OFFICE OF PUBLIC ARCHAEOLOGY
BRIGHAM YOUNG UNIVERSITY

Lincoln County Archaeological Initiative

Research Design

Obsidian Crossroads: An Archaeological Investigation of the Panaca Summit/ Modena Obsidian Source in Lincoln County, Nevada

OVERVIEW

The Office of Public Archaeology (OPA) has been awarded funding through Round Four of the Lincoln County Archaeological Initiative (LCAI). The OPA proposal, as the title above indicates, is focused on an examination of the Panaca Summit/ Modena (hereafter PS/M) obsidian source location in Lincoln County, Nevada (Figures 1 and 2). The proposal specifically addressed two of the LCAI Round Four Project Priorities: 1) Formative (Fremont) Settlements in Lincoln County, Nevada, and 2) Obsidian Toolstone Source Inventory, Evaluation, Protection and Management. The following document briefly outlines the basic research questions guiding this three year project, and the methodological approach that will be used to address those research questions – in other words, what we are trying to learn, and how we will go about learning it.

In contrast to other regionally significant obsidian sources, such as the Mineral Mountains to the northeast, or Obsidian Butte to the west, little is currently known of how the PS/M obsidian source (also known as the Dry Valley and Piñon Point sources) was used in the past, when, or by whom. There is limited data to suggest that it was an important source for toolstone manufacture in particular during the Formative and Late Prehistoric periods, but more specific information regarding land and resource use during those and other periods has not been collected.

The Obsidian Crossroads project is a three-year effort to address these issues, and in particular to collect and structure basic source area information as a baseline for further studies. It is hoped that future researchers will be able to build on this baseline data and better fill in the picture of PS/M prehistoric obsidian use.

OBSIDIAN AVAILABILITY AND NATIVE AMERICAN USE

Obsidian was widely available to Native Americans from sources across much of the Great Basin. The material is found prominently in the eroded areas of calderas that formed millions of years ago, and today evidenced by ancient calderas that are spread across the Great Basin, and in particular the southern Great Basin. Wagner (2005:8) has described the Caldera cycle as follows:

> "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, risking along faults…encounters ground water near the surface and explodes, leaving craters… (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…(3) When pressure builds to a critical point in the plugged up system, a huge explosive eruption occurs,

Figure 1. Project area looking northeast.

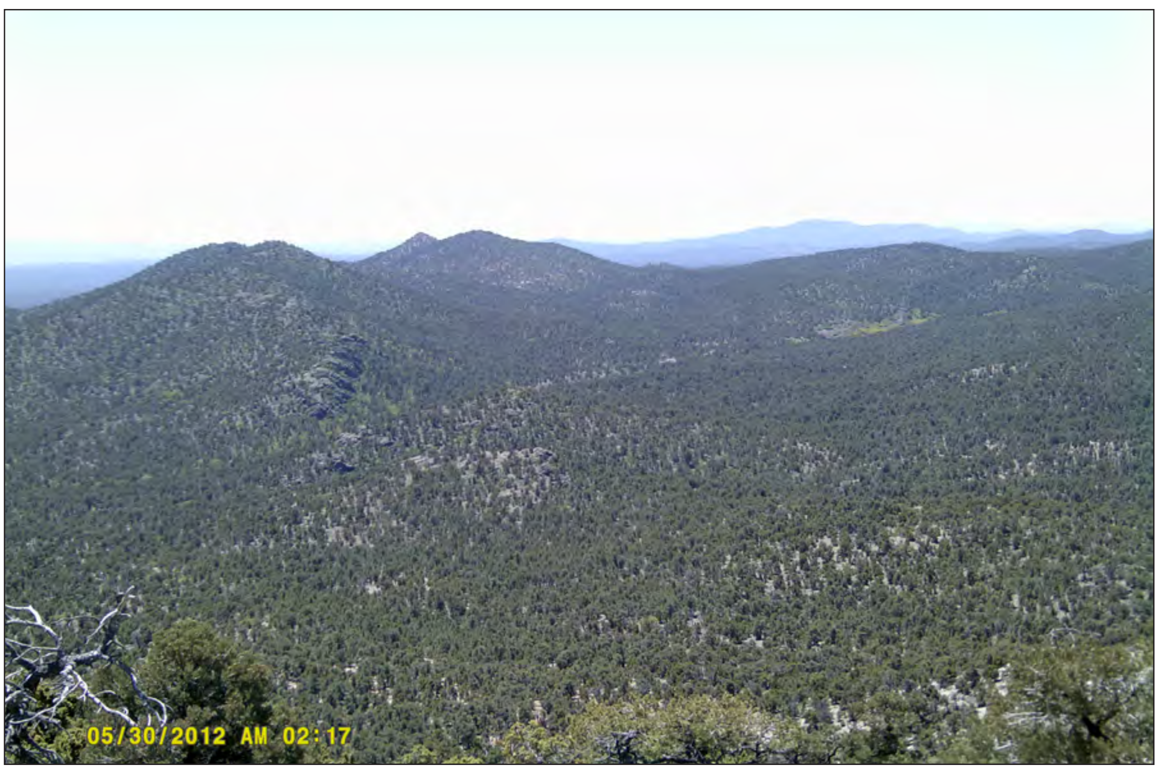

Figure 2. Project area looking south.

expelling hundreds to thousands of cubic kilometers of rock and ash in a geologic instant……, forming a caldera. A caldera is a circular depression formed when the roof of the magma chamber collapses after its contents are erupted…..(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…..

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.

Figure 3 shows various calderas, often occurring in discrete complexes, across the southern Great Basin. Of specific interest to this project is the Indian Peak Caldera Complex, which covers a large area across eastern Lincoln County, Nevada, and western Iron and Beaver Counties, Utah, but whose volcanic field spreads over a much larger area (Figure 4). Our project area is situated on the southern edge of the main Indian Peaks Caldera Complex. Best et al. (1989) have examined this caldera complex in detail, including the stratigraphic sequence of caldera development in the complex (Figure 5). A few of their conclusions are quoted below:

- The Indian Peak caldera complex is a cluster of four nested calderas and two poorly defined sources covering a present area of about 80 x 120 km. This caldera complex and related volcanic rocks are the surface manifestation of an underlying, major magmatic system that vented on the order of 10,000 km3 of magma about 32 to 27 Ma.

- Eruptions from this open magma system, which included discrete magma chambers whose size, shape, and constituents changed with time, yielded a variety of andesites, dacites, rhyolites, and trachydacite rocks that cannot have been strictly comagmatic, that is, derived from a single magma body. These rocks are calc-alkaline with low to moderate Fe/Mg ratios, low TiOz, inferred high oxygen fugacities, and,in the andesitic rocks, sizable Nb depletions. With the exception of some andesites, all are potassic with K20>Na20. Although also showing many calc-alkaline characteristics, low-silicarhyolites and a trachydacite ash-flow with distinctive enrichments of incompatible elements were erupted, respectively, early and late in the evolution of the magma system

- The voluminous dacite tuffs and the trachydacite Isom tuff were derived from sources that migrated southward through time…... This transgression mimics in rate and direction the pattern of volcanic activity in the entire Great Basin (Cross and Pilger, 1978; Best and others, 1989a) and suggests that sites of magma generation or eruption shifted in response to regional dictates.

- The history of the Indian Peak magma system is marked by cyclic eruptions of petrographically similar, compositionally zoned, lithic-rich rhyolites and more voluminous, crystal-rich dacites and a final trachydacite ash flow. Rather similar conditions of magma generation and evolution, as well as extent of crystallization prior to eruption, were recurrently achieved in the magma system.

- The denouement of the Indian Peak magma system is associated with the migration of magmatism to the south and waning mantle thermal input into the system. Magmas erupted from the "temporal flank" of the waning magma system include the trachydacite Isom tuff and andesitic lavas. The distinctive characteristics of the Isom (high concentrations of alkalies and incompatible elements for its Si02 content, high temperature, and anhydrous mineral

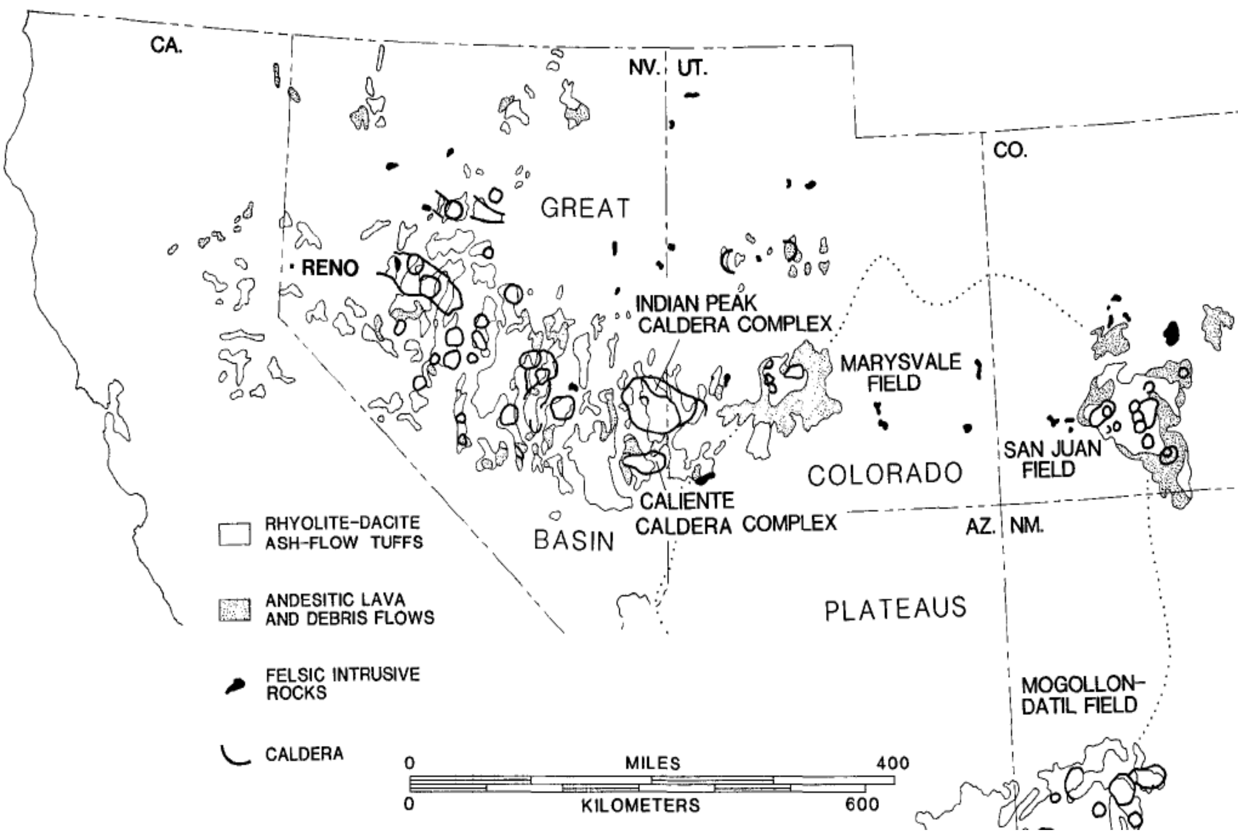

Figure 3. Known calderas in the Great Basin region, including the Indian Peak Caldera Complex (from Best et al. 1989: Figure 1)

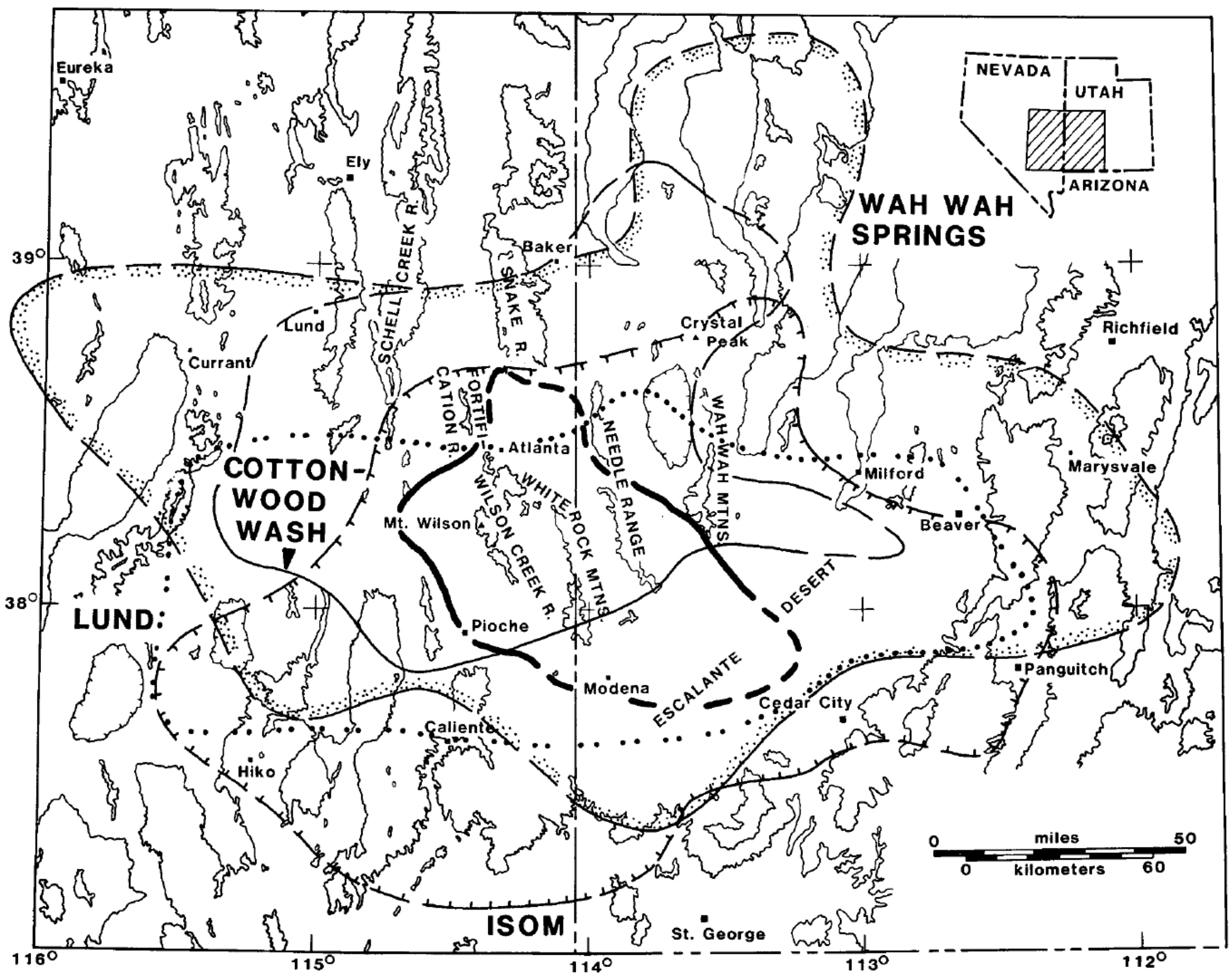

Figure 4. Extent of major tuff sheets of the Indian Peak volcanic field around the caldera complex (from Best et al. 1989: Figure 4)

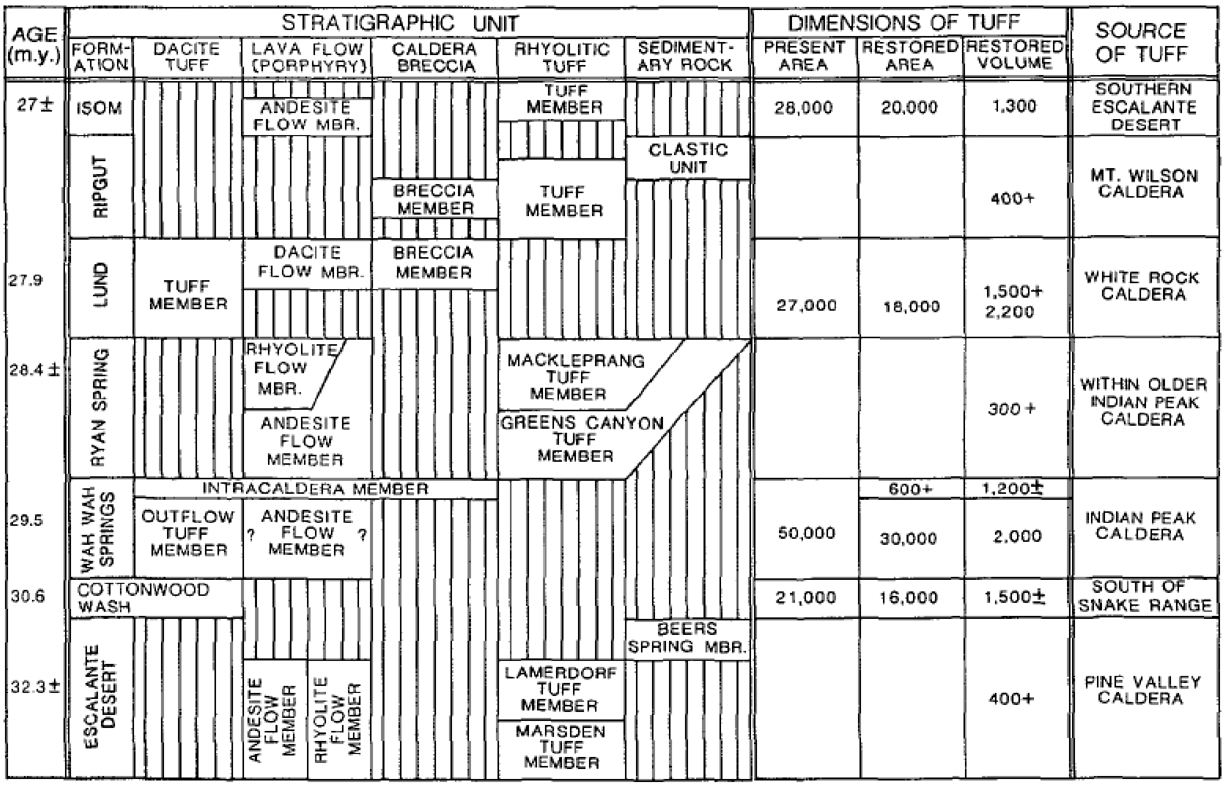

Figure 5. Stratigraphic relations and ages of rocks in the Indian Peaks volcanic field (from Best et al. 1989: Figure 3)

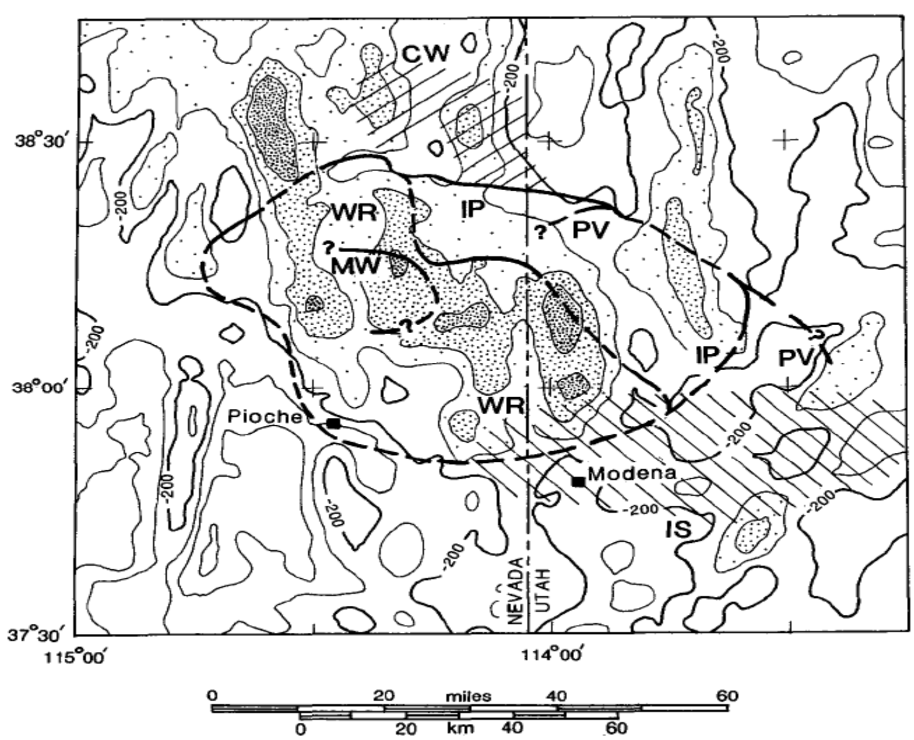

Figure 6. Bouguer gravity in and around the Indian Peak caldera complex, showing identified calderas, from oldest to youngest: Pine Valley (PV), Indian Peak (IP), White Rock (WR) and Mount Wilson (MW) (from Best et al. 1989:Figure 2)

assemblage) suggest that it was derived by fractionation of andesitic magmas

- Following a hiatus of at least 3 m.y. after eruption of the Isom magmas from the Indian Peak system, the Caliente caldera complex (Rowley and Siders, 1988; Best and others, 1989a), centered about 40 km to the south….., came to life, marking the continued southward migration of volcanism.

Best et al. (1989) identify the "four nested calderas" in the Indian Peak Caldera Complex, from earliest to most recent, as the Pine Valley, Indian Peak, White Rock, and Mount Wilson (Figure 6). Today this area encompasses the general region of the Wilson Creek, White Rock and Indian Peak rnages along the Nevada-Utah state line, northeast of Panaca, Nevada, and northwest of Modena, Utah. Our project area covers an area bounded on the east by the state line, and on the south by SR-319, and inclusive of the low mountain areas immediately to the north and west of those boundaries (Figure 7). We would expect that the PS/M obsidian source represents primarily materials from the White Rock Caldera. However, given the repeated eruption cycle described by Best et al., it is reasonable to expect there to be a general mixing of obsidian from that and earlier and/or later calderas, and in particular the earlier Indian Peak Caldera.

Native American use of the Indian Peak Caldera Complex obsidian, as at other sources, has everything to do with the quality and availability of materials in and around the source locations. Obsidian was a favored toolstone for prehistoric and and historic Native Americans. The ease with which it can be worked into tools of various function, and in particular the sharp edge that can be obtained, made it particularly attractive for chipped stone artifacts. Obsidian was used locally but also traded or carried over large distances.

Despite the large size of the Indian Peak volcanic field, little is known about aboriginal use of the volcanic glass (or other resources, for that matter) in that caldera. Instead, what is available are samples of obsidians collected from just a few random locations northeast of Panaca Summit and around Modena. Using this data, samples collected from archaeological sites both to the east, west and south have been sourced to the PS/M area (ref footprints), including Formative period Fremont and Virgin Anasazi sites a significant distance from the caldera (various, but see............). As the work at Obsidian Butte has demonstrated, this is common for many sources across the Great Basin. But the pure lack of data from the PS/M source area leaves us with little to aid in interpretation as to source area use and how the obsidian was accessed at different times by different groups, either by direct access or by trade. Nor is it clear whether the PS/M source area is the primary source location for Native American obsidian extraction in the Indian Peaks Caldera Complex area, or just one of many.

THE OBSIDIAN CROSSROADS PROJECT

Previous research in the eastern Great Basin (various, typically site specific reports) has demonstrated that Native Americans commonly utilized the PS/M obsidian source. Our greater goal as described above is to contextualize the PS/M obsidian source relative to the specific geochemical signature of the obsidian, and its use through time by native groups, and in particular (as per our LCAI Round Four priorities), the Formative period use of the project area, especially by Fremont but also Virgin Anasazi farming groups. To this end, we have proposed to examine the PS/M source area through a Class III intensive archaeological inventory. The project area as outlined (see Figure 7) encompasses well over 40,000 acres, so a designed inventory sampling strategy of that area is appropriate. We proposed to survey between 400 and 2000 acres in and around the Prohibition Flat area and on the eastern slopes of the Cedar Range within the first year. This first phase would also focus on drainages and springs that are more likely to contain long-term or temporary residential sites. Subsequent years would address areas farther away from drainages, working to identify areas that may have been used by either local or itinerant peoples who may have set up campsites that were temporarily occupied for the purpose of collecting obsidian.

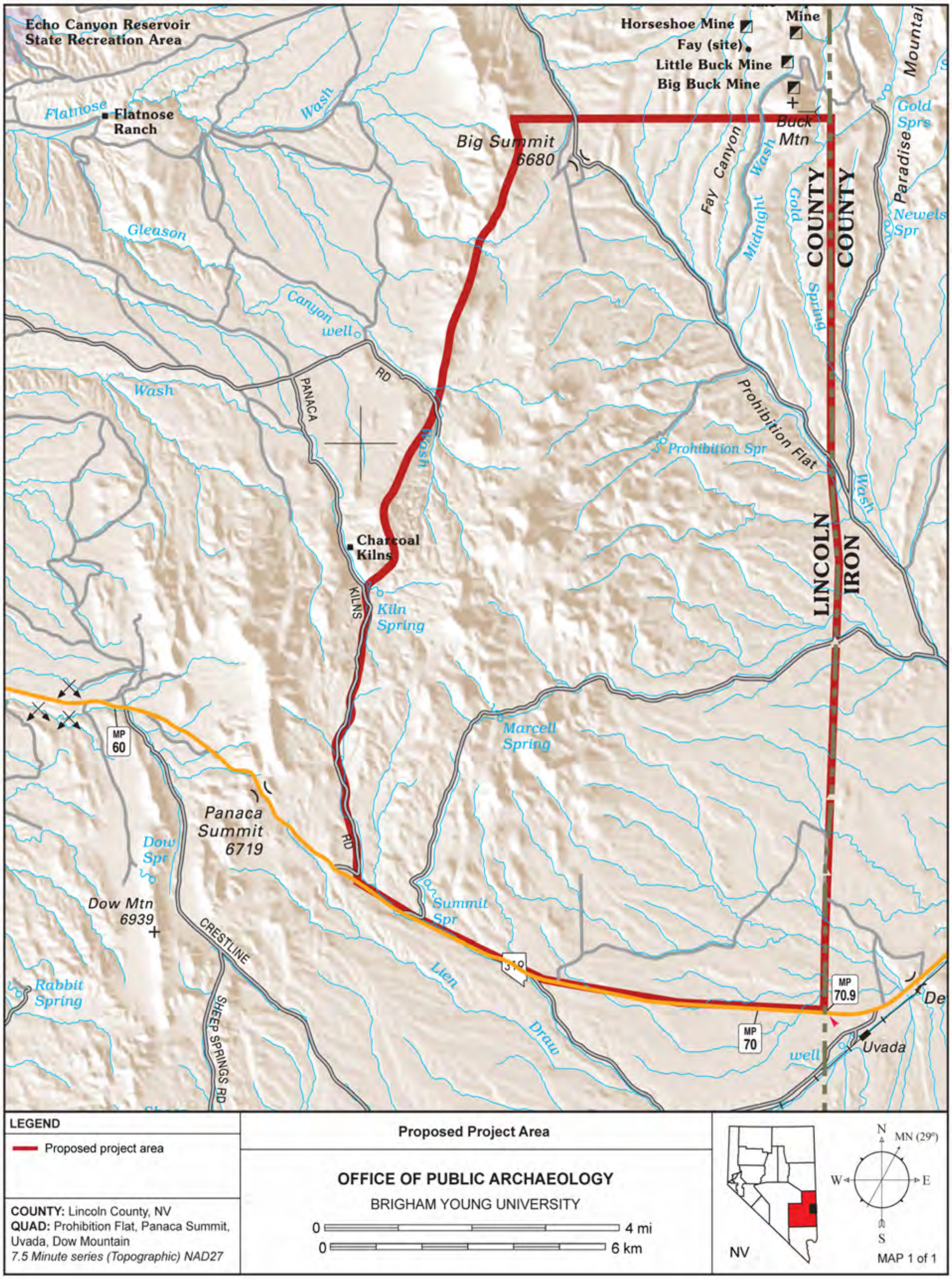

Figure 7. Map of Obsidian Crossroads project area.

Little archaeological work has been conducted in the proposed project area, which makes it a prime candidate for research. The principle focus of previous cultural resource work has been along the State Route 319 corridor, which resulted in the recording of several sites (Elston and Juell 1987). These varied in type, ranging from residential bases and short-term camps to other locations, the majority of which provided evidence of stone tool production, including lithic debitage and formal tools made of obsidian. Ceramic analysis also showed that this area was accessed or occupied by the Fremont, whose Snake Valley Gray wares suggest their presence around A.D. 1000-1100 (Elston and Juell 1987:105-104).

Earlier research also focused in southeastern Nevada provides other important settlement data regarding cultural groups associated with this area. Surveys and excavations throughout this region provide evidence that groups likely dating to the Archaic period initially occupied campsites and rock shelters like Etna Cave, O'Malley Shelter, and Conway shelter (Wheeler 1973). Later occupations were associated with the Fremont and Virgin Anasazi (Fowler et al. 1973; Wheeler 1973). Evidence of co-residence is especially interesting because this area was likely a point of contact for the Virgin Anasazi and Fremont, who actively interacted over time. While previous research has documented this interaction across southern Utah (see Janetski et al. 2000), the nature of this interaction in southern Nevada still needs to be further explored. Further, the Baker Village site to the north (Wilde and Soper 1999) appears to have been a Fremont outpost perhaps set to control the flow of material goods between the Fremont and hunter-gatherers to the west. If so, then PS/M obsidian would be one such very important resource for trade. Finally, other later occupations such as the Shoshone and Paiute tribes were evident in these areas and lends to the importance of the resources found here (Fowler et al. 1973).

In addition to settlement studies associated with this area, the PS/M obsidian source has been noted as an important resource for toolstone production over a large area. This obsidian has been exploited since the Pleistocene and early Holocene era and was found at Archaic sites in Butte Valley northeast of Ely, Nevada (Lytle and Pingitore 2002:186). It has also been identified at Fremont village sites, including Baker Village near Baker, Nevada (Wilde and Soper 1999) and at Evans Mound located in the Parowan Valley in southeastern Utah (Berry 1974; Dodd 1982).

PROJECT RESEARCH THEMES AND OBJECTIVES

This three-year project has two goals. The first is to refine if possible the geochemical signature of the PS/M obsidian source, as far as possible, within the defined project area. As discussed above, the source is part of the much larger Indian Peak Caldera Complex, a large area across central eastern Nevada and central western Utah (Best et al. 1989b, Lytle and Pingitore 2002). While some sourcing studies have identified a chemical signature for PS/M obsidian, it is still very generalized and uninformative as to specific areas and strategies of collection. We are interested in collecting more data using x-ray florescence (XRF) technology from the primary flows in the Panaca Summit area to look for specific chemical compositional groups from this large area.

The second goal is to define the general PS/M source physical and cultural characteristics: the boundaries of the source materials; the types and locations of source material (flow outcrops, distribution of cobble eruptions, etc); and general resource use patterning, or distribution and density of cultural loci. In particular we are interested in Formative period (Fremont but also Anasazi) use of this general source area, and want to be able to characterize at least in a general manner how Formative period farmers accessed and used the source materials.

PS/M Obsidian Toolstone Sourcing.

Shackley (2005:97) has noted that eroded Tertiary sources include nodules that are released and carried along with other sediments downstream from the source. In addition, while obsidian tends to be relatively homogeneous, some sources can generate more than one chemical group. For example, Mule Creek obsidian found in western New Mexico has produced evidence of four different chemical groups (Shackley 2005:100), and the Mineral Mountains in southwestern Utah contain a variety of chemically unique sources (e.g. Block Rock, Wild Horse Canyon, Black Mountain, etc). Wagner has described the Obsidian Butte obsidian source of southwestern Nevada as having had numerous, separate eruptions with different lava flows. After sampling those flows for distinctive chemical signatures that could be used to identify discrete toolstone grade obsidian sources, Wagner (2005:18) suggested that "Intrasource variability is probably more widespread in the Great Basin than archaeologists realize."

These examples offer cautionary guidance for PS/M source analysis. The PS/M obsidian source location, like most others in the region, is likely not a single event flow. Additionally, the majority of raw PS/M obsidian can be found as nodules scattered over the landscape (Lytle and Pingitore 2002:186). Per Wagner (2005:15), however, "care should be taken to extract obsidian from the outcrop (since) loose nodules can be transported down slope from higher outcrops that may be chemically distinct." We consider it important to characterize both the source locations and to sample the nodules eroding from those locations. Therefore, it is important to us to collect numerous samples in order to determine possible heterogeneity of any given obsidian source and the identification of separate chemical groups that may be associated with several different geographic locations.

The core research issue we take here can be summarized in two questions: Can chemically distinct obsidian flows be identified in or directly proximal to the project area, and which of those sources were being used by prehistoric groups, but in particular Formative period groups, as their principal toolstone sources (see Myhrer and Haarklau [2005] for similar considerations at Obsidian Butte). If distinct flows are present, they should be defined by distinct chemical signatures. And if obsidian artifacts from various sites show those distinct chemical signatures, then patterns should eventually be found to demonstrate which sources were being used.

To address these questions, and while conducting site inventory in the project area (Figure 7), we will concurrently collect chemical signature data on both raw and culturally modified obsidian that is located within the project area. This will be done using a handheld XRF analyzer, which has the ability to record principle component data quickly and while in the field. Following the analytical techniques of Shackley (2005:100-101), we will attempt to collect data on unaltered obsidian nodules as they are encountered in the field, and on chipped stone tools as they are found at archaeological sites. Diagnostic projectile points would be a particular focus for XRF sampling, but bifaces or other tools might also be examined. We will also record GIS location data for each analyzed sample using a GeoXT 2005 series GPS in order to provide location data that is tied to the landscape. The results of this data will include a detailed geographic distribution of PS/M obsidian along with identified chemical groups within the project area.

As a caveat to this methodology, however, if the first year's sampling fails to demonstrate distinct chemical signatures for the collected nodules, then we may seek to expand outward to find sample nodules to test that may be outside the project area, to better define how expansive this distinct and unique singular geochemical signature might be.

We then expect to collect a sample of up to 100 nodules, including some of those of the unaltered, field XRF-analyzed nodules, including samples taken from the primary source or outcrop areas, and bring those back to BYU for more precise analysis using the XRF facilities at the Geology Department at BYU. We also will submit samples to Jeffrey Ferguson who uses a table-top version of the handheld PXRF. This will provide comparable data to the formal tools that are tested in the field. The result of this work would be a corpus of chemical compositional data on the PS/M obsidian, which in turn would provide researchers both locally and regionally with more precise toolstone sourcing data.

During the first year of work, culturally modified obsidian artifacts will be examined only in the field. In years two and three of the project, however, we anticipate collection of modified obsidian, in particular diagnostic projectile points. This, of course, will occur only through and after appropriate consultation with the pertinent Native American representatives and the BLM. Of note, in the original proposal we had suggested in-field sampling of 200 nodules each of the 3 project years, and bring 100 of those each year back for laboratory analysis. However, since that time, and in consultation with geologist Dr. Eric Christiansen at BYU, it was determined that such a large sample was unnecessary. Consequently, we propose collecting no more than 100 nodules per year, and probably less. Depending on the first year findings of the XRF in the field, we may or may not continue using a field XRF in the subsequent years.

PS/M Source Physical and Cultural Context. A second project objective is to properly establish and contextualize the physical and cultural characteristics of the general PS/M source area in order to begin to understand how aboriginal peoples exploited the obsidian and other resources. This issue connects up the geochemical data with human occupation and movement. It is an attempt on our part to locate general patterns in the distribution of material culture across the PS/M source area. Those patterns might then help to clarify heretofore unexamined, diachronic issues relative to technologies, territoriality, settlement strategies, group organization, and economics. Our interest is, in particular, with how farming groups of about one to two thousand years ago (Fremont and Anasazi) accessed and utilized the PS/M obsidian, but the bigger picture is clearly that humans have been using the PS/M obsidian from Paleoindian times up until the Historic period. Recognizing patterns in obsidian availability and use will inform on all periods of human presence in the project area.

A primary concern is to define the boundaries of the source materials. Specifically, to understand how humans used the PS/M obsidian, we need to characterize the source itself, as defined by the availability of culturally workable obsidian nodules/outcrops. The research issue, then, is: are there definable boundaries for the PS/M obsidian source, and where are they? Achievement of this goal gives us a more precise physical target for addressing the research issues described above. It allows us and future researchers to compare land use strategies over time and space, such as between primary outcrops and secondary collection zones, or between Archaic and Formative period strategies. It is also problematic, however, because of the nested caldera context within which the PS/M source is found. We seek to find out if the source is isolated and/or distinct from other probable sources in the later Indian Peaks Caldera Complex, and defining boundaries will provide this information.

Another concern directed specifically to our goal of better characterizing farmer use of the PS/M obsidian source area, is see if these two groups and contemporary hunter-gatherers had definable territories within which each accessed the obsidian and, if so, to determine if and how those territories were defined and if and when they changed through time. This research question can be stated as follows: Did recognizably distinct Formative period ethnic groups such as Fremont, Anasazi, and hunter-gatherers, share the PS/M obsidian source, and if so did they share common collection areas or have their own definable territories in that source area? If evidence for one or more of these groups is found, then we would infer that they had direct access to the obsidian source, and site location patterns would then help to reveal the extent of each group's distribution across the landscape. If we cannot find evidence for one or more of those groups in the source area, then we might question whether that group actually had direct access to the obsidian source, and whether they instead obtained PS/M obsidian through trade. On the other hand, we might also question the ethnic identifier typically associated with each group. Perhaps the stays were of brief enough duration, or with a group make up or with such a focused procurement objective that precluded deposition of many ethnic identifiers. The clear assumption here, of course, is that each group has distinct ethnic identifiers to begin with. In the case of the Fremont, we reject the earlier Human Behavioral Ecology model of Fremont as foragers who also farmed (e.g. Madsen and Simms 1998), and instead view Fremont as similar to other Southwestern farming groups, as farmers who also exploited the wide range of natural resources around them, but who distinguished and announced themselves as distinct ethnically through a wide range of active and passive material culture, economic, and social markers (see Cole 2011; Janetski et al. 2011; Jardine 2007; and Searcy and Talbot 2012). In the project area these might include ceramics, domesticates, and the suite of other remains and architectural features distinct to Fremont sites. The same applies to Anasazi groups, who have their own suite of ethnic markers. The more difficult sites to distinguish are contemporary Great Basin hunter-gatherers whose mobility and resulting material remains resemble in great detail that left by farmers on hunting/gathering expeditions. Finding material remains that might identify any or all of these distinct ethnic groups, then, is critical to addressing this issue.

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