	178	40	25	106	18	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2355	189	40	20	112	19	NM	NM	172	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2412	183	39	20	108	25	NM	NM	182	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2455	180	42	20	108	23	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-2595	178	39	21	110	23	NM	NM	179	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2674	278	10	60	99	33	NM	NM	21	NM	NM	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2712	184	38	21	109	22	NM	NM	179	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2742	180	39	19	115	20	NM	NM	178	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2744	194	38	21	110	23	NM	NM	158	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-2820	189	41	20	113	25	NM	NM	169	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2871	174	37	23	106	20	NM	NM	184	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-2892	182	41	20	106	26	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-2962	188	78	27	118	18	NM	NM	504	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-3004	170	60	23	135	17	NM	NM	334	NM	NM	Pumice Hole Mine, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-3005	189	39	20	110	25	NM	NM	184	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3006	187	37	20	111	23	NM	NM	185	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-3041	194	78	27	122	17	NM	NM	498	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3069	188	40	22	109	23	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3144	186	42	25	112	23	NM	NM	177	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3201	196	78	24	122	19	NM	NM	478	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-3401	186	40	19	112	23	NM	NM	182	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-3459	175	64	24	127	22	NM	NM	331	NM	25	Pumice Hole Mine, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3543	178	39	15	113	26	NM	NM	186	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3643	179	39	16	107	19	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3688	183	42	21	114	24	NM	NM	177	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-3784	189	39	20	110	24	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-3898	182	38	22	108	21	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-3993	197	81	25	121	19	NM	NM	496	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-4010	187	41	22	114	23	NM	NM	167	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-4020	141	94	27	193	22	1111	342	1132	1.30	33	Unknown Type C
		± 4	3	3	4	3	22	11	12	0.10		
Evans Mound (42IN40)	37-4049	189	42	20	108	20	NM	NM	183	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2O^{3\,T}$	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-4435	174	39	20	105	14	NM	NM	156	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-4613	194	81	27	119	18	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	1	NM		
Evans Mound (42IN40)	37-4637	184	37	20	109	18	NM	NM	147	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-4800	185	78	25	127	16	NM	NM	470	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-4834	190	39	23	108	23	NM	NM	162	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-4861	260	11	56	97	29	NM	NM	3	NM	NM	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-4955	192	79	26	117	14	NM	NM	464	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-4956	188	39	20	109	25	NM	NM	179	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-4997	144	57	28	161	26	1157	317	503	1.22	32	Black Mountain, UT
		± 4	3	3	4	3	22	11	12	0.10		
Evans Mound (42IN40)	37-5120	185	39	17	107	21	NM	NM	154	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-5121	181	41	19	108	24	NM	NM	184	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-5234	183	38	22	107	19	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-5323	152	103	26	199	21	1268	356	1119	1.38	29	Unknown Type C
		± 4	3	3	4	3	23	12	15	0.10		
Evans Mound (42IN40)	37-5492	199	84	27	128	18	NM	NM	503	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-5508	144	99	28	194	20	1157	367	1092	1.36	31	Unknown Type C
		± 4	3	3	4	3	22	12	12	0.10		
Evans Mound (42IN40)	37-5527	180	42	20	110	24	NM	NM	173	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-5549	198	75	29	121	12	NM	NM	474	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-5989	185	40	22	111	21	NM	NM	167	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-5990	191	40	22	116	25	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-6211	186	41	20	113	20	NM	NM	179	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-6252		184	38	21	114	26	NM	NM	185	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-6307		182	38	18	105	17	NM	NM	165	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-6468		185	42	23	112	23	NM	NM	178	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-6607		183	39	25	113	23	NM	NM	159	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-6833		245	11	54	91	28	NM	NM	9	NM	NM	Black Rock Area, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-6972		204	78	28	124	15	NM	NM	498	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-7041		188	41	24	108	24	NM	NM	173	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-7048		178	40	20	108	25	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-7110		185	72	23	112	22	NM	NM	178	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-7150		199	80	28	122	21	NM	NM	542	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-7198		202	78	26	125	14	NM	NM	466	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-7445		183	40	21	111	21	NM	NM	165	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-7595		181	43	24	113	19	NM	NM	166	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-7598		183	40	23	112	23	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-7646		174	40	19	114	24	NM	NM	155	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-7656		148	106	25	204	22	1331	354	1094	1.42	35	Unknown Type C
		±	4	3	3	4	3	23	12	15	0.10		
Evans Mound (42IN40)	37-7858		199	78	25	114	15	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-7890		186	38	23	110	26	NM	NM	185	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-7928		192	78	27	122	16	NM	NM	532	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-7984		186	41	18	110	21	NM	NM	170	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-8219	195	72	28	109	15	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-8257	170	9	49	234	47	653	540	18	1.44	22	Unknown Type D
		± 4	3	3	4	3	18	14	10	0.10		
Evans Mound (42IN40)	37-8263	188	41	20	110	20	NM	NM	165	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-8363	188	42	21	109	17	NM	NM	170	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-8485	192	78	27	119	15	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-8486	174	38	22	112	22	NM	NM	170	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-8562	185	41	22	116	23	NM	NM	153	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-8563	176	37	19	107	25	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-8564	177	37	21	114	26	NM	NM	177	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-8598	271	10	58	94	26	NM	NM	13	NM	NM	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-8707	278	11	62	99	30	NM	NM	3	NM	NM	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-8727	186	40	22	111	23	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-8737	202	81	28	120	19	NM	NM	520	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-8935	189	41	20	109	21	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-8936	186	40	20	108	21	NM	NM	177	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-8937	186	39	23	112	20	NM	NM	180	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9090	180	41	22	106	25	NM	NM	172	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9091	185	42	23	112	20	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9209	182	42	22	112	24	NM	NM	178	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-9315	189	70	21	109	23	NM	NM	178	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-9452	188	39	20	109	22	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9476	195	80	25	121	17	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-9553	184	39	20	111	22	NM	NM	157	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9554	184	38	23	110	25	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9661	200	75	23	122	15	NM	NM	482	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-9662	184	43	18	112	21	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-9663	192	75	27	118	13	NM	NM	511	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-9684	181	39	22	104	22	NM	NM	164	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9760	176	41	23	110	25	NM	NM	175	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-9785	193	78	28	120	16	NM	NM	475	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-9836	192	74	27	119	17	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-9929	206	82	25	117	13	NM	NM	476	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-9983	178	NA	21	109	21	NM	NM	174	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-9998	207	81	27	117	15	NM	NM	516	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-10059	176	39	24	109	23	NM	NM	190	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10098	204	81	28	125	17	NM	NM	474	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-10280	188	37	20	111	22	NM	NM	178	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-10378	189	40	21	112	22	NM	NM	157	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10379	176	39	22	103	20	NM	NM	160	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-10380	186	42	23	115	22	NM	NM	184	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-10381	173	39	20	111	27	NM	NM	178	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10382	184	37	20	108	23	NM	NM	170	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10466	182	39	22	108	18	NM	NM	172	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-10529	208	77	21	118	18	NM	NM	467	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-10530	180	41	19	112	19	NM	NM	178	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10531	183	39	22	108	26	NM	NM	183	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10532	177	7	34	168	36	NM	NM	3	NM	17	Unknown Type E
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10563	0	3	1	9	4	NM	NM	84	NM	NM	Not Obsidian
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10660	197	81	27	118	16	NM	NM	460	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-10814	180	39	22	104	23	NM	NM	182	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-10894	149	101	27	200	23	1166	351	1130	1.32	32	Unknown Type C
		± 4	3	3	4	3	22	12	15	0.10		
Evans Mound (42IN40)	37-10962	181	38	21	111	19	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11018	204	82	25	124	16	NM	NM	501	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11019	179	38	20	105	24	NM	NM	150	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11020	179	40	22	112	27	NM	NM	186	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11103	200	82	27	119	17	NM	NM	473	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11104	183	40	21	114	23	NM	NM	183	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11105	174	38	24	105	21	NM	NM	149	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-11109	183	41	22	115	23	NM	NM	189	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11125	192	42	21	113	21	NM	NM	177	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-11221	187	76	24	113	18	NM	NM	499	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11262	193	38	17	112	19	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-11263	189	39	21	110	24	NM	NM	154	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11283	186	41	20	108	21	NM	NM	163	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11415	192	41	23	113	22	NM	NM	187	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11416	202	82	28	126	17	NM	NM	488	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11461	190	41	22	113	26	NM	NM	180	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-11477	199	80	28	116	18	NM	NM	481	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11510	183	35	18	106	22	NM	NM	173	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-11567	206	78	27	118	16	NM	NM	501	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-11777	193	81	26	119	13	NM	NM	476	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-11947	193	40	22	111	26	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-12061	137	129	32	293	26	1515	486	1367	1.68	35	Unknown Type B
		± 4	3	3	4	3	26	13	15	0.10		
Evans Mound (42IN40)	37-12379	191	41	20	117	24	NM	NM	190	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-12594	194	81	29	112	17	NM	NM	506	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-12635	181	42	18	113	28	NM	NM	185	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-12673	186	41	21	109	18	NM	NM	189	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-12720	179	37	17	106	22	NM	NM	183	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-13034	190	39	20	113	20	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-13123	204	76	27	123	15	NM	NM	492	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Evans Mound (42IN40)	37-13189	179	38	22	107	21	NM	NM	166	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-13254	187	40	22	108	23	NM	NM	161	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13255	189	41	20	111	25	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-13283	186	41	22	107	23	NM	NM	176	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-13302	185	64	26	139	23	NM	NM	348	NM	25	Pumice Hole Mine, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13356	168	60	24	127	24	NM	NM	375	NM	25	Pumice Hole Mine, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-13430	186	77	25	124	13	NM	NM	467	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13433	190	83	27	122	24	NM	NM	518	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-13434	186	75	25	107	22	NM	NM	517	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-13562	185	41	24	111	19	NM	NM	156	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13618	177	41	23	111	25	NM	NM	186	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13686	178	38	21	108	26	NM	NM	186	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-13712	190	41	22	111	22	NM	NM	148	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13772	194	40	20	117	22	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-13848	192	40	21	113	27	NM	NM	182	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-13936	168	59	24	119	20	NM	NM	330	NM	26	Pumice Hole Mine, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Evans Mound (42IN40)	37-13987	186	41	19	111	24	NM	NM	190	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Evans Mound (42IN40)	37-14000	192	41	20	111	25	NM	NM	169	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Evans Mound (42IN40)	37-14062	191	75	26	116	14	NM	NM	519	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Median Village (42IN124)	42In124, FS 37.83	195	79	30	119	17	NM	NM	528	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Median Village (42IN124)	42In124, FS 39-34		169	60	24	129	18	NM	NM	292	NM	25	Pumice Hole Mine, UT
		±	4	3	3	4	3	NM	NM	12	NM		
Median Village (42IN124)	42In124, FS 40-132		190	41	22	114	27	NM	NM	172	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Median Village (42IN124)	42In124, FS 41.16		180	75	27	110	18	NM	NM	518	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
Median Village (42IN124)	42In124, FS 45.45		185	NA	19	111	19	NM	NM	154	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	11	NM		
Median Village (42IN124)	42In124, FS 61.49		202	83	26	115	16	NM	NM	482	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
Median Village (42IN124)	42In124, FS 93.86		189	70	21	113	22	NM	NM	174	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	10	NM		
Median Village (42IN124)	42In124, FS 181.39		183	73	28	125	12	NM	NM	458	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	12	NM		
Median Village (42IN124)	42In124, FS 352.69		190	39	22	116	23	NM	NM	168	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Median Village (42IN124)	42In124, FS 368.102		184	40	20	108	24	NM	NM	159	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Median Village (42IN124)	42In124, FS 379.79		192	41	22	110	22	NM	NM	151	NM	NM	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		
Median Village (42IN124)	42In124, FS 408.236		135	121	32	292	30	1539	446	1422	1.63	32	Unknown Type B
		±	4	3	3	4	3	26	12	15	0.10		
Median Village (42IN124)	42In124, FS 432-212		180	75	27	113	21	NM	NM	489	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
Median Village (42IN124)	42In124, FS 498.61		196	79	28	115	18	NM	NM	481	NM	NM	Panaca Summit (Modena area), NV-UT
		±	4	3	3	4	3	NM	NM	11	NM		
Sevier Lake (42MD3)	42Md3, 9973		284	8	65	100	33	427	429	NM	1.04	20	Black Rock Area, UT
		±	4	3	3	4	3	16	11	NM	0.10		
Sevier Lake (42MD3)	42Md3, 9975		243	12	55	95	29	461	NM	NM	0.98	21	Black Rock Area, UT
		±	4	3	3	4	3	17	NM	NM	0.10		
Sevier Lake (42MD3)	42Md3, 9979		246	11	53	93	30	457	NM	NM	0.98	21	Black Rock Area, UT
		±	4	3	3	4	3	17	NM	NM	0.10		
Sevier Lake (42MD3)	42Md3, 9983		184	40	21	107	23	903	331	NM	0.96	22	Wild Horse Canyon, UT
		±	4	3	3	4	3	19	11	NM	0.10		
Sevier Lake (42MD3)	42Md3, 9991		270	13	62	101	29	547	NM	NM	1.10	22	Black Rock Area, UT
		±	4	3	3	4	3	18	NM	NM	0.10		
Sevier Lake (42MD3)	42Md3, 9996		242	13	55	91	28	411	NM	NM	0.99	20	Black Rock Area, UT
		±	4	3	3	4	3	17	NM	NM	0.10		
Sevier Lake (42MD3)	42Md3, 10028.1		268	12	55	99	30	481	NM	NM	1.07	22	Black Rock Area, UT
		±	4	3	3	4	3	16	NM	NM	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Sevier Lake (42MD3)	42Md3, 10649	269	10	56	95	32	461	NM	NM	0.98	24	Black Rock Area, UT
		± 4	3	3	4	3	17	NM	NM	0.10		
Sevier Lake (42MD5)	42Md5, 10656	305	8	61	105	35	455	NM	NM	0.95	18	Black Rock Area, UT
		± 4	3	3	4	3	16	NM	NM	0.10		
Sevier Lake (42MD6)	42Md6, 1067	247	11	52	98	24	490	NM	NM	0.95	22	Black Rock Area, UT
		± 4	3	3	4	3	17	NM	NM	0.10		
Sevier Lake (42MD6)	42Md6, 9994	267	11	53	99	32	520	NM	NM	1.02	21	Black Rock Area, UT
		± 4	3	3	4	3	17	NM	NM	0.10		
Sevier Lake (42MD6)	42Md6, 20017	260	8	57	98	29	440	NM	NM	1.00	20	Black Rock Area, UT
		± 4	3	3	4	3	16	NM	NM	0.10		
Kanosh Mounds (42MD1)	42Md1, 9387	185	40	21	113	21	NM	NM	139	NM	22	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD1)	42Md1, 9862	186	42	21	114	23	NM	NM	163	NM	24	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD1)	42Md1, AR 1753	287	6	64	99	36	NM	NM	9	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD1)	42Md1, AR 1754	183	39	23	106	19	NM	NM	150	NM	20	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 8979	252	10	52	99	24	NM	NM	12	NM	23	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD2)	42Md2, 8982	261	11	56	94	26	NM	NM	3	NM	19	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9011	180	39	17	104	21	NM	NM	135	NM	21	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD2)	42Md2, 9012	191	41	20	111	25	NM	NM	175	NM	23	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD2)	42Md2, 9026	262	11	56	90	31	NM	NM	3	NM	18	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9027	183	42	17	110	19	NM	NM	155	NM	20	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9057	169	61	21	132	18	NM	NM	340	NM	26	Pumice Hole Mine, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD2)	42Md2, 9067	260	13	50	93	26	NM	NM	0	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD2)	42Md2, 9158	276	10	60	96	32	NM	NM	3	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9181	306	9	72	101	36	NM	NM	18	NM	15	Black Rock Area?, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Kanosh Mounds (42MD2)	42Md2, 9182	185	70	22	109	22	NM	NM	175	NM	21	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Geochemical Source
Kanosh Mounds (42MD2)	42Md2, 9202	253	11	55	95	24	NM	NM	3	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9365	151	63	27	172	24	NM	NM	437	NM	34	Black Mountain, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Kanosh Mounds (42MD2)	42Md2, 9366	252	10	NA	100	32	NM	NM	19	NM	18	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9817	253	11	55	93	26	NM	NM	9	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Kanosh Mounds (42MD2)	42Md2, 9938	248	15	55	98	30	NM	NM	10	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 399	178	11	44	243	48	589	543	19	1.39	18	Unknown Type D
		± 4	3	3	4	3	20	14	10	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 405	152	102	28	193	22	1194	383	1101	1.36	31	Unknown Type C
		± 4	3	3	4	3	23	11	12	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 408	192	82	26	125	20	NM	NM	485	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 409	157	7	46	234	44	639	578	3	1.41	19	Unknown Type D
		± 4	3	3	4	3	19	13	10	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 410	201	46	33	155	24	NM	NM	266	NM	NM	Kane Springs Wash Caldera Variety 2
		± 4	3	3	4	3	NM	NM	11	NM		(Kane Springs), NV
Pine Park Shelter (42WS155)	42Ws155, AR 418	179	77	28	118	14	NM	NM	469	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 419	190	73	27	120	15	NM	NM	525	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 423	142	102	28	198	19	1173	358	1112	1.36	34	Unknown Type C
		± 4	3	3	4	3	23	12	12	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 426	186	74	27	116	17	NM	NM	483	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 438	205	45	27	158	24	NM	NM	271	NM	NM	Kane Springs Wash Caldera Variety 2
		± 4	3	3	4	3	NM	NM	11	NM		(Kane Springs), NV
Pine Park Shelter (42WS155)	42Ws155, AR 440	202	78	27	121	15	NM	NM	517	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 443	188	75	16	115	14	NM	NM	474	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 448	175	75	26	117	18	NM	NM	487	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 451	144	128	37	306	32	1607	494	1404	1.78	30	Unknown Type B
		± 4	3	3	4	3	26	14	15	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 452	204	81	27	120	15	NM	NM	483	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Pine Park Shelter (42WS155)	42Ws155, AR 453	188	77	29	112	19	NM	NM	522	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 454	185	71	30	112	16	NM	NM	477	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 455	198	80	29	123	16	NM	NM	522	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 469	187	71	28	108	15	NM	NM	476	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 470	176	72	27	111	17	NM	NM	498	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 471	192	74	27	113	15	NM	NM	467	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 472	202	82	28	110	20	NM	NM	542	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 473	165	8	34	142	35	691	481	3	1.08	15	Unknown Type E
		± 4	3	3	4	3	18	13	10	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 474	132	117	31	279	28	1471	434	1362	1.59	28	Unknown Type B
		± 4	3	3	4	3	25	13	15	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 477	181	72	27	111	17	NM	NM	476	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 480	188	76	29	107	15	NM	NM	445	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 485	199	128	32	163	28	775	425	600	1.39	27	Tempiute Mountain, NV
		± 4	3	3	4	3	19	13	12	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 488	183	81	27	118	19	NM	NM	466	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 490	184	78	28	120	19	NM	NM	492	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 506	193	82	27	120	17	NM	NM	461	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 508	142	128	37	300	31	1521	452	1351	1.66	29	Unknown Type B
		± 4	3	3	4	3	26	14	15	0.10		
Pine Park Shelter (42WS155)	42Ws155, AR 509	196	81	28	123	19	NM	NM	514	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 513	192	76	27	120	21	NM	NM	495	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 2859	196	84	28	126	16	NM	NM	500	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 2860	199	73	25	120	15	NM	NM	479	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Pine Park Shelter (42WS155)	42Ws155, AR 2861	192	78	31	120	16	NM	NM	486	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 2889	203	81	22	122	20	NM	NM	493	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pine Park Shelter (42WS155)	42Ws155, AR 2892	181	78	27	122	18	NM	NM	472	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 1.1A	266	11	57	100	28	NM	NM	14	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 1.152	243	10	52	94	28	NM	NM	20	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 22.227	248	12	49	94	29	NM	NM	10	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 24.128	221	12	50	96	29	NM	NM	30	NM	23	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Pharo Village (42MD180)	42Md180, FS 26.103	283	11	56	100	31	NM	NM	3	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 48.61	170	40	22	102	20	NM	NM	173	NM	24	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 69.158	267	13	55	99	31	NM	NM	10	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 102.17	286	26	98	125	36	NM	NM	41	NM	32	Unknown 4
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 103.111	240	9	56	89	30	NM	NM	29	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 109.4	259	10	56	95	29	NM	NM	3	NM	25	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 177.50	167	36	19	104	22	NM	NM	176	NM	23	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 198.226	268	11	54	99	30	NM	NM	10	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 220.77	290	11	58	101	33	NM	NM	0	NM	23	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 229.62	271	9	58	95	29	NM	NM	20	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 235.31	180	37	20	104	17	NM	NM	184	NM	23	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 272.32	264	10	55	94	32	NM	NM	17	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 288.114	185	39	23	112	25	NM	NM	NM	NM	23	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Pharo Village (42MD180)	42Md180, FS 289.113	281	10	62	92	33	NM	NM	21	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 358.15	180	39	20	109	24	NM	NM	186	NM	21	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 359.47	176	38	20	105	22	NM	NM	193	NM	24	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 359.52	244	9	52	95	32	NM	NM	7	NM	19	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 385.191	247	13	56	89	26	NM	NM	18	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 393.18	251	12	53	92	24	NM	NM	0	NM	24	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Pharo Village (42MD180)	42Md180, FS 393.21	189	42	19	112	23	NM	NM	140	NM	22	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 393.28	286	13	57	97	29	NM	NM	8	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Pharo Village (42MD180)	42Md180, FS 393.29	250	12	53	90	27	NM	NM	15	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	16	NM		
Garrison Site (26WP6)	26WP6, 23469.15	238	10	52	87	31	NM	NM	13	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Garrison Site (26WP6)	26WP6, 23528.32	274	12	58	97	27	NM	NM	0	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Garrison Site (26WP6)	26WP6, 7A	436	7	48	132	62	NM	NM	3	NM	20	Topaz Mountain, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Garrison Site (26WP6)	26WP6, 7B	269	12	60	100	31	NM	NM	NM	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	NM	NM		
Garrison Site (26WP7)	26WP7, 23554.6	268	12	57	96	28	NM	NM	33	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Garrison Site (26WP7)	26WP7, 23554.7	177	39	19	105	26	NM	NM	175	NM	24	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Garrison Site (26WP7)	26WP7, 23572.19	179	38	19	105	22	NM	NM	160	NM	22	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Garrison Site (26WP7)	26WP7, 23611	190	77	29	122	18	NM	NM	480	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	11	NM		
Garrison Site (26WP12)	26WP7, 23627.1	259	12	59	98	31	NM	NM	3	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Garrison Site (26WP12)	26WP12, 23750	261	10	54	95	32	NM	NM	15	NM	24	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Garrison Site (26WP12)	26WP12, AR 1935	250	10	52	92	30	NM	NM	23	NM	23	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Garrison Site (26WP12)	26WP12, AR 1936	279	10	66	99	36	NM	NM	16	NM	24	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Garrison Site (26WP12)	26WP12, AR 1938	192	40	21	111	23	NM	NM	165	NM	22	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Garrison Site (26WP12)	26WP12, 26Wp12	261	9	57	98	32	NM	NM	3	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi1, AR 4014	258	13	54	94	27	NM	NM	8	NM	22	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi1, AR 4015	425	7	51	141	67	NM	NM	8	NM	21	Topaz Mountain, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi1, AR 4020	174	38	21	108	21	NM	NM	152	NM	20	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Marysvale 3 & 7 (42PI1)	42Pi1, AR 4021	241	9	53	92	23	NM	NM	3	NM	19	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi1, AR 4023	247	12	53	89	25	NM	NM	30	NM	21	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi2, 20172-4	173	36	19	106	23	NM	NM	185	NM	23	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi2, 20172-6	278	9	55	99	30	NM	NM	15	NM	20	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Marysvale 3 & 7 (42PI1)	42Pi2, 20172-9	193	41	22	111	23	NM	NM	174	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5518	177	40	23	111	26	NM	NM	160	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5536	179	37	22	106	18	NM	NM	167	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5541	191	42	17	108	24	NM	NM	179	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5542	183	40	21	106	21	NM	NM	156	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5543	173	38	17	107	18	NM	NM	155	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5544	189	39	23	107	21	NM	NM	159	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5545	145	63	27	162	26	1335	333	407	1.38	34	Black Mountain, UT
		± 4	3	3	4	3	23	12	12	0.10		
Paragonah Mounds (42IN43)	42-In-43, 5546	189	41	22	107	22	NM	NM	172	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5547	190	38	22	110	23	NM	NM	154	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-2. Results of XRF Studies: Eastern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Paragonah Mounds (42IN43)	42-In-43, 5548	188	40	22	107	16	NM	NM	172	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Paragonah Mounds (42IN43)	42-In-43, 5550	178	37	19	104	21	NM	NM	171	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5551	193	40	20	105	20	NM	NM	156	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5553	140	59	27	160	25	1275	336	431	1.34	32	Black Mountain, UT
		± 4	3	3	4	3	24	12	12	0.10		
Paragonah Mounds (42IN43)	42-In-43, 5555	191	38	22	109	22	NM	NM	152	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5556	186	40	24	111	24	NM	NM	170	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	11	NM		
Paragonah Mounds (42IN43)	42-In-43, 5558	140	56	25	159	29	1347	338	476	1.26	32	Black Mountain, UT
		± 4	3	3	4	3	24	12	12	0.10		
Paragonah Mounds (42IN43)	42-In-43, 5561	173	39	22	107	24	NM	NM	158	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5562	192	76	26	117	17	NM	NM	422	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Paragonah Mounds (42IN43)	42-In-43, 5565	194	40	21	109	19	NM	NM	155	NM	NM	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	10	NM		
Paragonah Mounds (42IN43)	42-In-43, 5566	196	75	28	118	13	NM	NM	461	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Paragonah Mounds (42IN43)	42-In-43, AR 986	188	74	28	112	13	NM	NM	421	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Paragonah Mounds (42IN43)	42-In-43, AR 987	260	11	51	96	27	NM	NM	6	NM	NM	Black Rock Area, UT
		± 4	3	3	4	3	NM	NM	11	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	6	140	85	20	132	24	866	490	299	1.06	21	Saline Range, Variety 3, CA
		± 4	3	3	4	3	20	11	13	0.10		
Waucoba Springs (CAINY441)	7	212	10	24	NA	37	NM	NM	NM	NM	7	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	12	168	18	26	136	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	21	166	18	27	139	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	22	163	16	26	129	26	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	26	155	17	23	122	27	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	37	215	13	25	97	35	NM	NM	NM	NM	8	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	107	139	80	15	166	9	1017	337	NM	1.37	45	Lookout Mountain,
		± 4	3	3	4	3	29	12	NM	0.10		Casa Diablo Area, CA
Waucoba Springs (CAINY441)	135	160	18	25	132	25	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	139	173	19	26	132	29	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	147	175	18	22	123	27	NM	NM	NM	NM	11	Queen, CA-NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	153	165	20	26	137	32	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	163	163	20	24	139	28	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	169	166	16	27	138	32	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	179	163	20	29	143	34	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	182	166	18	28	140	27	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	185	167	17	25	138	32	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	205	169	20	27	140	30	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	218	162	22	25	130	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	237	147	110	13	188	11	1231	345	NM	1.43	46	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	29	11	NM	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	238	168	19	27	134	26	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	250	163	17	26	135	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	258	161	21	24	140	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	290	165	22	27	140	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	291	158	19	24	135	26	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	292	167	20	28	141	26	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	300	174	19	30	132	27	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	301	166	22	23	140	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	315	211	13	23	90	34	NM	NM	NM	NM	9	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	317	169	21	24	143	31	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	329	163	20	23	137	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	343	167	20	28	133	25	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	344	209	12	26	95	35	NM	NM	NM	NM	9	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	357	164	17	23	123	25	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	368	193	9	23	91	32	NM	NM	NM	NM	8	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	374	168	18	24	138	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	401	164	18	29	135	29	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	407	163	19	26	128	29	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	409	162	17	24	132	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	410	165	18	25	132	26	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	466	168	20	27	138	24	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	467	202	12	26	88	34	NM	NM	NM	NM	10	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	468	150	84	14	177	12	866	317	NM	1.33	47	Lookout Mountain, Casa Diablo Area, CA
		± 4	3	3	4	3	28	12	NM	0.10		
Waucoba Springs (CAINY441)	470	164	17	22	133	31	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	500	172	19	19	128	32	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	509	168	22	26	133	29	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	514	163	19	26	129	29	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	539	166	23	25	145	33	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	8	169	17	23	133	28	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	28	162	17	29	132	28	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20	166	19	28	138	30	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	38	144	16	23	113	26	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	48	169	18	30	135	31	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	53	166	19	26	131	31	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	56	196	10	27	93	31	NM	NM	NM	NM	8	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	71	160	21	27	129	32	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	75	155	19	24	121	29	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	90	168	19	27	140	32	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	93	160	23	29	123	28	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	95	142	85	12	165	10	940	342	NM	1.38	39	Lookout Mountain, Casa Diablo Area, CA
		± 4	3	3	4	3	24	11	NM	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$\mathrm{Fe}^2\mathrm{O}^{3\,T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	140	167	18	27	129	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	204	167	18	26	131	30	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	219	154	19	25	125	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	231	162	17	24	136	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	233	161	18	25	130	28	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	234	164	19	28	126	32	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	4	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	235	224	6	39	110	39	NM	NM	NM	NM	44	Sugarloaf Mountain,
		± 5	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Waucoba Springs (CAINY441)	262	167	20	26	134	32	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	263	176	19	25	139	29	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	271	162	20	29	134	28	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	287	168	19	26	128	29	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	288	166	20	26	139	31	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	309	164	19	26	128	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	328	168	20	25	136	29	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	347	167	18	29	138	30	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	350	245	11	40	135	38	467	364	NM	1.15	47	West Sugarloaf,
		± 5	3	3	4	3	19	11	NM	0.10		Coso Volcanic Field, CA
Waucoba Springs (CAINY441)	353	160	19	25	120	29	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 5	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	369	165	18	29	129	29	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	391	163	22	24	139	31	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	506	161	15	28	126	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	507	156	17	26	127	28	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	540	171	18	26	129	33	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	560	164	20	27	129	31	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	584	159	20	27	130	27	NM	NM	NM	NM	20	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	597	167	20	26	129	30	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	604	166	19	25	127	29	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	45	164	18	25	130	30	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	47	198	9	27	90	34	NM	NM	NM	NM	9	Fish Springs, CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	59	174	19	22	127	31	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	60	164	19	26	129	29	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	79	150	17	24	120	30	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	80	160	17	28	123	28	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	134	154	18	24	120	30	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	152	162	18	28	129	29	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	167	162	17	26	126	31	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	227	159	17	26	122	31	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	308	166	20	24	127	25	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	348	159	17	25	128	28	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	475	155	19	25	128	26	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	476	162	15	24	126	31	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	527	159	19	28	134	31	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	No #	165	21	26	131	29	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5	195	10	26	86	35	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	206	172	19	19	133	27	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	248	150	17	21	128	25	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	260	265	9	48	138	44	NM	NM	NM	NM	47	West Sugarloaf,
		± 5	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Waucoba Springs (CAINY441)	377	165	18	26	137	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	549	166	22	26	134	31	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	600	195	13	24	90	33	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	10	160	16	25	133	29	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	13	166	18	24	130	27	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	19	168	18	26	131	29	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	267	162	18	24	130	29	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	418	165	20	28	140	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	247	165	20	26	136	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	356	139	81	17	139	24	NM	NM	325	NM	20	Saline Range, Variety 3, CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	30	252	9	47	133	41	NM	NM	NM	NM	43	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Waucoba Springs (CAINY441)	405	170	19	25	136	31	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	8	161	18	26	129	31	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	18	134	85	18	134	27	NM	NM	320	NM	19	Saline Range, Variety 3, CA
		± 4	3	3	4	3	NM	NM	13	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	51	156	17	25	126	29	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	64	139	17	24	122	22	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	105	155	20	25	129	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	159	162	17	24	128	28	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	244	158	17	25	126	38	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	385	285	5	36	106	27	NM	NM	NM	NM	13	Montezuma Range, NV
		± 5	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	436	286	5	63	112	60	NM	NM	NM	NM	46	West Cactus Peak ,
		± 5	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Waucoba Springs (CAINY441)	961-9	158	19	30	132	33	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	961-14	163	19	32	139	37	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	961-15	159	20	31	138	35	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	961-207	138	83	15	171	14	NM	NM	960	NM	38	Lookout Mountain,
		± 4	3	3	4	3	NM	NM	13	NM		Casa Diablo Area, CA
Waucoba Springs (CAINY441)	961-461	171	20	32	138	29	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	961-577	172	17	30	138	33	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 1	152	19	29	134	30	NM	NM	50	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 2	139	19	29	136	28	NM	NM	33	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 3	154	18	26	135	31	NM	NM	51	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 4	164	18	28	133	30	NM	NM	24	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 5	163	18	29	139	31	NM	NM	64	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 6	166	17	29	138	35	NM	NM	37	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	0-5 cm, Sample 7	169	18	31	137	28	NM	NM	49	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	13	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	0-5 cm, Sample 8	144	16	27	125	36	NM	NM	44	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 9	147	18	27	128	30	NM	NM	20	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 10	136	53	14	100	22	NM	NM	197	NM	22	Unknown Type F
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 11	150	18	33	132	33	NM	NM	40	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 12	168	19	26	133	30	NM	NM	34	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 13	183	20	32	144	35	NM	NM	39	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 14	170	20	29	146	31	NM	NM	35	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 15	167	20	29	143	33	NM	NM	59	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 16	158	18	27	131	34	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 17	158	18	31	135	38	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 18	161	19	31	NA	34	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 19	164	21	31	133	35	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 20	166	22	30	137	37	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 21	166	20	30	137	33	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 22	165	23	34	138	35	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 23	175	24	29	141	37	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 24	178	18	31	143	30	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	0-5 cm, Sample 25	175	22	36	146	36	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	5-10 cm, Sample 1	158	17	33	132	33	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	5-10 cm, Sample 2	156	20	29	144	31	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$\mathrm{Fe}^{2}\mathrm{O}^{3\,T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	5-10 cm, Sample 3	162	19	28	126	33	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 4	168	16	28	131	28	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 5	151	19	28	125	27	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 6	177	18	34	142	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 7	166	17	28	131	35	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 8	175	19	31	137	36	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 9	157	22	31	141	32	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 10	170	20	31	143	37	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 11	159	20	28	125	30	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 12	158	19	31	141	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 13	156	19	32	133	34	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 14	156	30	31	139	32	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 15	160	19	28	129	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 16	171	21	32	137	35	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 17	165	20	28	129	29	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 18	156	18	32	130	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 19	154	19	31	133	34	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 20	170	23	28	143	37	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 21	175	22	30	144	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 22	162	19	28	139	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	5-10 cm, Sample 23	175	18	32	136	30	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 24	167	19	32	135	33	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	5-10 cm, Sample 25	160	19	30	138	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 1	163	18	27	133	32	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 2	158	17	30	129	33	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 3	151	20	28	131	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 4	155	18	28	142	33	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 5	168	21	31	136	34	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 6	170	20	31	140	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 7	169	21	31	136	32	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 8	170	18	31	135	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 9	172	18	33	141	33	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 10	161	19	30	140	33	NM	NM	40	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 11	154	19	29	129	35	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 12	170	22	31	141	34	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 13	171	22	31	141	35	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 14	174	18	33	140	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 15	177	22	31	138	37	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 16	176	22	32	142	34	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 17	175	19	31	139	35	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	10-15 cm, Sample 18	163	18	29	131	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 19	169	19	30	128	35	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 20	167	19	28	133	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 21	170	19	33	141	33	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 22	156	20	31	132	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 23	165	20	36	140	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 24	156	20	30	133	33	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	10-15 cm, Sample 25	158	19	30	132	32	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 1	183	19	34	140	35	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 2	183	22	31	150	36	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 3	173	22	31	138	32	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 4	175	18	33	139	30	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 5	166	21	32	135	35	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 6	174	22	31	143	38	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 7	164	20	28	137	34	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 8	166	19	32	140	35	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 9	178	20	31	146	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 10	166	20	31	136	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 11	174	21	30	135	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	15-20 cm, Sample 12	159	21	30	134	34	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	15-20 cm, Sample 13	169	19	28	139	34	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 14	157	16	31	130	35	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 15	177	20	30	147	33	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 16	175	18	30	134	33	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 17	168	17	35	140	34	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 18	171	18	31	136	36	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 19	167	17	33	143	36	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 20	180	20	31	145	37	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 21	171	21	29	138	34	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 22	171	20	29	137	31	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 23	172	21	30	142	36	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 24	165	19	31	134	34	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	15-20 cm, Sample 25	168	18	28	137	37	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 1	156	19	30	127	28	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 2	153	19	28	134	32	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 3	171	20	31	131	31	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 4	163	19	30	139	39	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 5	157	20	31	146	32	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 6	159	18	31	131	34	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	20-25 cm, Sample 7	152	18	30	127	35	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	20-25 cm, Sample 8	158	21	31	132	36	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 9	180	20	33	137	35	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 10	170	20	28	145	38	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 11	169	21	35	139	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 12	169	19	34	141	32	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 13	158	18	31	129	29	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 14	162	19	30	138	37	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 15	152	19	27	126	33	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 16	175	20	27	143	33	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 17	168	18	32	133	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 18	154	16	32	129	37	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 19	169	20	30	141	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 20	167	18	29	144	32	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 21	175	17	29	143	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 22	177	22	30	140	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 23	179	19	30	145	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 24	176	23	30	142	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	20-25 cm, Sample 25	183	23	33	145	36	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	25-30 cm, Sample 1	163	21	31	140	32	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	25-30 cm, Sample 2	166	18	33	133	32	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	25-30 cm, Sample 3	182	22	30	149	35	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 4	179	30	29	136	36	NM	NM	13	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 5	161	19	28	134	35	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 6	156	19	28	138	36	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 7	168	21	30	136	32	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 8	173	19	28	144	34	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 9	164	20	31	133	33	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 10	166	18	31	137	35	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 11	165	21	32	136	37	NM	NM	32	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	13	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 12	170	17	32	135	34	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 13	164	22	34	136	35	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 14	169	20	30	138	36	NM	NM	NM	NM	18	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 15	181	17	31	137	37	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 16	165	18	31	136	33	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 17	168	18	33	137	27	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 18	181	18	30	140	38	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 19	186	25	33	139	39	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 20	180	18	31	144	35	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 21	171	20	35	141	28	NM	NM	NM	NM	17	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Waucoba Springs (CAINY441)	25-30 cm, Sample 22	157	18	28	130	32	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Waucoba Springs (CAINY441)	25-30 cm, Sample 23	174	21	31	132	31	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	25-30 cm, Sample 24	181	20	31	141	34	NM	NM	NM	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Waucoba Springs (CAINY441)	25-30 cm, Sample 25	185	20	33	142	35	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	2633	261	8	55	131	44	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2634	228	6	43	106	37	NM	NM	NM	NM	43	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2661	153	20	28	128	28	NM	NM	NM	NM	18	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	2664	189	10	31	86	37	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2713a	237	10	52	129	41	NM	NM	NM	NM	53	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2713b	238	6	50	108	43	NM	NM	NM	NM	38	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2717	245	9	53	140	46	NM	NM	NM	NM	53	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798a	204	7	47	111	41	NM	NM	NM	NM	41	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798b	248	10	55	134	47	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798c	233	8	51	128	47	NM	NM	NM	NM	45	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798d	248	9	54	146	46	NM	NM	NM	NM	42	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798e	252	10	55	141	48	NM	NM	NM	NM	42	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798f	258	9	51	134	43	NM	NM	NM	NM	39	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798g	266	10	53	133	41	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798h	198	11	31	87	39	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2798i	228	5	47	107	43	NM	NM	NM	NM	36	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798j	241	11	53	136	48	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^3 ^{T}	Fe:Mn	Geochemical Source
Owens River Valley District	2798k		248	9	49	135	38	NM	NM	NM	NM	48	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798l		236	8	51	132	43	NM	NM	NM	NM	42	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798m		235	10	53	131	41	NM	NM	NM	NM	43	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2798n		192	8	32	87	39	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2827		264	3	53	129	45	NM	NM	NM	NM	46	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2842a		302	3	62	115	67	NM	NM	NM	NM	45	West Cactus Peak ,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2842b		159	19	31	138	34	NM	NM	NM	NM	19	Saline Range, Variety 1
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Owens River Valley District	2850		244	8	51	132	43	NM	NM	NM	NM	39	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2867a		191	11	31	85	38	NM	NM	NM	NM	9	Fish Springs, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2867b		126	76	21	133	29	NM	NM	307	NM	20	Saline Range, Variety 3, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2889		245	6	52	128	43	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2967		247	11	54	142	40	NM	NM	NM	NM	53	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	2978a		193	12	42	150	34	NM	NM	NM	NM	54	Joshua Ridge, Coso Volcanic Field, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2978b		198	11	26	88	40	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	2978c		147	113	17	187	12	NM	NM	1287	NM	NM	Sawmill Ridge, Casa Diablo Area, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	15	NM		
Owens River Valley District	2983		195	9	29	86	34	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	4707a		253	10	53	131	43	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	4707b		247	9	53	135	44	NM	NM	NM	NM	54	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	4707c		238	9	50	132	37	NM	NM	NM	NM	40	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	4707d		252	9	55	133	44	NM	NM	NM	NM	47	West Sugarloaf,
(Joshua Tree NP)		±	4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Owens River Valley District	4708a	254	8	54	134	44	NM	NM	NM	NM	45	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	4708b	262	8	53	144	47	NM	NM	NM	NM	42	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	4708c	260	10	50	136	49	NM	NM	NM	NM	41	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	4708d	226	7	47	109	43	NM	NM	NM	NM	43	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660a	240	7	50	126	37	NM	NM	NM	NM	38	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660b	239	8	49	132	44	NM	NM	NM	NM	38	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660c	253	9	46	131	42	NM	NM	NM	NM	46	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660d	223	8	42	111	40	NM	NM	NM	NM	38	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660e	234	8	46	111	41	NM	NM	NM	NM	37	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660f	253	10	54	142	43	NM	NM	NM	NM	52	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5660g	252	11	54	137	49	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	5662	160	22	27	131	28	NM	NM	41	NM	16	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Owens River Valley District	6257	144	43	22	117	35	NM	NM	212	NM	18	Saline Range, Variety 2, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	10	NM		
Owens River Valley District	6267a	136	85	15	171	10	NM	NM	1020	NM	50	Lookout Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	12	NM		Casa Diablo Area, CA
Owens River Valley District	6267b	256	13	50	128	44	NM	NM	NM	NM	48	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6267c	246	11	56	132	46	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6267d	158	19	23	123	30	NM	NM	NM	NM	12	Queen, CA-NV
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	6267e	151	19	28	132	34	NM	NM	NM	NM	18	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6267f	143	18	28	130	33	NM	NM	NM	NM	17	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6313	188	11	29	91	41	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Owens River Valley District	6317a	262	9	47	134	43	NM	NM	NM	NM	41	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6317b	147	18	26	129	31	NM	NM	NM	NM	18	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6327	238	7	48	107	41	NM	NM	NM	NM	43	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6437a	182	10	29	82	39	NM	NM	NM	NM	9	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	6437b	219	14	44	145	37	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6545	231	12	48	139	40	NM	NM	NM	NM	38	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6556a	265	9	52	138	48	NM	NM	NM	NM	44	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6556b	253	11	49	137	45	NM	NM	NM	NM	56	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6556c	295	6	60	114	56	NM	NM	NM	NM	44	West Cactus Peak ,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6556d	167	20	29	130	33	NM	NM	NM	NM	16	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6556e	231	13	49	142	44	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6556f	234	10	51	128	43	NM	NM	NM	NM	43	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6572a	244	9	50	135	42	NM	NM	NM	NM	55	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6572b	229	12	45	144	38	NM	NM	NM	NM	56	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6572c	203	9	31	86	38	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	6760	152	24	13	78	18	NM	NM	70	NM	17	Mt. Hicks, NV
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	10	NM		
Owens River Valley District	6568a	144	114	13	183	9	NM	NM	1118	NM	44	Sawmill Ridge, Casa Diablo Area, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	12	NM		
Owens River Valley District	6568b	129	83	20	164	13	NM	NM	958	NM	45	Lookout Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	12	NM		Casa Diablo Area, CA
Owens River Valley District	6568c	240	8	49	130	43	NM	NM	NM	NM	54	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6568d	210	13	46	154	36	NM	NM	NM	NM	61	Joshua Ridge, Coso Volcanic Field, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Owens River Valley District	6573a	144	85	23	141	28	NM	NM	305	NM	24	Saline Range, Variety 3, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	10	NM		
Owens River Valley District	6573b	138	84	18	137	23	NM	NM	325	NM	23	Saline Range, Variety 3, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	12	NM		
Owens River Valley District	6614a	156	18	28	131	34	NM	NM	NM	NM	18	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6614b	164	21	27	132	34	NM	NM	NM	NM	18	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6614c	237	6	49	109	40	NM	NM	NM	NM	43	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6614d	247	7	52	137	40	NM	NM	NM	NM	45	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6614e	245	8	51	136	46	NM	NM	NM	NM	53	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6775a	155	16	32	137	34	NM	NM	NM	NM	16	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6775b	190	10	28	91	40	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	6775c	250	7	51	138	47	NM	NM	NM	NM	46	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6775d	188	9	41	155	35	NM	NM	NM	NM	63	Joshua Ridge, Coso Volcanic Field, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	6778a	250	10	57	134	45	NM	NM	NM	NM	42	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6778b	248	10	51	136	44	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6778c	190	8	31	88	40	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	6778d	252	9	56	138	46	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6938	145	18	28	129	33	NM	NM	NM	NM	18	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6953a	229	6	45	110	40	NM	NM	NM	NM	38	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6953b	162	17	31	135	32	NM	NM	NM	NM	17	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	6954a	225	5	16	107	39	NM	NM	NM	NM	41	Sugarloaf Mountain,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	6954b	238	11	51	134	43	NM	NM	NM	NM	51	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$\mathrm{Fe}^2\mathrm{O}^{3\,T}$	Fe:Mn	Geochemical Source
Owens River Valley District	6988a	148	113	14	185	12	NM	NM	1137	NM	47	Sawmill Ridge, Casa Diablo Area, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	13	NM		
Owens River Valley District	6988b	121	177	16	104	15	NM	NM	1318	NM	21	Unknown 16
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	15	NM		
Owens River Valley District	7080	190	9	30	86	36	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	8939	193	9	30	92	41	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	26613	198	9	29	84	41	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	26614	166	20	24	122	32	NM	NM	NM	NM	11	Queen, CA-NV
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	26615a	245	11	52	133	35	NM	NM	NM	NM	42	West Sugarloaf,
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Owens River Valley District	26615b	197	8	29	87	38	NM	NM	NM	NM	8	Fish Springs, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		
Owens River Valley District	26615c	164	19	32	128	28	NM	NM	NM	NM	17	Saline Range, Variety 1
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Owens River Valley District	26616	135	85	22	132	29	NM	NM	281	NM	22	Saline Range, Variety 3, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	10	NM		
Owens River Valley District	6356a	132	50	14	94	20	NM	NM	273	NM	24	Unknown Type F
(Joshua Tree NP)		± 4	3	3	4	3	NM	NM	10	NM		
Owens River Valley District	6356b	141	117	15	187	13	NM	279	1122	0.80	48	Sawmill Ridge, Casa Diablo Area, CA
(Joshua Tree NP)		± 4	3	3	4	3	NM	12	15	0.10		
Ash Meadows/Amargosa Desert, CA/NV	Site 123-57, 9577	162	76	23	137	24	NM	NM	489	NM	28	Obsidian Butte, NV, Variety 3
(Site 12357)		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Ash Meadows/Amargosa Desert, CA/NV	Site 123-57, 9578	192	78	25	212	24	NM	NM	641	NM	NM	Shoshone Mountain, NV
(Site 12357)		± 4	3	3	4	3	NM	NM		NM		
Ash Meadows/Amargosa Desert, CA/NV	Site 148-57, 9667	142	115	16	155	14	NM	NM	694	NM	35	Obsidian Butte, NV, Variety 5
(Site 14857)		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)
Ash Meadows/Amargosa Desert, CA/NV	Site 164-56, 10824	183	75	23	195	25	NM	NM	659	NM	NM	Shoshone Mountain, NV
(Site 16456)		± 4	3	3	3	3	NM	NM	12	NM		
Ash Meadows/Amargosa Desert, CA/NV	Site 242-56, 9500	307	4	40	98	33	NM	NM	NM	NM	15	Montezuma Range, NV
(Site 24256)		± 4	3	3	4	3	NM	NM	NM	NM		
Ash Meadows/Amargosa Desert, CA/NV	Site 243-56, 9472	183	73	23	206	22	NM	NM	661	NM	45	Shoshone Mountain, NV
(Site 24356)		± 4	3	3	4	3	NM	NM	12	NM		
Ash Meadows/Amargosa Desert, CA/NV	Site 244-56, 9531	189	74	27	212	23	NM	NM	614	NM	NM	Shoshone Mountain, NV
(Site 24456)		± 4	3	3	3	3	NM	NM	12	NM		
Ash Meadows/Amargosa Desert, CA/NV	Site 244-56, 9532	174	15	46	162	33	NM	NM	92	NM	60	Kane Springs Wash Caldera
(Site 24456)		± 4	3	3	4	3	NM	NM	12	NM		Variety 1, NV

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O$^{3\,T}$	Fe:Mn	Geochemical Source
Ash Meadows/Amargosa Desert, CA/NV (CAINY669)	Iny-669, 4585		188	22	91	1115	80	939	865	19	3.39	34	Oak Spring Butte, NV
		±	4	3	3	4	3	26	18	10	0.10		
Ash Meadows/Amargosa Desert, CA/NV (Site 34456)	Site 344-56, 9537		170	77	24	197	26	NM	NM	664	NM	NM	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Panamint Range, CA (CAINY3044)	Iny-3044, 8266		186	41	38	143	28	NM	NM	272	NM	48	Unknown 5
		±	4	3	3	4	3	NM	NM	12	NM		
Panamint Range, CA (CAINY3044)	Iny-3044, 8268		240	9	55	131	45	NM	NM	NM	NM	52	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	12	NM		
Panamint Range, CA (CAINY3044)	Iny-3044, 8275		234	15	44	147	40	NM	NM	NM	NM	46	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	NM	NM		
Panamint Range, CA (CAINY3044)	Iny-3044, 8277		193	10	87	990	69	1085	1135	0	3.76	27	Oak Spring Butte, NV
		±	4	3	3	4	3	28	22	12	0.10		
Panamint Range, CA (CAINY3044)	Iny-3044, 8283		261	10	55	135	46	NM	NM	17	NM	38	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	12	NM		
Eagle Borax Mine, CA (CAINY885)	Iny-885, 10692		194	10	36	146	34	NM	NM	37	NM	59	Joshua Ridge, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	12	NM		
Furnace Creek Fan, CA (CAINY489)	Iny-489, 2443		194	73	21	212	23	NM	NM	677	NM	NM	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Furnace Creek Fan, CA (CAINY558)	Iny-558, 2644		171	70	26	195	25	NM	NM	665	NM	39	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Furnace Creek Fan, CA (CAINY593)	Iny-593, 2730		254	7	54	137	45	NM	NM	NM	NM	49	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	NM	NM		
Furnace Creek Fan, CA (CAINY616)	Iny-616, 4198		261	10	52	139	45	NM	NM	NM	NM	53	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	NM	NM		
Furnace Creek Fan, CA (CAINY639)	Iny-639, 4235		182	120	37	155	30	NM	NM	593	NM	26	Tempiute Mountain, NV
		±	4	3	3	4	3	NM	NM	15	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35477		170	74	27	191	17	NM	NM	604	NM	38	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35484		159	17	31	128	36	NM	NM	50	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		±	4	3	3	4	3	NM	NM	12	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35486		166	79	25	132	20	NM	NM	492	NM	31	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		±	4	3	3	4	3	NM	NM	12	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35487		168	60	25	124	26	NM	NM	288	NM	28	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		±	4	3	3	4	3	NM	NM	12	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35495		169	89	27	143	21	NM	NM	474	NM	30	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		±	4	3	3	4	3	NM	NM	15	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35505		131	79	16	158	11	NM	NM	1001	NM	NM	Lookout Mountain, Casa Diablo Area, CA
		±	4	3	3	4	3	NM	NM	15	NM		
Grapevine Canyon Rockshelter (CAINY378)	Iny-378, DEVA 35508		183	37	21	111	26	NM	NM	175	NM	24	Wild Horse Canyon, UT
		±	4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Geochemical Source
Grapevine Mountains, CA	BRS 2, 7919	156	17	27	132	34	NM	NM	48	NM	21	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Grapevine Mountains, CA	BRS 2, 7920	164	58	25	126	26	NM	NM	294	NM	25	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	12	NM		(Airfield Canyon)
Grapevine Mountains, CA	GRV 6, 7574	185	77	24	208	20	NM	NM	635	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Grapevine Mountains, CA	GRV 6, 7582	166	80	25	136	22	NM	NM	534	NM	32	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Grapevine Mountains, CA	GRV 34, 7545	186	77	23	202	23	NM	NM	644	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Grapevine Mountains, CA	GRV 34, 7604	164	27	33	131	34	NM	NM	52	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Mesquite Flat (CAINY955)	Iny-955, 6580	147	16	28	123	36	NM	NM	46	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Mesquite Flat (CAINY955)	Iny-955, 6610	161	80	23	143	26	NM	NM	477	NM	27	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Mesquite Flat (CAINY955)	Iny-955, 6640	169	22	32	133	35	NM	NM	NM	NM	22	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Mesquite Flat (CAINY960)	Iny-960, 6041	158	89	24	144	21	NM	NM	543	NM	30	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Mesquite Flat (CAINY1040)	Iny-1040, 6618	166	22	30	139	33	NM	NM	41	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Mesquite Flat CAINY1098	Iny-1068, 6660	233	6	49	111	45	NM	NM	NM	NM	44	Sugarloaf Mountain,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Mesquite Flat (CAINY1101)	Iny-1101, 6334	191	22	30	85	39	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Flat (CAINY1101)	Iny-1101, 6387	136	82	21	134	29	NM	NM	313	NM	21	Saline Range, Variety 3, CA
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Flat (CAINY1101)	Iny-1101, 6513	228	7	50	111	45	NM	NM	NM	NM	43	Sugarloaf Mountain,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Mesquite Flat (CAINY1106)	Iny-1106, 6333	137	84	21	129	31	NM	NM	314	NM	20	Saline Range, Variety 3, CA
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Flat (CAINY1106)	Iny-1106, 6507	158	18	30	126	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Mesquite Flat (CAINY1107)	Iny-1107, 6581	155	18	28	129	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Mesquite Flat (CAINY1192)	Iny-1192, 6379	224	8	45	111	41	NM	NM	NM	NM	43	Sugarloaf Mountain,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Mesquite Flat (CAINY1192)	Iny-1198, 6664	254	8	52	134	49	NM	NM	NM	NM	50	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Mesquite Flat (CAINY1201)	Iny-1201, 6332	188	78	25	205	28	NM	NM	703	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Flat (CAINY1201)	Iny-1201, 6383	162	81	26	143	22	NM	NM	504	NM	34	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	15	NM		(Obsidian Butte)
Mesquite Flat (CAINY1203)	Iny-1203, 6542	167	19	32	143	36	NM	NM	50	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Mesquite Flat (CAINY1251)	Iny-1251, 6406	238	10	50	130	42	NM	NM	NM	NM	47	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Mesquite Flat (CAINY1258)	Iny-1258, 6375	189	79	28	215	27	NM	NM	596	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Flat (CAINY1258)	Iny-1258, 6596	165	56	28	124	22	NM	NM	300	NM	29	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	10	NM		(Airfield Canyon)
Mesquite Flat (CAINY1267)	Iny-1267, 6348	194	75	24	203	25	NM	NM	663	NM	38	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Flat (CAINY1267)	Iny-1267, 6371	179	74	27	199	23	NM	NM	668	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	16	NM		
Mesquite Flat (CAINY1274)	Iny-1274, 6389	196	22	92	1165	80	NM	868	NM	3.36	35	Oak Spring Butte, NV
		± 4	3	3	4	3	NM	20	NM	0.10		
Mesquite Flat (CAINY1281)	Iny-1281, 6411	196	78	28	213	25	NM	NM	678	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Flat (CAINY1282)	Iny-1282, 6373	194	80	26	220	27	NM	NM	700	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Flat (CAINY1293)	Iny-1293, 6631	177	78	23	202	22	NM	NM	685	NM	42	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Flat (CAINY1295)	Iny-1295, 6395	135	81	20	129	NA	NM	NM	302	NM	20	Saline Range, Variety 3, CA
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Flat (CAINY3303)	Iny-3303, 6380	231	10	49	126	39	NM	NM	NM	NM	44	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Mesquite Flat (CAINY3305)	Iny-3305, 6346	233	11	56	129	44	NM	NM	NM	NM	53	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Mesquite Flat (CAINY3306)	Iny-3306, 6366	187	122	31	152	27	NM	NM	550	NM	27	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Flat	Isolate, 6693	240	6	45	115	46	NM	NM	NM	NM	36	Sugarloaf Mountain,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Little Grapevine Creek, CA (CAINY3012)	Iny-3012, DEVA 34534	153	19	28	124	31	NM	NM	21	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Little Grapevine Creek, CA (CAINY3019)	Iny-3019, DEVA 34505sh	159	18	28	128	31	NM	NM	24	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Little Grapevine Creek, CA (CAINY3019)	Iny-3019, DEVA 34505cn	143	114	17	153	15	NM	NM	738	NM	30	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	12	NM		(Unknown C)

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3\,T}$	Fe:Mn	Geochemical Source
Grapevine Mountains, NV (26NY1641)	Ny1641, DEVA 44269	158	54	25	117	23	NM	NM	302	NM	33	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	12	NM		(Airfield Canyon)
Grapevine Mountains, NV (26NY1641)	Ny1641, DEVA 44271	153	50	25	113	23	NM	NM	325	NM	23	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	11	NM		(Airfield Canyon)
Grapevine Mountains, NV (26NY1640)	Ny1640, DEVA 44265	147	125	20	159	14	NM	NM	800	NM	29	Obsidian Butte, NV, Variety 5
		± 4	3	3	4	3	NM	NM	13	NM		(Unknown C)
Grapevine Mountains, NV (26NY1634)	Ny1634, DEVA 44254	165	53	25	121	21	NM	NM	335	NM	26	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	10	NM		(Airfield Canyon)
Grapevine Mountains, NV (26NY1634)	Ny1634, DEVA 44133	150	94	23	155	21	NM	NM	673	NM	32	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Grapevine Mountains, NV (26NY1634)	Ny1634, DEVA 44147	295	5	44	96	34	NM	NM	9	NM	15	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Grapevine Mountains, NV (26NY1634)	Ny1634, DEVA 44129	160	81	23	142	24	NM	NM	544	NM	32	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	13	NM		(Obsidian Butte)
Grapevine Mountains, NV (26NY1634)	Ny1634, DEVA 44253	162	20	31	132	35	NM	NM	11	NM	16	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	10	NM		(Queen Impostor), CA
Grapevine Mountains, NV (26NY1641)	Ny1641, DEVA 44270	188	19	82	991	61	1470	1282	3	4.29	31	Oak Spring Butte, NV
		± 4	3	3	4	3	30	22	12	0.10		
Grapevine Mountains, NV	Isolate, DEVA 44272	159	91	23	141	20	NM	NM	526	NM	27	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Escalante Valley Sites (42WS2613)	42Ws2613, FS-128	195	75	25	119	22	NM	NM	532	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	15	NM		
Escalante Valley Sites (42WS2615)	42Ws2615, FS-6	175	71	28	117	21	NM	NM	493	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Escalante Valley Sites (42WS2615)	42Ws2615, FS-7	188	72	29	119	20	NM	NM	484	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Escalante Valley Sites (42WS2615)	42Ws2615, FS-9	186	73	29	122	20	NM	NM	506	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Escalante Valley Sites (42WS2615)	42Ws2615, FS35	182	76	27	122	21	NM	NM	493	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Escalante Valley Sites (42WS2615)	42Ws2615, FS-115	191	84	26	121	21	NM	NM	537	NM	NM	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	14	NM		
Deep Springs Valley, CA	354-186	209	9	28	92	45	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-203	197	13	43	152	40	NM	NM	NM	NM	53	Joshua Ridge, Coso Volcanic Field, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-263	164	19	31	133	32	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-264	205	10	29	89	42	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Deep Springs Valley, CA	354-522	168	21	27	118	32	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-582	194	10	34	87	41	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-609	162	18	28	129	33	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-660	200	9	30	82	36	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-662	213	9	32	93	42	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-894	165	24	32	127	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-923	138	89	16	167	14	849	255	NM	1.33	53	Lookout Mountain,
		± 4	3	3	4	3	28	15	NM	0.10		Casa Diablo Area, CA
Deep Springs Valley, CA	354-924	201	9	26	89	42	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-979	199	10	26	86	43	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-991	175	21	28	137	37	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1015	169	21	23	125	35	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1052	214	11	29	86	43	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-93	199	8	31	84	39	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-111	210	12	30	89	41	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-130	174	21	34	132	37	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-201	211	9	29	90	42	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-202	186	20	33	142	38	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-519	170	21	30	132	30	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-556	209	9	33	90	45	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-557	159	5	20	89	22	472	253	NM	0.81	24	Mono Glass Mountain, CA
		± 4	3	3	4	3	23	13	NM	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Deep Springs Valley, CA	354-578	182	20	23	128	36	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-659	322	4	44	98	36	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-921	188	19	32	142	34	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-922	214	11	30	94	43	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-973	177	20	29	135	34	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-990	207	10	30	85	43	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1006	178	19	32	139	34	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1051	184	21	30	144	39	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1123	180	18	30	145	34	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1131	175	21	34	137	35	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1182	204	9	33	88	43	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1249	168	20	31	141	38	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-61	168	20	30	137	38	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-96	165	18	30	128	37	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-97	178	64	11	90	19	710	394	152	0.88	17	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	24	14	12	0.10		
Deep Springs Valley, CA	354-199	142	85	16	175	15	889	271	1074	1.29	45	Lookout Mountain,
		± 4	3	3	4	3	33	16	15	0.10		Casa Diablo Area, CA
Deep Springs Valley, CA	354-308	193	9	29	93	40	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-418	149	100	24	159	23	904	337	677	1.23	32	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	28	14	15	0.10		(Obsidian Butte)
Deep Springs Valley, CA	354-453	203	9	30	90	43	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-558	178	20	30	136	34	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Deep Springs Valley, CA	354-610	202	9	28	83	39	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-963	199	17	31	89	40	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1190	162	20	23	127	36	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1191	171	19	20	120	34	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1198	147	86	16	178	12	1083	296	NM	1.39	NM	Lookout Mountain,
		± 4	3	3	4	3	30	14	NM	0.10		Casa Diablo Area, CA
Deep Springs Valley, CA	354-429	215	8	31	90	40	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1162	144	88	17	173	14	1041	287	NM	1.35	52	Lookout Mountain,
		± 4	3	3	4	3	28	14	NM	0.10		Casa Diablo Area, CA
Deep Springs Valley, CA	354-62	162	13	31	134	36	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-66	144	118	18	192	15	1235	282	NM	1.36	46	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	31	14	NM	0.10		
Deep Springs Valley, CA	354-229	204	10	30	87	42	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-261	147	117	16	183	11	1177	285	NM	1.37	49	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	30	14	NM	0.10		
Deep Springs Valley, CA	354-309	184	4	27	86	26	514	272	NM	0.88	31	Mono Glass Mountain, CA
		± 4	3	3	4	3	23	13	NM	0.10		
Deep Springs Valley, CA	354-310	170	4	28	88	23	499	272	NM	0.85	28	Mono Glass Mountain, CA
		± 4	3	3	4	3	26	12	NM	0.10		
Deep Springs Valley, CA	354-365	177	21	24	130	34	NM	NM	NM	NM	12	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-967	201	10	28	95	42	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1130	213	11	29	87	43	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1166	329	5	42	97	37	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1245	315	4	43	98	38	NM	NM	NM	NM	14	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-7	178	27	27	135	27	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-16	156	23	29	128	36	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Deep Springs Valley, CA	354-34	165	21	31	138	31	NM	NM	NM	NM	20	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-47	164	19	29	132	29	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-450	166	20	29	131	35	NM	NM	NM	NM	17	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-489	208	10	30	93	41	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-580	201	9	30	91	42	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-654	197	10	31	85	38	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-718	166	27	22	124	34	NM	NM	NM	NM	13	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-748	133	119	15	189	11	1157	270	1274	1.35	54	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	30	14	18	0.10		
Deep Springs Valley, CA	354-774	181	80	11	87	16	851	420	177	1.00	19	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	26	14	12	0.10		
Deep Springs Valley, CA	354-783	177	22	24	129	34	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-917	156	18	30	132	33	NM	NM	NM	NM	18	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1073	176	39	21	103	19	NM	NM	181	NM	22	Wild Horse Canyon, UT
		± 4	3	3	4	3	NM	NM	12	NM		
Deep Springs Valley, CA	354-1155	161	87	26	136	18	NM	NM	452	NM	25	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	15	NM		(Obsidian Butte)
Deep Springs Valley, CA	354-1291	197	11	27	90	36	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-448	167	18	29	137	28	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Deep Springs Valley, CA	354-1002	266	7	51	133	43	NM	NM	NM	NM	45	West Sugarloaf,
		± 4	3	3	4	3	NM	NM	NM	NM		Coso Volcanic Field, CA
Deep Springs Valley, CA	354-1013	201	10	27	87	40	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1179	156	119	17	191	11	NM	NM	1168	NM	46	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	NM	NM	15	NM		
Deep Springs Valley, CA	354-1199	145	87	16	173	16	NM	NM	1052	NM	50	Lookout Mountain,
		± 4	3	3	4	3	NM	NM	15	NM		Casa Diablo Area, CA
Deep Springs Valley, CA	354-749	190	70	9	95	13	833	425	157	0.97	20	Silverpeak/Fish Lake Valley, NV
		± 4	3	3	4	3	27	15	12	0.10		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2O^{3\,T}$	Fe:Mn	Geochemical Source
Deep Springs Valley, CA	354-827	191	11	32	84	43	NM	NM	NM	NM	9	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1	321	5	43	105	41	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-2	151	116	16	194	16	1274	276	1196	1.37	46	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	29	13	15	0.10		
Deep Springs Valley, CA	354-695	150	117	20	156	13	1039	381	738	1.38	33	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	28	14	15	0.10		
Deep Springs Valley, CA	354-794	147	88	17	171	12	1132	320	NM	1.45	50	Lookout Mountain, Casa Diablo Area, CA
		± 4	3	3	4	3	31	15	NM	0.10		
Deep Springs Valley, CA	354-495	161	18	21	116	32	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-705	173	19	31	129	34	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-750	181	3	26	92	26	424	253	NM	0.81	25	Mono Glass Mountain, CA
		± 4	3	3	4	3	25	12	NM	0.10		
Deep Springs Valley, CA	354-884	179	21	31	140	31	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1080	148	82	18	180	11	NM	NM	1033	NM	49	Lookout Mountain, Casa Diablo Area, CA
		± 4	3	3	4	3	NM	NM	15	NM		
Deep Springs Valley, CA	354-1175	145	87	15	173	13	NM	NM	1001	NM	54	Lookout Mountain, Casa Diablo Area, CA
		± 4	3	3	4	3	NM	NM	15	NM		
Deep Springs Valley, CA	354-1218	204	9	28	92	39	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-651	167	20	23	124	37	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1090	325	5	46	102	36	NM	NM	NM	NM	13	Montezuma Range, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1158	167	19	29	131	37	NM	NM	NM	NM	20	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1170	171	19	31	129	30	NM	NM	NM	NM	19	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-1171	153	122	17	194	8	NM	NM	1090	NM	51	Sawmill Ridge, Casa Diablo Area, CA
		± 4	3	3	4	3	NM	NM	15	NM		
Deep Springs Valley, CA	354-877	166	20	22	121	30	NM	NM	NM	NM	11	Queen, CA-NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-92	163	18	32	129	34	NM	NM	NM	NM	16	Saline Range, Variety 1 (Queen Impostor), CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-611	200	8	26	86	41	NM	NM	NM	NM	8	Fish Springs, CA
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-3. Results of XRF Studies: Western Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3\,T}$	Fe:Mn	Geochemical Source
Deep Springs Valley, CA	354-841		201	12	27	85	41	NM	NM	NM	NM	9	Fish Springs, CA
		±	4	3	3	4	3	NM	NM	NM	NM		
Deep Springs Valley, CA	354-699		150	92	19	180	10	NM	327	1007	1.43	55	Lookout Mountain,
		±	4	3	3	4	3	NM	14	15	0.10		Casa Diablo Area, CA

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-4. Results of XRF Studies: Southern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Mesquite Valley District (Joshua Tree NP)	2625	168	90	26	98	25	NM	NM	337	NM	13	Devil Peak East, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Valley District (Joshua Tree NP)	2626	147	204	27	138	20	NM	NM	NM	NM	19	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	2627	157	231	27	142	24	NM	NM	647	NM	17	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Valley District (Joshua Tree NP)	26619a	174	39	33	152	22	NM	NM	1061	NM	47	Unknown 12
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Valley District (Joshua Tree NP)	26619b	171	146	27	119	24	NM	NM	992	NM	17	Bagdad (Bristol Mountains), CA
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Valley District (Joshua Tree NP)	26619c	147	237	26	143	21	NM	NM	NM	NM	19	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	26619d	202	80	24	209	24	NM	NM	NM	NM	38	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	26619e	167	227	25	143	25	NM	NM	NM	NM	20	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	26619f	190	80	26	114	16	NM	NM	1187	NM	32	Unknown 13
		± 4	3	3	4	3	NM	NM	18	NM		
Mesquite Valley District (Joshua Tree NP)	26619g	196	78	24	215	25	NM	NM	NM	NM	38	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	26619h	152	9	44	428	38	NM	NM	830	NM	17	Hackberry Mountain, CA
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Valley District (Joshua Tree NP)	26619i	180	19	47	160	32	NM	NM	595	NM	55	Unknown 9
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Valley District (Joshua Tree NP)	26619j	175	148	27	116	22	NM	NM	1127	NM	17	Bagdad (Bristol Mountains), CA
		± 4	3	3	4	3	NM	NM	18	NM		
Mesquite Valley District (Joshua Tree NP)	2451	157	226	26	141	23	NM	NM	NM	NM	20	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	2452	186	42	26	144	27	NM	NM	1017	NM	44	Unknown 12
		± 4	3	3	4	3	NM	NM	15	NM		
Mesquite Valley District (Joshua Tree NP)	2453	118	177	22	123	18	NM	NM	1309	NM	26	Unknown 16
		± 4	3	3	4	3	NM	NM	18	NM		
Mesquite Valley District (Joshua Tree NP)	2454	165	241	29	142	23	NM	NM	NM	NM	20	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	2455	163	222	25	142	19	NM	NM	NM	NM	20	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	2456	137	117	24	105	20	NM	NM	723	NM	15	Unknown 10
		± 4	3	3	4	3	NM	NM	12	NM		
Mesquite Valley District (Joshua Tree NP)	2457	165	250	27	145	22	NM	NM	NM	NM	20	Devil Peak West, NV
		± 4	3	3	4	3	NM	NM	NM	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-4. Results of XRF Studies: Southern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3{}^T$	Fe:Mn	Geochemical Source
Mesquite Valley District (Joshua Tree NP)	2458		186	148	28	121	23	NM	NM	1240	NM	17	Bagdad (Bristol Mountains), CA
		±	4	3	3	4	3	NM	NM	15	NM		
Mesquite Valley District (Joshua Tree NP)	2459		150	201	26	137	22	NM	NM	NM	NM	18	Devil Peak West, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	2460		178	150	27	119	22	NM	NM	1066	NM	16	Bagdad (Bristol Mountains), CA
		±	4	3	3	4	3	NM	NM	18	NM		
Mesquite Valley District (Joshua Tree NP)	2461		151	218	27	139	23	NM	NM	NM	NM	21	Devil Peak West, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	2462		144	204	23	131	20	NM	NM	NM	NM	18	Devil Peak West, NV
		±	4	3	3	4	3	NM	NM	NM	NM		
Mesquite Valley District (Joshua Tree NP)	7902		188	73	22	207	19	NM	NM	732	NM	39	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	15	NM		
Mesquite Spring (Joshua Tree NP)	1391		137	12	131	275	36	NM	NM	402	NM	50	Obsidian Butte, CA
		±	4	3	3	4	3	NM	NM	15	NM		
Mesquite Spring (Joshua Tree NP)	26624		253	6	204	289	274	NM	NM	14	NM	64	Big Southern Butte, ID
		±	4	3	3	4	3	NM	NM	10	NM		
Crucero District (Joshua Tree NP)	9021		187	136	20	120	20	NM	NM	NM	NM	22	Bagdad (Bristol Mountains), CA
		±	4	3	3	4	3	NM	NM	NM	NM		
Crucero District (Joshua Tree NP)	9036		155	222	24	147	19	NM	NM	706	NM	20	Devil Peak West, NV
		±	4	3	3	4	3	NM	NM	13	NM		
Paradise River Valley District (Joshua Tree NP)	4952a		219	9	43	130	41	NM	NM	28	NM	47	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	10	NM		
Paradise River Valley District (Joshua Tree NP)	4952b		150	28	13	80	18	NM	NM	59	NM	16	Mt. Hicks, NV
		±	4	3	3	4	3	NM	NM	10	NM		
Paradise River Valley District (Joshua Tree NP)	26610		231	9	50	130	47	NM	NM	30	NM	56	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	10	NM		
Paradise River Valley District (Joshua Tree NP)	26611a		214	7	45	103	43	NM	NM	30	NM	52	Sugarloaf Mountain, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	10	NM		
Paradise River Valley District (Joshua Tree NP)	26611b		171	9	38	149	32	NM	NM	30	NM	50	Joshua Ridge, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	10	NM		
Paradise River Valley District (Joshua Tree NP)	26612a		6	40	4	13	1	NM	NM	20	NM	116	Not Obsidian
		±	4	3	3	4	3	NM	NM	10	NM		
Paradise River Valley District (Joshua Tree NP)	26612b		224	7	47	126	43	NM	NM	57	NM	44	West Sugarloaf, Coso Volcanic Field, CA
		±	4	3	3	4	3	NM	NM	10	NM		
Joshua Tree National Park District (Joshua Tree NP)	245		136	19	128	343	36	NM	NM	453	NM	54	Obsidian Butte, CA
		±	4	3	3	4	3	NM	NM	12	NM		
Joshua Tree National Park District (Joshua Tree NP)	285		0	23	1	13	1	NM	NM	NM	NM	NM	Not Obsidian
		±	4	3	3	4	3	NM	NM	NM	NM		
Joshua Tree National Park District (Joshua Tree NP)	7833a		187	6	65	170	93	NM	NM	3	NM	18	Unknown 1
		±	4	3	3	4	3	NM	NM	10	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-4. Results of XRF Studies: Southern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Geochemical Source
Joshua Tree National Park District (Joshua Tree NP)	7833b	137	24	14	78	12	51	NM	60	NM	19	Mt. Hicks, NV
		± 4	3	3	4	3	51	NM	10	NM		
Joshua Tree National Park District (Joshua Tree NP)	7833c	144	10	42	155	47	620	388	29	1.25	27	Cerro del Medio, NM
		± 4	3	3	4	3	620	388	10	1.25		
Sarcobatus Flat District (Joshua Tree NP)	5190a	161	81	24	141	26	NM	NM	459	NM	30	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	12	NM		
Sarcobatus Flat District (Joshua Tree NP)	5190b	190	78	27	130	15	NM	NM	449	NM	28	Obsidian Butte, NV, Variety 3 (Obsidian Butte)
		± 4	3	3	4	3	NM	NM	12	NM		
Sarcobatus Flat District (Joshua Tree NP)	5190c	155	125	20	163	20	NM	NM	766	NM	29	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	12	NM		
Sarcobatus Flat District (Joshua Tree NP)	5190d	166	56	25	121	23	NM	NM	299	NM	29	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	12	NM		
Sarcobatus Flat District (Joshua Tree NP)	5190e	163	58	28	123	25	NM	NM	286	NM	29	Obsidian Butte, NV, Variety 2 (Airfield Canyon)
		± 4	3	3	4	3	NM	NM	12	NM		
Surprise Spring District (Joshua Tree NP)	5236a	156	113	20	136	21	NM	NM	713	NM	26	Obsidian Butte, NV, Variety 5 (Unknown C)
		± 4	3	3	4	3	NM	NM	12	NM		
Surprise Spring District (Joshua Tree NP)	5236b	0	2	1	9	1	NM	NM	3	NM	13	Not Obsidian
		± 4	3	3	4	3	NM	NM	10	NM		
Desert Queen Ranch (Joshua Tree NP)	19675	134	15	128	279	32	NM	NM	408	NM	57	Obsidian Butte, CA
		± 4	3	3	4	3	NM	NM	12	NM		
Saratoga Springs District (Joshua Tree NP)	26621	248	11	52	129	43	NM	NM	NM	NM	44	West Sugarloaf, Coso Volcanic Field, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Hinkley District (Joshua Tree NP)	26617	116	179	24	42	25	NM	NM	570	NM	12	Unknown 8
		± 4	3	3	4	3	NM	NM	12	NM		
Chiriaco Summit (Joshua Tree NP)	25178	123	38	101	367	26	NM	NM	523	NM	NM	Obsidian Butte, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Tule Springs District (Joshua Tree NP)	5273	170	20	49	163	30	NM	NM	77	NM	51	Kane Springs Wash Caldera Variety 1, NV
		± 4	3	3	4	3	NM	NM	10	NM		
Panaca Hill District (Joshua Tree NP)	4865	186	77	27	125	20	NM	NM	462	NM	30	Panaca Summit (Modena area), NV-UT
		± 4	3	3	4	3	NM	NM	12	NM		
Newberry Spring District (Joshua Tree NP)	7977	241	7	48	132	46	NM	NM	NM	NM	40	West Sugarloaf, Coso Volcanic Field, CA
		± 4	3	3	4	3	NM	NM	NM	NM		
Oasis of Mara (Joshua Tree NP)	24772	146	6	44	159	53	616	385	37	1.16	26	Cerro del Medio, NM
		± 4	3	3	4	3	18	10	10	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-1	184	122	34	159	28	NM	NM	591	NM	27	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-2	181	82	25	206	27	NM	NM	673	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-6	185	82	25	200	23	NM	NM	603	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-4. Results of XRF Studies: Southern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Tippipah Spring (26NY3)	26Ny3, 12-10-7	182	17	84	941	66	1451	1117	NM	3.96	29	Oak Spring Butte, NV
		± 4	3	3	4	3	31	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-9	166	84	25	141	23	NM	NM	484	NM	34	Obsidian Butte, NV, Variety 3
		± 4	3	3	4	3	NM	NM	11	NM		(Obsidian Butte)
Tippipah Spring (26NY3)	26Ny3, 12-10-11	173	21	84	947	67	1162	1180	NM	3.77	30	Oak Spring Butte, NV
		± 4	3	3	4	3	28	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-14	165	18	80	974	66	1130	1144	NM	3.72	29	Oak Spring Butte, NV
		± 4	3	3	4	3	27	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-15	198	78	25	213	26	NM	NM	667	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-16	178	75	25	203	25	NM	NM	699	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-17	203	80	25	215	27	NM	NM	675	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-20	198	77	23	214	24	NM	NM	600	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-22	181	77	30	206	37	NM	NM	645	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-23	191	81	23	208	27	NM	NM	653	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-24	184	80	26	205	25	NM	NM	689	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-26	177	59	25	125	18	NM	NM	291	NM	NM	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	10	NM		(Airfield Canyon)
Tippipah Spring (26NY3)	26Ny3, 12-10-27	192	85	27	212	26	NM	NM	674	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-29	201	89	33	224	30	NM	NM	687	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-30	197	79	28	212	28	NM	NM	653	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-32	185	78	25	204	24	NM	NM	670	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-34	185	26	66	766	56	860	670	NM	2.35	27	South Kawich Range, NV
		± 4	3	3	4	3	22	16	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-37	162	104	27	163	19	NM	NM	677	NM	34	Obsidian Butte, NV, Variety 4
		± 4	3	3	4	3	NM	NM	12	NM		(Obsidian Butte)
Tippipah Spring (26NY3)	26Ny3, 12-10-39	167	56	28	119	24	NM	NM	316	NM	30	Obsidian Butte, NV, Variety 2
		± 4	3	3	4	3	NM	NM	12	NM		(Airfield Canyon)
Tippipah Spring (26NY3)	26Ny3, 12-10-41	188	77	22	207	26	NM	NM	636	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-4. Results of XRF Studies: Southern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

		Trace Element Concentrations									Ratio	
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^{2}O^{3T}	Fe:Mn	Geochemical Source
Tippipah Spring (26NY3)	26Ny3, 12-10-43	196	82	25	218	25	NM	NM	659	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-49	198	78	26	212	26	NM	NM	687	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-51	164	18	31	133	34	NM	NM	NM	NM	19	Saline Range, Variety 1
		± 4	3	3	4	3	NM	NM	NM	NM		(Queen Impostor), CA
Tippipah Spring (26NY3)	26Ny3, 12-10-53	189	76	27	208	27	NM	NM	667	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-56	197	84	26	208	25	NM	NM	693	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	15	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-59	195	28	93	1161	81	NM	NM	NM	NM	35	Oak Spring Butte, NV
		± 4	3	3	4	3	NM	NM	NM	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-61	193	25	88	1156	73	1049	837	NM	3.38	34	Oak Spring Butte, NV
		± 4	3	3	4	3	25	15	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-65	191	78	27	207	27	NM	NM	635	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-66	191	80	25	209	26	NM	NM	690	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	13	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-68	181	19	83	978	64	1335	1244	NM	4.10	27	Oak Spring Butte, NV
		± 4	3	3	4	3	28	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-70	187	75	27	203	29	NM	NM	657	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-74	180	71	24	202	28	NM	NM	667	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	14	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-79	180	77	25	206	25	NM	NM	685	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-82	185	117	30	155	26	NM	NM	557	NM	26	Tempiute Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-83	184	50	24	218	25	NM	NM	682	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-84	189	75	25	204	22	NM	NM	645	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-89	182	77	25	199	23	NM	NM	660	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-90	183	21	83	982	67	1230	1283	NM	4.10	27	Oak Spring Butte, NV
		± 4	3	3	4	3	28	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-92	188	80	25	216	26	NM	NM	672	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-93	183	76	25	210	27	NM	NM	639	NM	NM	Shoshone Mountain, NV
		± 4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.

Table D-4. Results of XRF Studies: Southern Great Basin Artifacts, Nellis Obsidian II Project, Nevada

			Trace Element Concentrations									Ratio	
Site	Catalog No.		Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Geochemical Source
Tippipah Spring (26NY3)	26Ny3, 12-10-95		181	17	69	750	59	918	789	NM	2.63	28	South Kawich Range, NV
		±	4	3	3	4	3	25	19	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-97		193	82	24	206	29	NM	NM	686	NM	NM	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-98		173	20	87	948	68	1292	1200	NM	4.05	29	Oak Spring Butte, NV
		±	4	3	3	4	3	28	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-99		185	20	88	984	72	1323	1211	NM	4.10	28	Oak Spring Butte, NV
		±	4	3	3	4	3	28	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-100		174	21	83	948	66	1139	1197	NM	3.93	30	Oak Spring Butte, NV
		±	4	3	3	4	3	27	11	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-105		192	88	26	211	25	NM	NM	695	NM	NM	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-292		176	118	30	150	29	NM	441	629	1.39	26	Tempiute Mountain, NV
		±	4	3	3	4	3	NM	12	12	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-295		184	71	26	199	25	NM	NM	658	NM	NM	Shoshone Mountain, NV
		±	4	3	3	4	3	NM	NM	12	NM		
Tippipah Spring (26NY3)	26Ny3, 12-10-300		176	20	84	963	70	1299	1248	NM	4.11	29	Oak Spring Butte, NV
		±	4	3	3	4	3	29	12	NM	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-390		183	96	11	98	15	681	353	596	0.76	17	Bodie Hills, CA
		±	4	3	3	4	3	19	12	12	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-463		134	76	18	68	21	582	409	428	0.82	16	Unknown 6
		±	4	3	3	4	3	18	11	10	0.10		
Tippipah Spring (26NY3)	26Ny3, 12-10-464		186	99	12	99	10	NM	NM	577	NM	15	Bodie Hills, CA
		±	4	3	3	4	3	NM	NM	12	NM		

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = 600 seconds livetime.