An Archaeological Analysis of the Sublett Troughs Site (10-OA-33), Oneida County Idaho

By

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USE AUTHORIZATION

COMMITTEE APPROVAL

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I would also like to thank the Anthropology Department at ISU. Each faculty member, past and present, has played a role in my academic career. I have been the recipient of instruction, insight, inspiration, guidance, and friendship here. This department has become a second home for me and I am grateful.

ABSTRACT

This thesis is an analysis of the archaeological assemblage collected at the Sublett Troughs site in southern Idaho during the summer of 2013. Historic period diagnostics were dated to sometime after 1890. There was no evidence of pioneers using a spur of the California Trail, adjacent to the site, known as Hudspeth Cutoff. Prehistoric diagnostics define the range of early human utilization up to 5,000 BP. Trace element analysis of obsidian from the first ten layers of excavation showed that three local sources (Malad, Brown's Bench, and Walcott) provided 98% of obsidian toolstone at the site. A group of secondary sources, concentrated near Yellowstone, appears in the top six layers of excavation and merit further research. The Sublett Troughs site provides information vital to the study of toolstone utilization by archaic populations in Idaho as a site-specific investigation that shows change over time.

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CHAPTER 1: INTRODUCTION

As the sun inched away from the eastern horizon behind us, 13 people poured out of two vehicles excited to begin the field season. We stretched our legs and wandered onto a small patch of land. This is where we would spend the next six weeks covered in dirt with smiles on our faces recovering cultural material from Mother Earth. Little did I know, that I would spend the next three and a half years trying to recover the story of the past that those materials held within them.

The Sublett Troughs site (10-OA-33) was utilized by both historic and prehistoric populations. Historic uses ranged from a possible rest area for pioneers and miners on the California Trail to its current exploitation as a cattle-watering trough. Prehistoric uses of the site are not clear and are one of the questions this study attempts to shed light on. This thesis is an analysis of archaeological material collected at Sublett Troughs during excavations in May and June of 2013.

Sublett Troughs is located in the Sublett Mountains of southern Idaho, nestled in the crook between two hills in a spring drainage (Figure 1). This site has been the subject of minimal archaeological investigation (Tracy 2015). The Sublett Troughs site was identified in the late 60's (Corliss 1967) but was not subjected to subsurface investigation until it became the focus of the 2013 Idaho State University (ISU) Archaeological Field School. Students under the supervision of Dr. David Peterson (ISU Anthropology) and Dr. Brett Guisto (United States Forest Service) performed intensive pedestrian survey, shovel tests, and test excavations at the site. Cultural materials, predominantly prehistoric, were collected and transported to ISU for analysis and curation at the Idaho Museum of Natural History (IMNH).

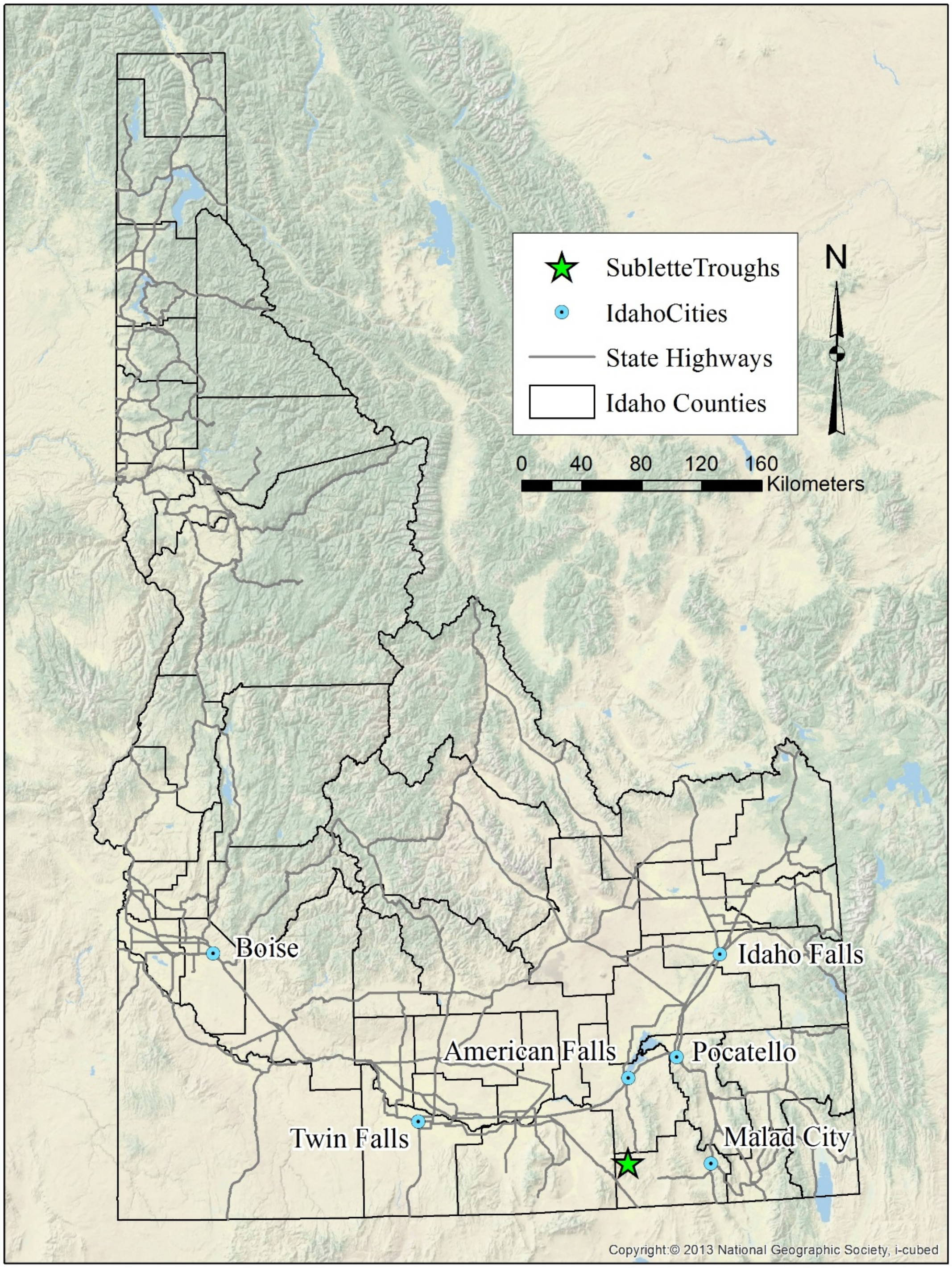

Figure 1. General location of the Sublett Troughs archaeological site.

The historic potential for cultural material derives from Hudspeth Cutoff, a spur of the California Trail, and from the utilization of the area by ranchers since 1890. Sublett Troughs is adjacent to a section of Hudspeth Cutoff where it defines the northern extent of the site. This route was highly utilized after its establishment in 1849 (Idaho Historical Society 1964). The volume of traffic over the cutoff gives any site along its route with access to water the potential to yield material left by pioneers. The archaeological investigation of Sublett Troughs provided the opportunity to test the site for evidence of historic material related to early pioneers.

Prehistoric populations are responsible for the deposition of the vast majority of cultural material recovered. Based on the projectile points collected we can estimate that prehistoric occupation extended up to 5,000 years ago, well into the Archaic Period (7,200-250 BP) (Holmer 2009; Justice 2002). The populations that would have inhabited this site in the Archaic are classified as foragers. This classification is based on subsistence behaviors that include the collection of available plant foods and the hunting of both large and small game. Sublette Troughs is located between camas prairies to the north and piñon nut harvesting grounds to the south (see Figure 3), both highly exploited plant resources for foraging populations in the area (Steward 1938).

Sublett Troughs and the surrounding area offer various edible vegetation in the form of seed- bearing grasses and berries during the warm season. This area also has an abundant rodent population, which, according to Steward (1938), was a source of animal protein for indigenous groups. The faunal assemblage includes the remains of larger game animals, though there is minimal evidence of human alteration of the bone. The raw lithic material provides further insights into prehistoric behaviors.

Sublett Troughs, like many archaeological sites, produced a prehistoric assemblage dominated by lithic material. The dominance of lithics in archaeological assemblages is in part a function of stone's durability relative to other materials. Of the prehistoric lithics collected from Sublett Troughs, 85% are obsidian. This abundance of obsidian within the assemblage provides a natural focus for this study.

Obsidian is a material with unique physical and geochemical properties. The physical properties of obsidian result in predictable conchoidal fracturing and can produce extremely sharp edges. These characteristics make obsidian an ideal toolstone (Shackley 2005). The general superiority of obsidian as a toolstone contributes to its dominance in this and many other archaeological assemblages of Idaho (Plager 2001, 9). The geochemical composition of each obsidian flow is unique, which allows a material source to be assigned to artifacts based on relative trace element concentrations. The unique chemical signature of each flow makes obsidian an ideal material for provenience research (Shackley 2005).

The geographic location of Sublett Troughs, 46 kilometers from the nearest obsidian source, suggests that any obsidian found there was transported to the site by people. Using portable x-ray florescence (pXRF), obsidian debitage from the first meter of excavations at Sublett Trough was analyzed for provenience. Identifying the source of an obsidian artifact provides us with the minimum distance of displacement. Distance from the source tells us very little by itself. More telling are patterns of source utilization. Trends of source utilization over time can suggest group movements, material source preference, or trade. Changes in source utilization may indicate changes in social behavior patterns (Holmer 1994).

The identification of obsidian sources using x-ray florescence (XRF) dates to the mid 1960's (Cann & Renfrew 1964) and has proven increasingly reliable in source analyses (Black 2014; Plager 2001; Shackley 2005, 2011). Sources are identified by statistically comparing an artifact's chemical signature to known source signatures. Understanding exactly what a source identification means for the story of Sublett Troughs is, however, not a simple matter.

It is tempting to attribute any deposition of obsidian to those that procured the raw material, but the issue is more complex. Based on the amount of obsidian debitage at the site, we know that stone tools were produced at Sublett Troughs; but did the people who acquired the raw material bring it to the site or was it acquired through trade? Was a particular source preferred? Was the acquisition of raw toolstone simply a function of convenience? Understanding the interaction of people with the landscape and the resources it provides is the drive behind sourcing these samples. Verifying where these samples came from will add to ongoing research about the toolstone utilization by prehistoric populations in southeast Idaho.

Recent research of Idaho obsidian provenience has focused on regional distribution of raw materials (Plager 2001), comparison of research results from different labs (Black 2014), or analysis of a specific source (Thompson 2004). These studies have provided a wealth of information concerning regional distribution of Idaho obsidian. A regional perspective provides a general perspective on toolstone use. The scholarship will benefit from the analysis of source utilization at a single site over time. This will help the formulation of increasingly accurate models of regional distribution, and reveal any anomalies in expected material usage. The geochemical analysis of obsidian collected from Sublett Troughs provides this perspective.

The overarching goal of this thesis is to assess the archaeological assemblage from Sublett Troughs for information about the presence and the recurrent patterns of behavior of the people there. The assemblage is divided into three artifact classifications: historic, faunal, and prehistoric. Historic materials were analyzed for age and evidence of any particular historic groups that may have been responsible for their deposition. Faunal remains were assessed to identify the animal resources available at the site and for evidence of human alteration. The prehistoric remains were evaluated to define the overall time depth of the site and to reveal evidence of any behavioral patterns that may reflect in the material record.

CHAPTER 2: BACKGROUND

This chapter provides a review of background information and literature relevant to the archaeological investigation of Sublett Troughs. This information will provide the context for methods utilized in this research. The environmental context section describes the ecological factors that made Sublett Troughs attractive to historic and prehistoric populations. The historical context section discusses features of the historic record pertinent to the site. A review of early ethnographic research provides information about indigenous populations and their strategies for utilizing local resources. The archaeological context section reviews archaeology in Idaho and at the Sublett Troughs site. A discussion of the geology of southern Idaho covers the formation of the Sublett Range, the Snake River Plain, and the numerous obsidian deposits in south and east Idaho. A review of x-ray florescence (XRF) technology provides an overview of its basic mechanics and its utility in lithic provenience studies.

Environmental Context

Sublett Troughs is located in an area rich with natural resources during the warm months of the year. Access to the site during the winter is difficult due to snow cover. Snow cover also reduces the availability of edible vegetation to almost nothing. During the warmer months however, this site provides many potential subsistence resources. These resources, the most important of which is water, are what would have attracted foraging populations and historic travelers alike to the site.

Sublett Troughs is centrally located north-to-south within the Sublett Range and drains east to Rock Creek. The site sits at 1,829 meters (6,000 ft.) above sea level in a shallow valley. The majority of the site is on shallow grade alluvium created by spring drainage and annual runoff into South Fork Rock Creek, which flows through the northern extent of the site. The spring at Sublett Troughs is the central of three in the area that lie in an east-west orientation separated by roughly one kilometer each. These springs are filtration springs, or seeps, which occur when subsurface water works its way up through permeable soil.

Effective temperature (ET) is a measure of the intensity and annual distribution of solar radiation and is used in archaeology to characterize an area's potential for terrestrial plant life abundance (Kelley 2013). Calculating ET is one way to quantify an environment's plant productivity and, in turn, its capacity to sustain foraging activities. An estimated ET of ~11 is reported by Reid and Gallison in their 1995 survey of the northern portion of the Sublett Range. An ET of 11 is relatively low and indicates limited plant production. This limitation in the temperate climate of southern Idaho means that vegetation is sparse or nonexistent during the cold season, becoming available only during the warmer months of the year.

The vegetation at Sublett Troughs is typical of the Sublett Range, consisting of various grasses, sagebrush, currant berry bushes, and wildflowers. The ground coverage ranges from 0-100% in patches depending on the season. Tree types consist of willows around the spring and scattered aspens on the hillsides.

Faunal resources range from various rodents to a variety of large game. Large populations of pocket gophers, ground squirrels, chipmunks, and mice are present at the site both currently and throughout the assemblage. Rabbits and hares are also currently abundant in the area. Grouse, quail, pheasant, and possibly chukars make up the avian game population. Deer, elk, and moose are present; and antelope may have ranged into the area during the warm season. Bison possibly inhabited the valleys on either side of the Sublett Range before being hunted to near extinction in the mid-19th century (Steward 1938).

Historical Context

The most notable historic feature in the area of Sublett Troughs is Hudspeth Cutoff (see Figure 2). Hudspeth Cutoff is a spur of the California Trail pioneered in 1849 by a party from Missouri led by Benoni M. Hudspeth and John J. Myers. The cutoff was employed as a shortcut to avoid the northern arc of the California trail through Fort Hall (Idaho State Historical Society 1964). Though its effectiveness as a shortcut is debatable, it became a popular detour from the established route for those headed to the Humboldt River in northern Nevada and the mines in that area, and further to California (Idaho State Historical Society 1964).

Hudspeth Cutoff is adjacent to the northern extent of the Sublett Troughs, parallel to South Fork Rock Creek. Parts of Forest Service Road 583, Sublett Troughs' access road, are made up of remaining sections of the cutoff including the portion adjacent to the site. As a highly utilized pioneer route, Hudspeth Cutoff provided direct access to Sublett Troughs. It is conceivable that pioneers would have stopped at any one of the three springs to water horses, cattle, and themselves. The relatively flat area of the Sublett Troughs site would have also provided a good place to make repairs to a wagon or rest.

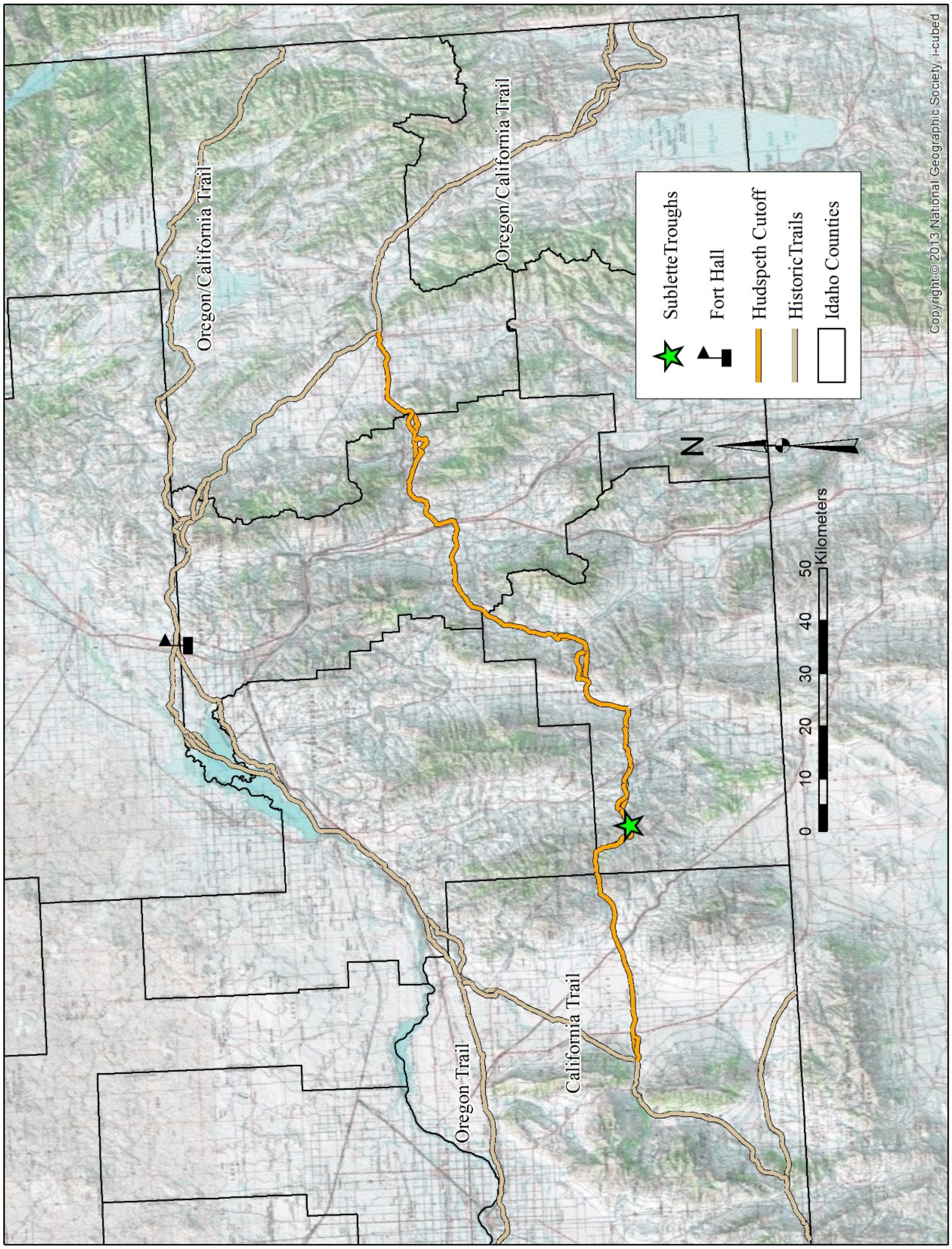

Figure 2. Map showing the location of historic pioneer trails including Hudspeth Cutoff.

Ranching and hunting have been the prevalent activities in the area since travel by wagon became obsolete. Recreational camping is an option in the area, but is more concentrated on the western half of the Sublett Range around Sublett Reservoir, where there is good fishing and several developed campgrounds. As a watering trough, the Sublett Troughs site is naturally covered by material evidence of the presence of significant numbers of cattle. Since Idaho gained statehood in 1890, the land has been federally regulated and available for the grazing of free-range cattle.

Early Ethnography

Julian Steward's 1938 ethnographic study of indigenous groups of the Great Basin, and parts of the Colorado and Columbia Plateaus, is the first large-scale ethnographic report written about these groups, combining both historical accounts and direct observation. It is also the most thorough early record of the subsistence behaviors of native groups in the Great Basin. Steward saw social behavioral patterns as rooted in adaptations to the environment, specifically in the seasonal and fluctuating availability of resources. Steward's theoretical approach went beyond the static description of behavior at a specific time and place and attempted to explain changes in those behaviors dynamically, in relation to changes in the natural environment (Fagan 2005).

Though Steward's research covered an extensive area, this study is concerned with native groups in Idaho and their subsistence behaviors. The following information is based on Steward's discussion of Shoshone and Bannock groups who occupied much of southern and eastern Idaho at the time of his study. Steward identified a general pattern of small, highly mobile groups that subsisted by foraging. The gathering of plant food was the primary subsistence activity, with hunting taking a supplementary role (Steward 1938, 231). Due to the limited availability of resources, both seasonally and geographically, it was generally more effective to collect resources in small groups. Even groups limited to immediate family could exhaust available local resources quickly. This made a highly mobile lifestyle necessary and limited group size for most of the year. Winter villages were customarily where larger groups would establish semi-permanent residence.

There were exceptions to the general restriction on group size outside winter camps when a resource was plentiful. The gathering of most plant foods was conducted by females exclusively for their families, with the exception of camas bulbs and piñon nuts. Both camas and piñon are found in dense clusters, which provide an abundant harvest. These exceptions were substantial contributors to native diets; and their harvest was often a communal activity involving many otherwise independent groups. These foods were preserved and often stockpiled for the winter.

Hunting and fishing could either be an individual or group activity, depending on the game, its abundance, and the size of the group or groups involved. Small game such as rodents and insects were generally collected by individuals of both sexes for their own families. The pursuit of large game such as deer, bison, or antelope was more likely to be a communal activity carried out by males, which provided enough meat for a larger group. The harvesting of large game also provided skins, sinew, and bones that were fundamental to foraging technologies. Communal fishing was focused on salmon runs up the Snake River as far as Shoshone Falls (Steward 1938, 42) (Figure 3). Much like the camas and piñon-nut harvests, these events provided ample harvest for large groups.

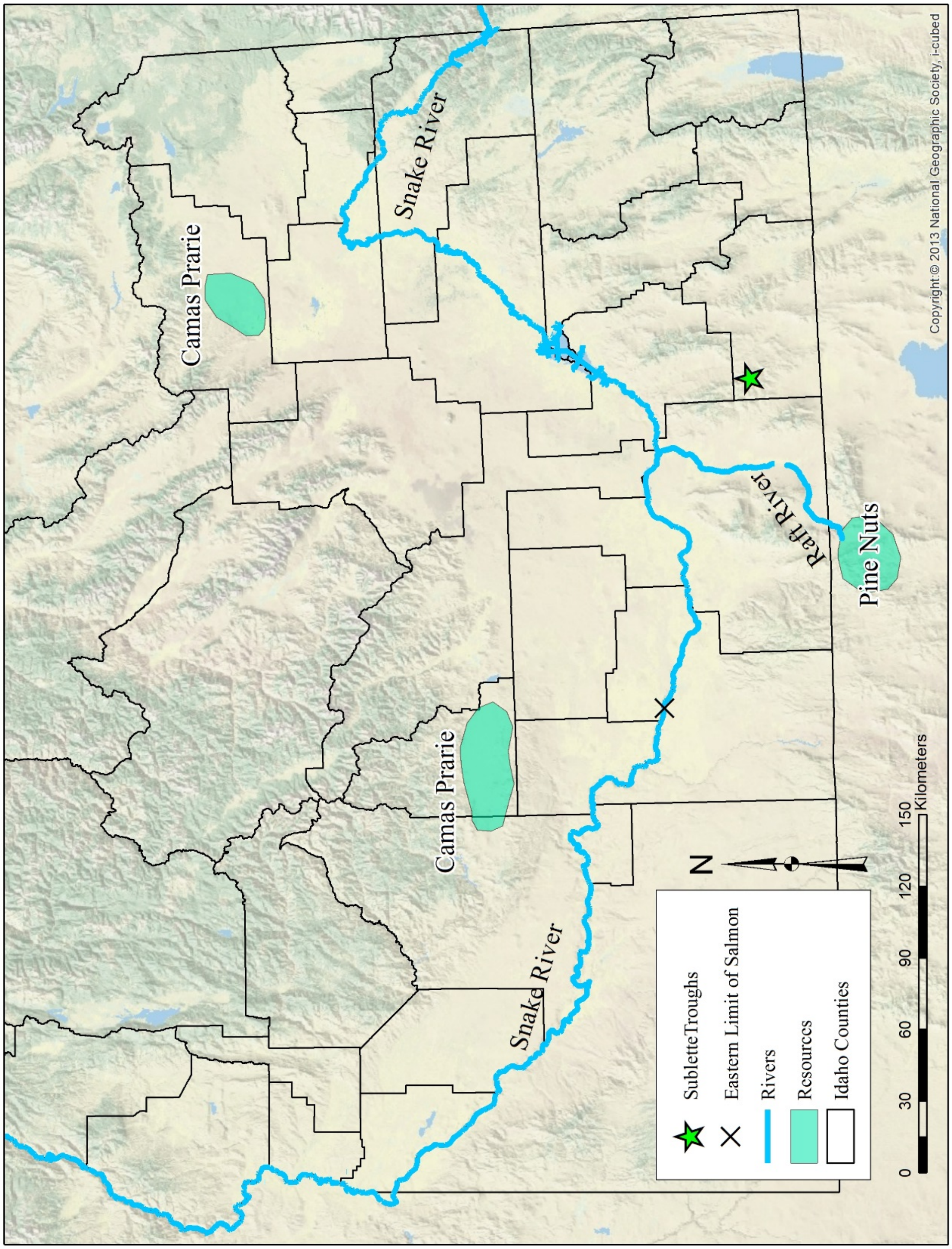

Figure 3. Map of early subsistence resources discussed in the text.

The introduction of horses in the early 1700's affected the subsistence activities of some native groups, particularly the Northern Shoshone (Steward 1938, 235). Groups that were able to provide ample grazing lands to sustain herds of horses relied heavily on bison hunting for subsistence. Even after the effective extinction of bison west of the Rockies in the mid 1800's, these groups ranged out onto the Great Plains to hunt bison.

The area south of the American Falls Reservoir, including the Sublett Range, is cited by Steward as an area where "poor" Shoshone (those that did not own horses) lived during the summer and ate rabbits (1938). This area is labeled "RABBIT EATERS" in Steward's map of the Basin-Plateau area (1938, IX). This area is also noted as being a travel corridor from the Snake River Plain that enabled them to collect piñon nuts in northern Utah (Steward 1938, 136).

Archaeology

There were very few published works about Idaho archaeology until 1956. The reports published between 1908 and 1956 were mostly cursory descriptions of material that contributed little to fundamental knowledge of Idaho's prehistoric populations (Butler 1968). In 1956, Donald R. Tuohy and George L. Coale published reports in the Davidson Journal of Anthropology. Tuohy described shards of early brown-ware recovered from the Snake River Plain near Glenn's Ferry (1956). Coale presented a report on the archaeological survey of the Mountain Sheep and Pleasant Valley Reservoirs (1956). These reports were thorough investigations of cultural material from Idaho and helped spur interest in the area. In 1957, Dr. Earl H. Swanson Jr. was appointed the director of the new Idaho State College Museum in Pocatello. Swanson helped promote archaeological research in Idaho by establishing periodical publications through the museum and securing funding and contracts for continued research (Butler 1968).

In 1959, a joint research venture between the Idaho State College Museum and the Peabody Museum of Harvard University conducted an excavation of Wilson Butte Cave in the central Snake River Plain. The excavation of Wilson Butte Cave and the resulting report established a great time depth of human occupation in Idaho (Gruhn 1961). This time depth was further defined by radiocarbon dates from the lower levels of the cave of up to 15,000 BP (Gruhn 1965). The Wilson Butte Cave investigation was the first comprehensive report of a single archaeological site in Idaho (Butler 1968) and, combined with the efforts of Swanson and others, firmly established the importance of Idaho archaeology in the story of prehistoric North American peoples.

Since the 1960's, archaeology in Idaho has provided a wealth of invaluable material from both Paleoindian (13,000- 7,200 BP) and Archaic (7,200- 250 BP) populations in the state. In addition to Wilson Butte Cave (Gruhn 1965), Paleoindian assemblages have been identified at the Simon Clovis Cache (Butler 1963), at Bison and Veratic rock shelters (Butler 1968; Swanson 1972), and at Jaguar Cave (Butler). Wilson Butte Cave, the Bison and Veratic rock shelters, and Jaguar Cave all provided well-stratified assemblages that span Paleoindian and Archaic time periods (Butler 1968, 1978; Gruhn 1961, 1965; Swanson 1972). These sites established a definitive chronology for lithic technologies in the state. The changes in these technologies reflect changes in subsistence strategies.

The Paleoindian period lithic technologies are predominantly large lanceolate points. Larger lanceolate points of the Paleoindian period gave way to smaller stemmed and notched points in the Archaic (Butler 1968, 1978; Holmer 2009; Lohse 1995). Plew (2000) divides the Archaic of southern Idaho into three periods. The Early Archaic (7,200 - 4,400 BP), Middle Archaic (4,400 – 2,000 BP), and Late Archaic (2,000 – 250 BP) are defined by specific climatic conditions and evolving subsistence strategies (Plew 2000). The changes in subsistence strategies are interpreted as adjustments to shifting climatic conditions and are evident in the material record as evolving technology. Projectile points continued to get smaller through the Archaic as the bow-and-arrow were adopted and eventually replaced the atlatl and dart (Plew 2000; Yohe 1998).

Lithic point typologies are based on morphological characteristics unique to each type. The point types found in Idaho are generally widespread throughout surrounding regions, particularly in the Great Basin, and often span multiple time periods (Fagan; Holmer; Justice). Holmer does identify the Wahmuza Lanceolate point as specific to eastern Idaho and the Northern Shoshone people (1994). The Wahmuza point has a geographic distribution limited to eastern Idaho and its basic morphology does not change over a 4,000 year span (Holmer 1994). This is the only point type identified as exclusive to Idaho and provides a link between early ethnographies and the archaeological record (Holmer 1994, 183).

Point typology can be useful in identifying a time range for a site or stratigraphic layer but the vast majority of lithic material found at most archaeological sites is debitage (Andrefsky 2001). As the detritus from stone tool manufacture, debitage has the potential to provide detailed information about tool manufacturing behaviors. There are many research techniques for investigating debitage in an assemblage. The foci of these studies cover every stage of stone tool manufacturing and deposition (Andrefsky 2001). Debitage is also useful in raw material provenience studies.

Raw material provenience was a matter of expert opinion, or 'megascopic' analysis, until the 1960's, when the technology and analytical methods became available to chemically analyze lithic material (Shackley 2005). The first attempt to geochemically identify the sources of artifacts from an Idaho site happened in the late 1960's. The material was recovered from Veratic rock shelter and sent to the University of Michigan by Swanson for neutron activation analysis (Plager 2001). The analysis successfully identified material from Obsidian Cliffs in Yellowstone National Park and separated the remaining artifacts into two other distinct groups (Wright, et al. 1969). As geochemical analysis techniques were refined, the sourcing of Idaho toolstone, particularly obsidian, became more common (Plager 2001).

Robert L. Sappington conducted extensive obsidian provenience research in Idaho and surrounding areas (1981a, 1981b, 1984). Sappington utilized X-ray florescence technology and multivariate statistical analyses to identify sources. Multiple variations of this methodology are still utilized in current lithic analyses of Idaho obsidians (Black 2014; Fowler 2014; Holmer 1997; Plager 2001). The studies present a broad regional perspective and our knowledge of stone tool procurement and use in Idaho will benefit from a site-specific analysis.

Archaeological investigation of the Sublett Troughs site began in 1967 with a survey by Dave Corliss of the Bureau of Land Management (BLM). This survey identified Sublett Troughs as an archaeological site. Corliss classified the site as a prehistoric aboriginal camp based on lithic debitage and artifact scatters observed during the survey. Three chalcedony biface fragments and a single flake of red obsidian were collected during the survey. The artifacts observed were scattered over three acres and concentrated near the three springs in the area. The spring at Sublett Troughs and another, roughly one kilometer east, were being utilized by local ranchers as livestock watering locations at the time of the survey. Spring development consisted of a pump house, subterranean pipe, and trough at the eastern spring and a subterranean pipe and collection trough at Sublett Troughs. The spring developments resulted in a highly disturbed surface context due to construction and the presence of cattle (Corliss 1967).

The site was visited again in 2001 by Richard Goddard and Paddy Sant. This survey was conducted to fulfill requirements of the National Historic Preservation Act (NHPA) in relation to proposed improvements to the exclosure surrounding the spring. The survey concentrated on the 2.5 acre area surrounding the spring where the proposed work would take place. Goddard and Sant noted the proximity of Hudspeth Cutoff to the site and the potential for historic remains. No heritage sites were identified, nor were any cultural materials collected during this survey (Goddard & Sant 2001).

The excavations at Sublett Troughs in 2013 provided material for this thesis and one other. Maegan Tracy used data collected from spring sites in the Sublett Range to test predictive models of the presence of open-air sites. Five of eight springs in the Sublett Range, including Sublett Troughs, produced prehistoric cultural material (Tracy 2015, 72). Tracy's study highlights the research potential of the area and may help to encourage further research into the interaction of prehistoric populations with the landscape of the Sublett Range.

Geology and Obsidian Formation in Southern Idaho

The Sublett Mountain Range in southern Idaho extends from the Snake River Plain in the north to just across the Utah border in the south. Elevation ranges from 1,500 feet above sea level, at the base of the foothills, to 7,492 feet above sea level at Sublett Range High Point (USFS). It is a block faulted range of Permian and Pennsylvanian Period sedimentary stone (Lewis, et al. 2012) with north-to-south trending ridge lines. Tilting during faulting resulted in an asymmetrical range profile with steeper eastern than western slopes (Ross & Savage 1967). Drainage from the Sublett Range flows to the Raft River Valley in the west and the Rockland Valley in the east. The Sublett Range is flanked by the Black Mountains to the southwest and Deep Creek Mountains to the east that both display the same asymmetrical block faulting pattern and rock type (Figure 4).

The block faulting and sedimentary stone composition show that the Sublett Range and those adjacent to it are not volcanic in origin. This is significant considering the amount of obsidian (volcanic glass) found at the Sublett Troughs site. There are various chert, quartzite, and slate deposits within the Sublett Range that have potential as toolstone, yet obsidian is the most common material present in the assemblage from Sublett Troughs making up 56.4% of all material collected, and 85% of all lithic material. Obsidian is the product of the rapid cooling of highly viscous lava (Shackley 2005). The volcanic activity responsible for this type of formation is relatively common along the Yellowstone hot spot track and surrounds the Sublett Range on three sides (Almeev, et al., 2012; Nash, et al. 2006; Pierce & Morgan 1992).

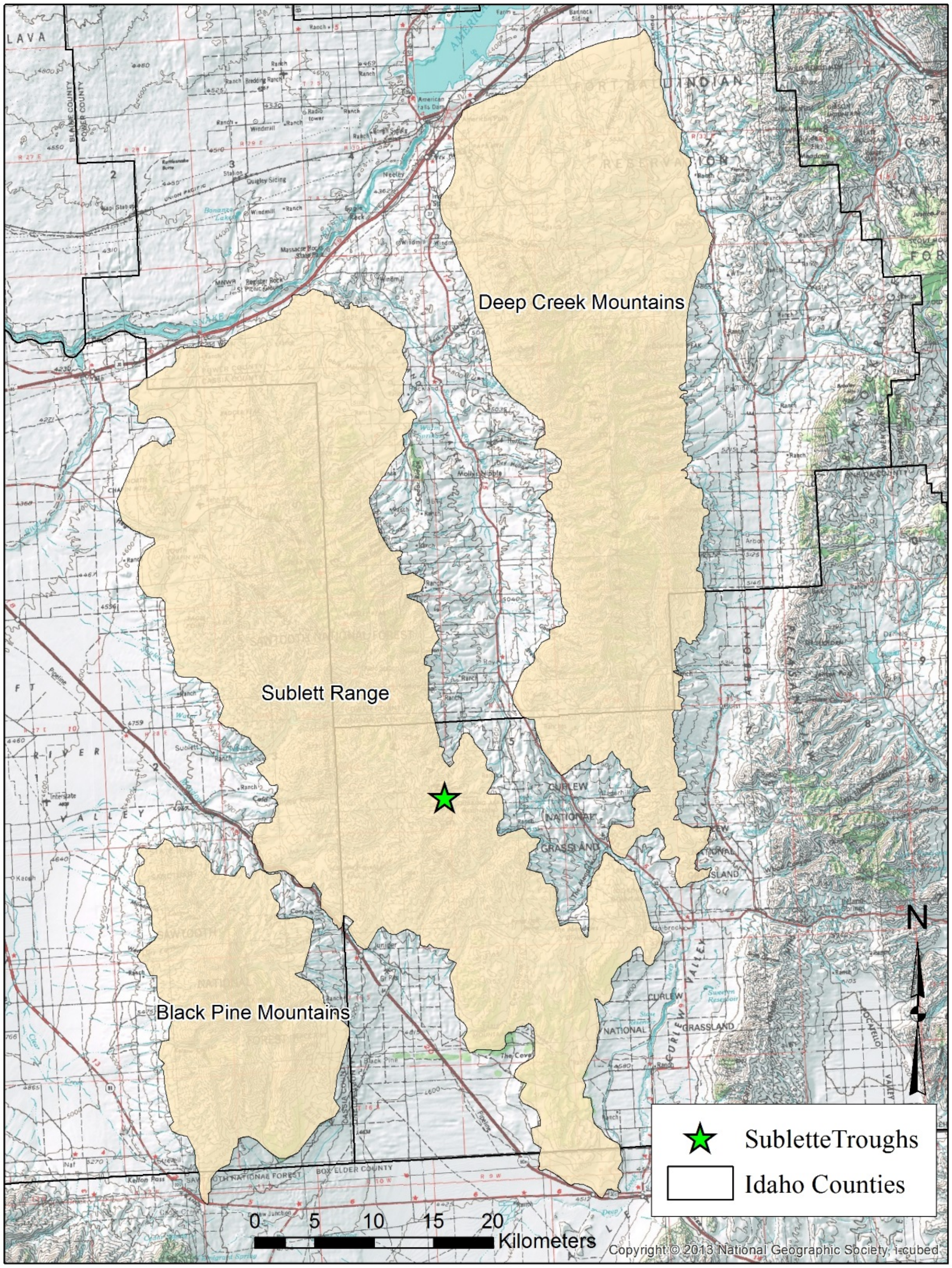

Figure 4. Map of the Sublett and surrounding mountain ranges.

The formation of obsidian is dependent on a magma's viscosity and the rate at which it cools (Shackley 2005). A dominant characteristic of the Yellowstone hotspot's volcanism over the last 16 million years is large volume rhyolitic lava flows (Bonnichsen, et al. 2008; Ellis & Wolff 2012; Nash, et al. 2006; Pierce & Morgan 1992; Watts, et al. 2011). Rhyolite is conducive to the formation of obsidian due to concentrations of silicon and aluminum oxides (SiO_2 and Al_2O_3) in its chemical composition (Shackley 2005, 14). The presence of these oxides in rhyolitic melts creates the high viscosity magma necessary to form glass (Cox, et al. 1979). Rapid cooling of these magmas produces the isotropic structure characteristic of glass. Isotropy in this context refers to an atomic structure that is completely disordered (Shackley 2005, 10). The rapid cooling of the silicic magma does not allow mineral crystals time to form (Andrefsky 2005, 48) and results in a material that does not have a preferred direction of fracture.

The three known obsidian sources closest to Sublett Troughs are Malad (46.3 kilometer east), Walcott (48.9 kilometer north), and Brown's Bench (89.6 kilometer west) (Figure 5). All are rhyolitic extrusions produced by volcanic activity over the last 13 million years. These three sources are the most likely candidates for the obsidian found at Sublett Troughs based on proximity. There are many other known obsidian sources in Idaho, some of which are represented in the collection, that were created by the same volcanic processes. The volcanic activity of the Yellowstone hotspot across Idaho was geographically widespread and ideal for the formation of obsidian.

The formation of tool grade obsidian is partially dependent on the water content of the magma from which it forms. Magma with > 2% H_2O content produces perlite or pitchstone, a porous material which cannot be utilized for tool production (Shackley

Figure 5. Known obsidian sources used in the source data for this study.

2005). The water content of the magma at the Bruneau-Jarbidge eruptive center is estimated at 0.6-1 % and is higher for the younger tuff around the Yellowstone caldera complex (Almeev, et al. 2012). This may help explain the formation of feldspar crystals in the Walcott obsidian. The Walcott and Malad sources are younger than Brown's Bench and are the product of higher water content and lower pre-eruptive temperature magmas (Almeev, et al. 2012; Nash, et al. 2006).

Brown's Bench is composed of Miocene Epoch rhyolite ranging from 13-7.5 Ma (million years ago) (Bonnichsen, et al. 2008; Lewis, et al. 2012). The Brown's Bench source is geographically widespread yet chemically homogenous enough to be considered a single source. This means that there is more variance in the chemical composition between Brown's Bench and other known sources than there is within the Brown's Bench source itself. This widespread distribution of a single chemical signature is due to the intense volcanism of the early stages of the Yellowstone hotspot's manifestation. Large volume eruptions of silicic magma over 5.5 million years produced widespread rhyolite formations including Brown's Bench (Bonnichsen, et al. 2008; Nash, et al. 2006; Pierce & Morgan 1992). This timespan includes the Owyhee-Humboldt (OH), Bruneau-Jarbidge (BJR), Twin Falls (TF), and Picabo (P) eruptive centers (Nash, et al. 2006; Watts, et al. 2011). These eruptive centers do not represent singular volcanic events but centralized locations for volcanic activity over a period of about 2 million years for each location (Bonnichsen, et al. 2008; Nash, et al. 2006). It is likely that that the bulk of the rhyolite that we see at Brown's Bench originated from the BJ, TF, and P eruptive centers (Bonnichsen, et al. 2008).

The chemical homogeneity of Brown's Bench obsidian can be attributed to the eruption of magma from a source that developed with parallel generation and inter-crustal storage (Bonnichsen, et al. 2008). In other words, the silicic magmas of each eruptive event were not completely isolated during either their formation or their pre-eruptive storage stages. This period of volcanism was characterized by hot pre-eruptive temperatures (900-1000° C) and very low water content (Almeev, et al. 2012; Nash, et al. 2006). The high temperature and low water content of the magma resulted in lower viscosity, which made pre-eruptive mixing and large volume eruptive events more likely. The chemical composition does evolve as crustal material was integrated into the magma (Almeev, et al. 2012; Bonnichsen, et al. 2008). The integration of crustal material did not alter the chemical composition of the widespread Brown's Bench source enough to discriminate individual sources within it using pXRF (Black 2014; Plager 2001).

Malad and Walcott are younger formations of Miocene and Pliocene Epoch rhyolite ranging from 6.6-4.5 Ma (Lewis, et al. 2012). These rhyolite formations are the product of the Heise eruptive center and differ from those that formed Brown's Bench in a few distinct ways. Their chemical composition is less homogenous between eruptive events. This creates distinctive source chemical signatures for obsidian produced by this eruptive center at different times (Embree, et al. 1982). The cooler pre-eruptive temperature of the magma (800-900° C) is associated with higher viscosity and higher water content (Almeev, et al. 2012).

Malad is an isolated rhyolite formation at the northern extent of the Malad Mountain Range. It is a relatively small formation known as a dome. Rhyolite domes are extrusions that form as a swell instead of a flow. This is due to the high viscosity of the magma, which hinders the flowing of a material that otherwise acts like a liquid (Shackley 2005). There are other rhyolite domes in the Snake River Plain that are the product of the same volcanic sequence. The Big Southern Butte is one of these rhyolite domes that is also a known prehistoric obsidian source.

The Malad source is well known and has been found as far away as Arkansas (Thompson 2004). It is a high quality obsidian that is very predictable to work with. Its location adjacent to the Portneuf and Marsh Valleys, which are understood to have been a highly utilized prehistoric travel corridor to and from winter camps in the Pocatello area (Steward 1938), would have made its procurement convenient for local groups.

The Walcott obsidian geochemical signature is found in at least four locations. The closest of the Walcott locales to Sublett Troughs is south of the American Falls Reservoir near Little Creek. The Walcott obsidian is relatively low quality in that feldspar crystal inclusions are common that make the material unpredictable during knapping (Carr & Trimble 1963). The geographic dispersion of the source can be attributed to a large initial eruptive event and the later subsidence of the Snake River Plain (Pierce & Morgan 1992).

There are three more sources that are directly related to obsidian recovered from Sublette Troughs. Bear Gulch, Conant Creek, and Pack Saddle are all sources found in northeast Idaho near Yellowstone National Park. All three are also a product of the Heise eruptive center but are younger ranging from 5.5 - 4 Ma (Watts, et al. 2011). These are high quality obsidians generated from silicic magmas with relatively cool pre-eruptive temperatures of (800-900° C) and high water content (Almeev, et al. 2012).

All other known obsidian sources mentioned in this study are the product of the same geologic processes discussed above. The six sourced detailed here are the most relevant to the Sublett Troughs site based on geochemical source analysis.

Portable X-Ray Florescence (pXRF)

X-rays are short wavelength, high energy electromagnetic radiation identified in 1901 by German physicist Wilhelm K. Röntgen. Over the next 40 years X-ray research and technology made large strides toward commercial utilization. By the 1950's, commercial X-ray technology was available and in use but it was not till the mid-1960's that it was applied to archaeology. In 1964, Cann and Renfrew used X-rays to characterize Mediterranean obsidian. The first geochemical sourcing application in the Americas was performed at Berkley by Jack and Heizer in 1968 (Shackley 2011).

Using X-rays to determine the elemental composition of geological samples depends on the ionization of atoms exposed to high-energy radiation. When an electron from the inner ring of an atom is displaced and replaced by an electron from an outer ring of the atomic structure, measurable energy is released. This emitted energy is called fluorescent radiation, or fluorescence. Using known differences between electron shell energies, the fluorescent radiation measured is indicative of trace elements present as well as their abundance (Shackley 2005).

This type of XRF is known as energy dispersive X-ray fluorescence (EDXRF) and can be performed using two different techniques. Laboratory XRF units are tabletop machines that analyze the specimen in a vacuum and precisely detect 13 elements (Black 2014). Portable XRF (pXRF) units are handheld and only precisely detect up to 11 elements. The difference in number of elements detected is an issue of voltage. Desktop units utilize higher voltages than portable units, making them more powerful analytical tools. What portable units lack in power they make up for in cost. Portable units are cheaper and more versatile due to their mobility.

Either machine is capable of producing data with the ability to make reliable source assignments (Black 2014; Frahm 2013, 2014; Shackley 2011). There are some limitations to using pXRF. The first is the existence of obsidian sources that require very specific measurements of certain elements to discriminate them from other sources. For instance, the Malad obsidian source requires an accurate barium measurement to distinguish it from the Cow Canyon source in Arizona (Shackley 2011). Portable units lack the ability to measure barium accurately due to power constraints. This can be problematic if there is any overlap in source use. It also calls into question instances of a material being found at great distances from a source, as we have seen with the Malad obsidian. More powerful analytical techniques are not yet readily available to all researchers to clarify questions of validity in source assignment.

Another limitation of pXRF is the repeatability of results by other researchers. There is no standard for the calibration of pXRF for obsidian to date and each researcher or institution develops their own protocols for calibration. Ellery Frahm has conducted research into the reliability of "off-the-shelf" pXRF units and found that for the purpose of determining obsidian provenience they are effective (Frahm 2013, 2014). The problem with Frahm's conclusion is that, although the experiments are internally consistent, the results may not be repeatable by another lab or with other equipment (Speakman & Shackley 2013).

CHAPTER 3: METHODS

The following is a comprehensive list of methods used throughout this study. The collection of material was completed using established archaeological methods for the assessment of a site and the collection of its materials. Faunal analysis was performed by a member of the field team and presents information on available animal resources. Historic artifact identifications are based on diagnostic traits of the historic assemblage. The collection of pXRF data includes the creation of a source database and artifact analysis. Source assignment based on bivariate plots of trace element levels are discussed. Finally, artifact depositional context is presented as the analytical element that reveals patterns in the material record.

Field Collection

Sublett Troughs was surveyed by a crew of nine undergraduates supervised by two graduate students using < 5m north-south oriented transects in an intensive pedestrian survey to assess the potential for subsurface investigation. Eighteen artifacts were collected from the surface during pedestrian survey at Sublett Troughs, four were partial or intact projectile points and the rest were classified as debitage. The crew returned to Sublette Troughs the following day to begin subsurface testing.

A 20 x 20 meter grid was mapped on the site and 19 shovel tests were performed at the intersections of the grid (Figure 6). Shovel tests were roughly 30.5 cm in diameter with a minimum depth of 37 cm and a maximum depth of 80 cm. The soil was sifted through ¼ inch steel mesh screens. The majority of these shovel tests (17 of 19) were positive for cultural material. Eight more shovel tests were conducted during the

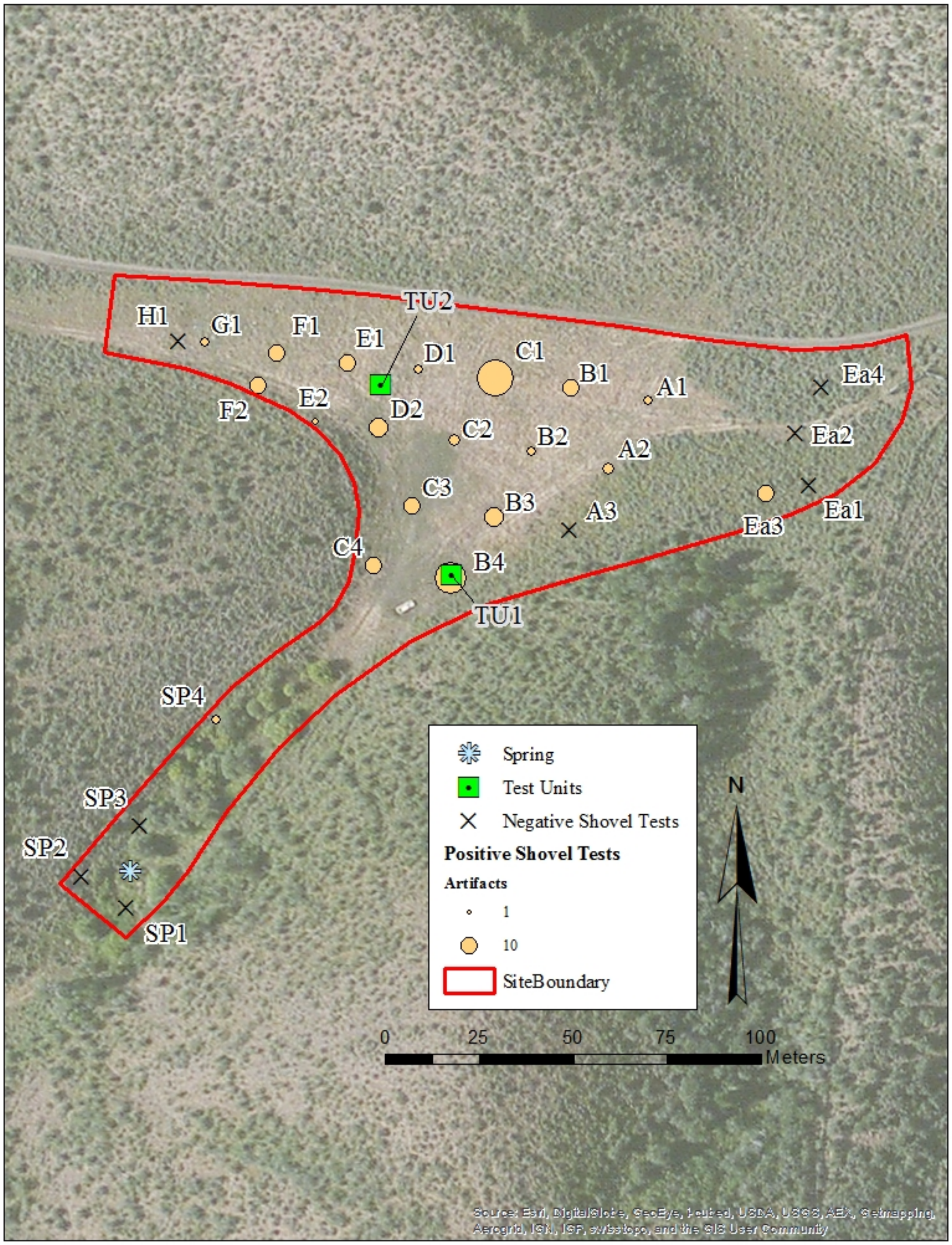

Figure 6. Map of the Sublett Troughs site.

course of the investigation at Sublett Troughs. Two shovel tests were excavated within ten meters of the spring and two more along the western hillside parallel to the subsurface pipe connecting the spring and the watering trough. Only one of the spring site shovel tests was positive for cultural material. Four more shovel tests were performed east of the northern portion of the site. Only one of these was positive for cultural material. Of the 27 total shovel tests performed, 19 (70%) were positive for cultural material and produced 193 artifacts (Figure 6). Recorded depths for material recovered from shovel tests were measured from the upper-most surface to the bottom of the hole in centimeters or centimeters below the surface.

Excavation of two 1 x 2 meter test units followed the completion of shovel tests at the site. Test Unit 1 (TU1) was at the base of the southeastern hill adjacent to shovel test B4. This location was chosen because B4 was one of the most productive of the initial shovel tests with 31 artifacts collected. TU1 was slightly higher in elevation than the watering trough and 117 meters northeast of the spring. Test Unit 2 (TU2) was at the base of the southwestern hill below the trough and its drain field, 145 meters north by northeast of the spring. TU2 was positioned between shovel tests D2 and E1 which produced 13 and 11 artifacts respectively (Figure 6).

The test units were mapped out and a zero datum for each was established. The students were divided into two teams, and excavation began. TU1 was directly supervised by graduate student Maegan Tracy and TU2 was supervised by Dr. Peterson. The humus layer was removed using shovels and the soil that remained after separating the vegetation was screened through a ¼ inch wire mesh. Hand excavation followed by level in 10 cm intervals. All soil removed was screened for artifacts and documentation, including photographs of the bottom of the layer, was completed for each layer before beginning excavation of the next. When excavation of a test unit was completed (2 meters) the stratigraphic profile of the soil matrix was documented.

Artifacts were recorded in situ whenever possible, when recovered via screening artifacts were assigned to the appropriate layer. If there were questions regarding any of the recorded attributes, the unit supervisor was consulted to resolve the issue. Depths for material recovered from test units were measured from the established datum in centimeters or centimeters below datum. If an artifact was found in situ, northing and easting distances from the zero datum were recorded.

All geographic site attributes were recorded using a Trimble Geoexplorer 6000 series GeoXT GNSS (Global Navigation Satellite System) unit for the duration of the field work. The Trimble was equipped with ArcPad software, which facilitated “on-the-fly” data collection. Shapefiles with appropriate attribute fields were created for each feature and the data were recorded as the work progressed. The 6000 Series GeoXT utilizes the US GPS (Global Positioning System), Russia’s GLONASS (Globalnaya Navigazionnaya Sputnikovaya Sistema), and WAAS (Wide Area Augmentation System) to obtain sub-meter accuracy. The real- time correction accuracy during collection is 75 cm with down to 1 cm accuracy after post-processing (Trimble Navigation Limited 2011). With the Trimble GPSCorrect extension, data was prepared for post-processing with Trimble Pathfinder Office software, which adjusted the final data to an accuracy of < 20 cm. All maps created from these data were made by the author using ArcGIS 10.2 and 10.3 desktop software.

Identification of the Faunal Assemblage

The identification of the faunal assemblage from Sublett Troughs was completed by Charlotte Wells, a member of the field crew, under the supervision of Dr. Peterson and Dr. Mary Thompson of the Idaho Museum of Natural History (IMNH). This analysis was restricted by the poor preservation of most of the bones. For many of the remains identification beyond class to genus or species was impossible. The full report of the analysis can be found in Appendix A.

Historic Artifact Identification

Identifying the historic artifacts present in the collection can reveal a date range for the historic utilization of the site. The historic artifacts found at Sublett Troughs are mostly fragmented metal, glass, ceramics, and concrete. Most of these are in poor condition, which makes specific identifications difficult. Using the diagnostic traits that remain, these artifacts can be sorted into general age-ranges which give us some idea about their depositional history.

The metal in the collection varies from non-descript ferrous fragments to a .22 caliber shell casing. Identifying metal implements relies on being able to recognize period-specific manufacturing methods, materials, and makers' marks. Identifying the manufacturing method gives us an earliest possible date for deposition. Spikes and nails in the collection were assessed for their manufacturing attributes as a starting point for a date range. The single piece of barbed wire found was assessed for manufacturing technique to obtain an earliest possible date for its deposition. The shell casing's manufacturer can be identified by the head stamp and, in combination with the shell's caliber, an earliest date of deposition can be assigned.

The identification of historic glass relies on manufacturing technique as well as the physical attributes of the material. Visual and structural attributes of the glass can shed light on what time period it was made. There are colors and tints that change as glass-making technology and aesthetic tastes evolved. The manufacturing of glass also leaves behind many specific diagnostic traits that can often be very helpful. Every seam or edge holds valuable information as to when a vessel was manufactured (Lindsey 2016). The glass from Sublette Troughs is exclusively fragments, which makes specific identification and the determination of date ranges difficult. The color is the most telling attribute available for this study and general date ranges for when a specific color was manufactured in the US is as far as this study's analysis of historic glass could go.

There are seven pieces of historic ceramics from the Sublette Troughs site. Like the glass, all are fragments. There are some edge pieces that provide limited information about the vessels they came from. The material used allows us to classify the type of ceramic based on the color and texture of the paste. The finish can also provide diagnostic information based on type (glaze, slip, etc.) and colors or design techniques used. However, determining a general date range for the manufacture of the artifacts is the limit of this analysis.

The three pieces of concrete found lack any truly diagnostic features. Chemical analysis could be telling about the specific mix used, but without rebar or some other diagnostic inclusion, any date range given would be nothing more than speculation. The white color and powdery texture of the concrete does indicate that the original mix either had an excessive amount of lime or that calcium was added to speed the curing process. Neither of these adjustments to the standard concrete mix is abnormal or specific to any time period. It is also possible that the color and texture of the concrete found is a product of its depositional context. The alluvial nature of the site creates an environment that is capable of leaching elements out of and into a material as porous as concrete.

pXRF Data Collection

The pXRF analysis was performed using a Bruker Tracer III-V (Figure 7). The unit is equipped with a rhodium (Rh) tube, a 190 eV resolution Si-PIN diode detector, and operates at 40 kV and 12µA using an external power source (Bruker). The unit was calibrated using an electronic file of trace element values from obsidian around the world provided by the Missouri Research Reactor Archaeometry Laboratory. The ten elements recorded by the Bruker for obsidian were calibrated and are as follows; manganese (Mn), iron (Fe), zinc (Zn), gallium (Ga), thorium (Th), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). This calibration provided internal consistency between the source and specimen measurements.

Figure 7- Bruker Tracer III-V

The source data were collected by Buck Benson of the IMNH lithics lab. Obsidian specimens from 17 known sources were analyzed. Geologic samples were collected from known source locations and brought back to ISU for analysis. The samples were prepared by creating a flat surface to sit over the detection window of the pXRF that was > 7 mm^2 and thicker than 2mm. Each specimen was analyzed for 200 live seconds at 10,000 counts per second (cps). The counts for each specimen were collected with S1pXRF software and analyzed to find a mean and standard deviation of all measurements. The data were exported to an Excel spreadsheet, extraneous data were eliminated, and a data base of source profiles was created.

Each obsidian specimen was placed over the detection window using the face with the most complete coverage of the window. The size and morphology of samples are noted issues affecting pXRF results (Black 2014; Shackley 2005, 2011). Ideally, a specimen will have a flat, smooth face that covers the entire detection window (7 mm^2) and is > 2 mm thick (Shackley 2005, 2011). When analyzing specimens that do not meet these requirements, using the best available face is enough to produce sufficient data for source analysis (Frahm 2013).

The pXRF measured for 120 seconds at 10,000 cps. The raw data were recorded using S1pXRF software. The measurements were averaged to produce the final trace element profile for each specimen. Each profile was saved in an Excel compatible format, where the specimen data base was built by removing all but the ppm trace element measurements and nominal identifiers. These data were compared to the source data using bivariate plots of discriminate trace elements to determine provenience.

Obsidian Source Assignment

Statistical assignment of a geochemical source identification can be accomplished using a number of multivariate statistical methods (Black 2014; Glascock, et al. 1998; Shackley 2005, 2011). A bivariate plot of discriminant elements can identify group clusters that are representative of particular sources. Bivariate plots are graphic representations of the variation and any groupings within the data. The JMP Pro 12 statistical package was used to create bivariate plots of all possible trace element combinations to compare the density of clusters created and to determine which combinations proved most discriminate for these data. Bivariate plots of yttrium (Y) and zirconium (Zr) for both the source (Figure 8) and artifact (Figure 9) data show dense clustering indicative of greater between source variation than within source variation.

Three combinations of trace elements were used in the final source assignment; yttrium (Y) and zirconium (Zr) (Figure 10), strontium (Sr) and zirconium (Zr) (Figure 11), and strontium (Sr) and yttrium (Y) (Figure 12). Yttrium and zirconium have been identified in previous research as the two most statistically discriminant elements for Idaho obsidian (Black 2014) and was verified by the bivariate plots produced for this study. Strontium is commonly used for bivariate plots of obsidian data (Shackley 2005) and proved effective at creating dense clusters from these data.

The source data available for this study has a low ratio of observations to variables, with the exception of the Bear Gulch source (Table 1). The Conant Creek source originally had ten geologic samples but one was removed from the analysis due to a null value for iron (Fe). The low ratio of observations to covariates makes using

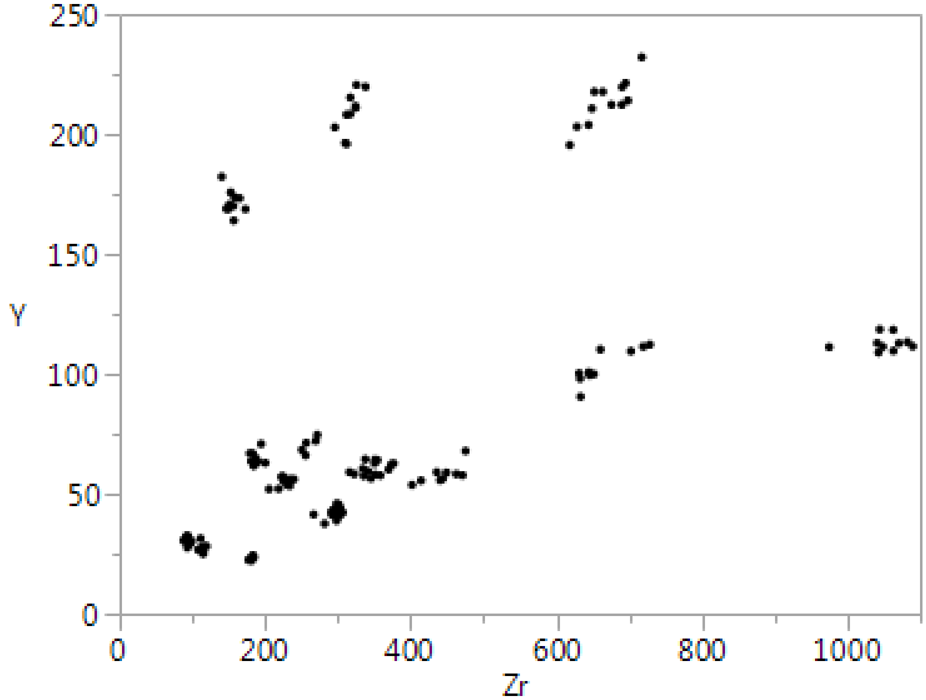

Figure 8. Bivariate plot of yttrium and zirconium for source data.

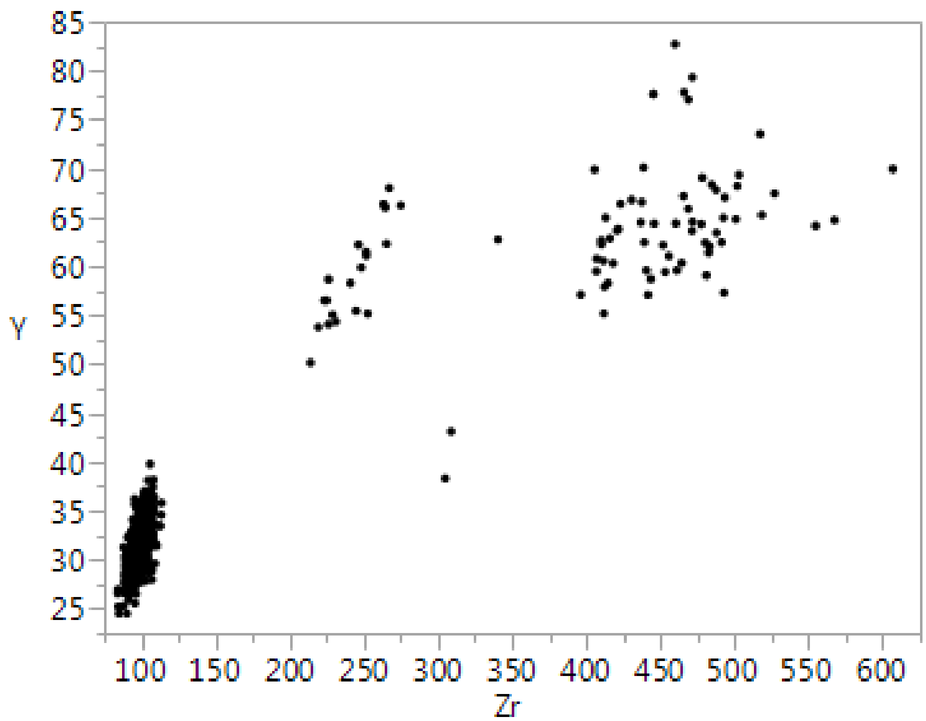

Figure 9. Bivariate plot of yttrium and zirconium for artifact data.

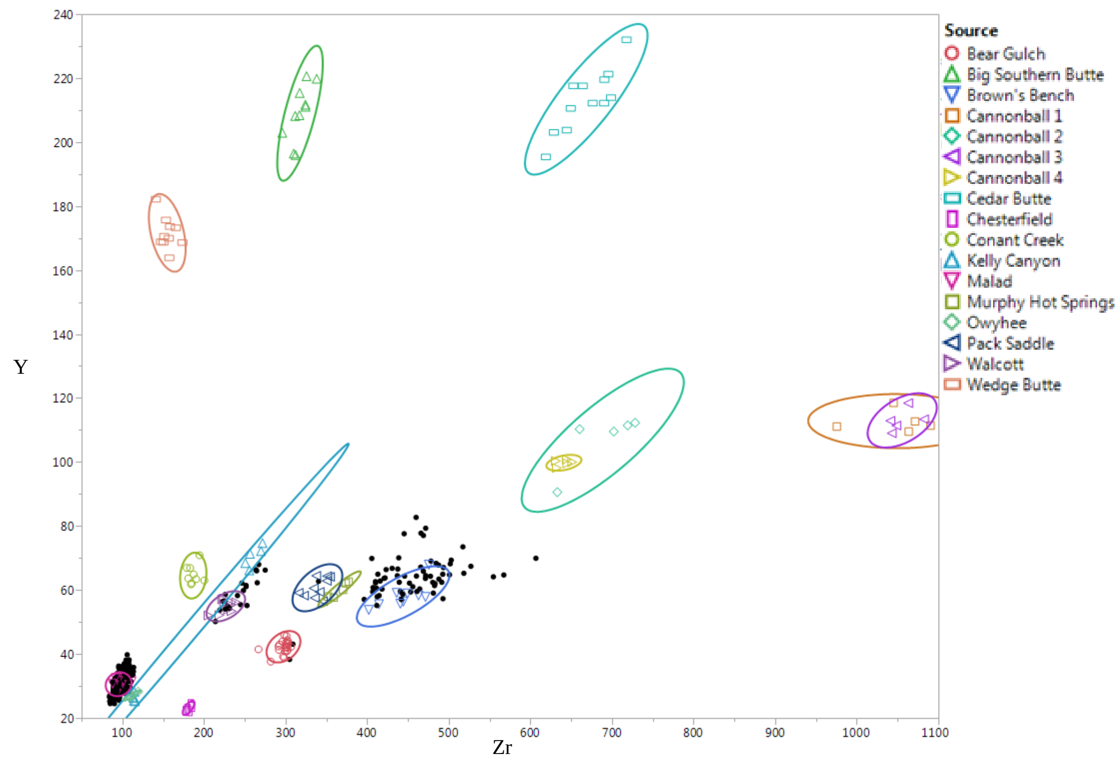

Figure 10. Bivariate plot of yttrium and zirconium showing 95% density elipses for sources.

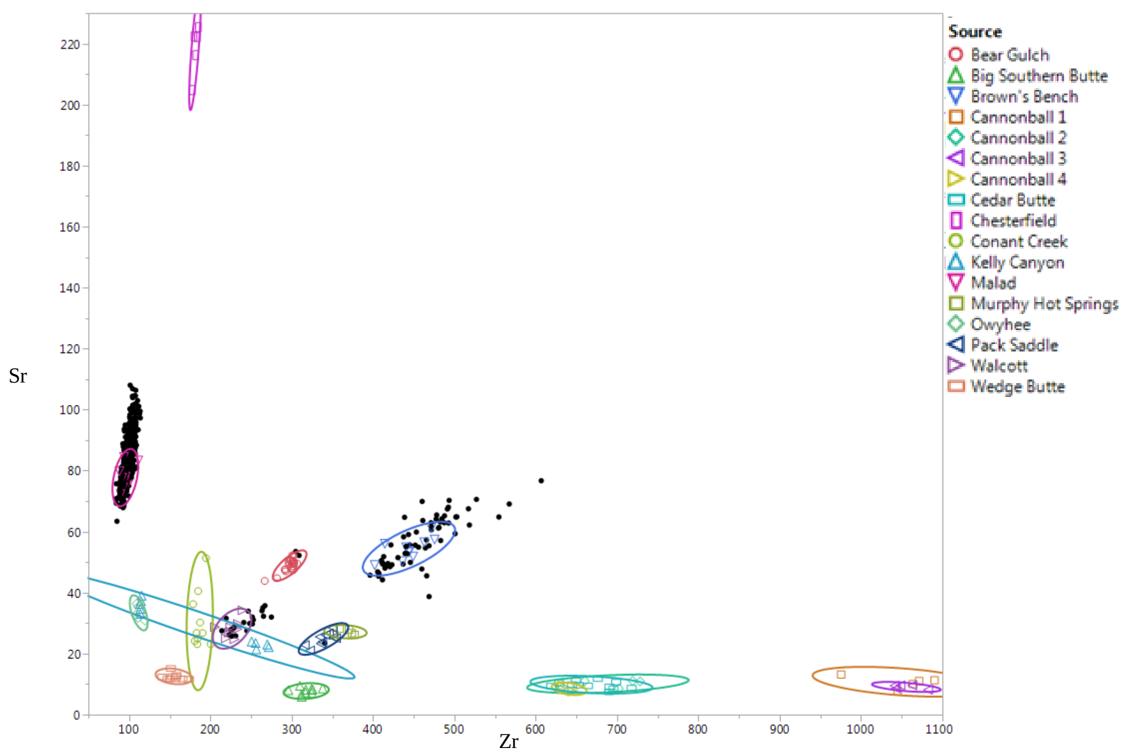

Figure 11. Bivariate plot of strontium and zirconium showing 95% density elipses for sources.

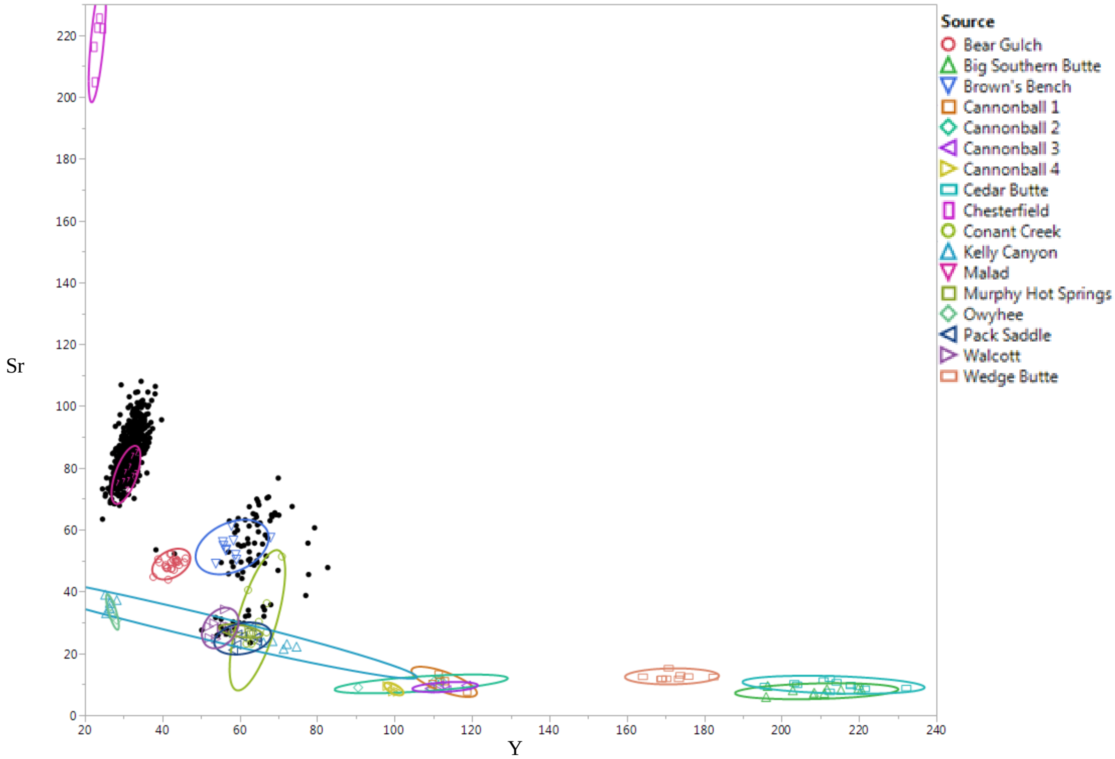

Figure 12. Bivariate plot of strontium and yttrium showing 95% density elipses for sources.

Source Name	Count (n=)
Bear Gulch (BG)	23
Big Southern Butte (BSB)	10
Brown’s Bench (BB)	10
Cannonball 1 (CB1)	5
Cannonball 2 (CB2)	5
Cannonball 3 (CB3)	5
Cannonball 4 (CB4)	5
Cedar Butte (CeB)	12
Chesterfield (Cf)	5
Conant Creek (CC)	9
Kelley Canyon (KC)	10
Malad (M)	10
Murphy Hot Springs (MHS)	5
Owyhee (O)	5
Pack Saddle (PS)	10
Walcott (W)	10
Wedge Butte (WB)	10

Table 1. Sources and number of geologic samples used to create each source profile.

discriminant methods such as principal component analysis (PCA) a poor option for this study.

Analysis of Context

Context is key to understanding the significance of any artifact in the story of human activity at a site (Renfrew & Bahn 2016). There are many environmental factors to be considered when analyzing depositional context. Regional climate, location of the site within the landscape, and the presence of burrowing rodents all play a role in the preservation of an artifact and in the development of the matrix surrounding it. Provenience, or an artifact's specific location within a matrix, is dependent on initial deposition and post-depositional factors such as erosion and subsurface activity. At Sublett Troughs there are specific contextual factors that affect the interpretation of the assemblage, in both a general sense and in very specific ways.

Generally, the development of the soil matrix and post-depositional movement are directly affected by the temperate regional climate and the Sublett Trough's position at the base of two hills within a spring drainage. Erosion from the hills and the spring area can carry sediment and artifacts from higher elevations into the basin where the site is located. This, coupled with airborne particles, provide the material that makes up the soil matrix. Site specific factors include the prevalence of burrowing rodents and cattle.

Modern ranching practices have created a heavily impacted surface context at Sublette Troughs (Corliss 1967; Goddard & Sant 2001). Development of the spring at the site for watering free-range cattle caused extensive surface disruption and concentrated subsurface disturbance. The spring development is typical of others in the area, consisting of a subsurface pipe from the spring to the trough. The use of heavy equipment in the excavation of the pipe trench causes both surface and subsurface disruptions (Corliss 1967). The cattle that utilize the trough also cause extensive surface disturbance.

Burrowing rodents at Sublett Troughs cause subsurface disturbance of primary context. Remains of burrowing rodents are found in all layers of the excavation at the site (Wells & Peterson 2015). This introduces the potential for disturbance throughout the entire matrix. Evidence of this disturbance is present in both test units. There are minimal (< 10% of the unit) rodent runs evident in the upper 13 layers and a more extensive presence (> 25%) in the upper four layers.

All archaeological excavations at Sublett Troughs, with the exception of four shovel tests, were conducted below the trough, minimizing the probability of previous excavations having affected the primary context of artifacts found. The possible effects of noted disturbance by burrowing rodents are taken into consideration when appropriate.

There are attributes of the artifacts that can help determine if the primary context has been preserved. The condition of historic artifacts and bone, compared to other artifacts of the same material, can give us some idea of how long each has been buried. This relative dating technique is generally employed to indicate possible movement of artifacts in the matrix. Vertical location in the matrix, compared to possible date ranges of artifacts, can also highlight discrepancies in the chronology of the site's stratigraphy.

Excavation techniques also deserve consideration in the analysis of context. The difference in recorded context between shovel tests and test units is significant. Shovel tests are used to determine the subsurface potential of a site, but do not preserve context.

They can provide general information about the depth of an artifact but are prone to sluffing of material from upper layers. Primary context cannot be determined from shovel tests. The methods used in the hand excavation of test units are specifically designed to preserve context. The remainder of this analysis will rely on information from test units when discussing context. Artifacts recovered from shovel tests may be mentioned but are considered inconclusive with regard to context.

Diagnostic artifacts, both historic and prehistoric, are particularly vital to the discussion of context. Though all artifacts are part of the story, diagnostics provide more specific information about the chronology of the site. Their position within the matrix gives us reference points for dating artifacts associated with them in the same excavated layer. It can also provide information about possible movements of artifacts within the matrix.

The analysis of artifact context at Sublett Troughs begins with a count of artifact types in each layer. This defines the prevalence of each artifact type. Diagnostic artifacts are then evaluated by layer to identify any anomalies in the general chronology of the assemblage. Anomalies are noted and assessed for their impact on date ranges assigned to layers of the excavation. The results of pXRF analysis are then organized by layer and examined for trends in toolstone use.

CHAPTER 4: RESULTS

The following data are the cumulative results of the application of methods described above. The identification and date ranges applied to historic materials are based on known diagnostic manufacturing techniques. Relevant aspects of the faunal analysis provided by Charlotte Wells and Dr. Peterson are presented (2015). Prehistoric artifacts were classified by material and diagnostic projectile points were identified. The source assignments of obsidian geochemical analysis are listed. The discussion of artifact context and resulting date ranges are provided.

Historic Material

Of the artifacts found at Sublett Troughs only 59 of 2,083 are of historic origin; there are 36 metal fragments, 13 glass shards, 7 fragments of historic ceramics, and 3 pieces of concrete. Most of these artifacts are in a poor state of preservation. Those that maintained diagnostic attributes were analyzed to establish date ranges of deposition.

The metal is predominantly ferrous fragments with little diagnostic potential. There are seven metal artifacts that maintain diagnostic features for analysis; two nails, one spike, a shell casing, a piece of barbed wire, and two aluminum ring tabs. The nails and the spike were made using the wire manufacturing technique. This specific method dates to the mid-19th Century in the United States. Though small nails were produced in New York using this technique by the 1850's, the machinery to produce large nails for construction purposes was not perfected on this side of the Atlantic until 20 years later (Nelson 1963, 9). Nelson also notes that wire style nails did not become the preferred fastener in general construction until the 1890's (1963, 10). The shell casing's form (rimmed flanged) and measurements (.225” diameter, .43” length) are indicative of either a .22 CB or .22 short rim fire cartridge (Ball 1997). The head stamp indicates that the shell casing was manufactured by The Union Metallic Cartridge Company (UMC) sometime after 1880 (Huegel 2013). The barbed wire is known as the Baker Flat Barb and is characterized by two strand wire and a double point, half-twist barb. This specific wire was patented in 1883 (National Parks Service 2016). The aluminum ring tabs found were first marketed in 1965 (Maxwell 1993).

The glass fragments found were all small pieces of shatter lacking diagnostic manufacturing traits such as lips, seams, edges, or makers’ marks. There are not enough of the contours preserved to determine the specific vessels that these pieces came from. One trait that can be telling for manufactured glass is color. Of the 13 glass shards found, five were colorless, four were non-olive green, two were aqua, and two were brown. All of these colors have been widely used throughout the last two hundred years of American glass manufacturing. The aqua glass is most common between the early 1800’s and 1920. It was a color of manufactured glass that was almost completely replaced by colorless glass in the 1920’s. The popular Ball brand mason jars were an exception, made of aqua glass till the 1930’s. Colorless or clear glass became most popular in the 1920’s but was available before that time. The non-olive green and brown glass have been used throughout American glass manufacturing history and cannot provide a specific date range without further analysis (Lindsey 2016).

The seven pieces of historic ceramics found are all lead glazed white-ware which has been manufactured since the 1820’s. Two are edge pieces of what may have been a plate or some other large piece of tableware. There are two fragments without edges made of an off white paste with a shattered lead glaze. An edge piece with blue pigment added to the glaze with no distinct pattern is possibly representative of a sponged design dating to between 1830 and 1871 (Brown 1982). These fragments are composed of an off-white paste with a shattered lead glaze. A piece in particularly poor condition has white lead glaze on one side and what might be brown glaze on the other. The color of the paste is difficult to discern but is very fine grained, and similar in texture to the paste generally associated with white-ware. There is one fragment with no discernable diagnostic features.

Faunal Material

Faunal material collected at Sublett Troughs consists of 643 bones or bone fragments. Faunal remains were not assigned to historic or prehistoric contexts unless there was evidence of human alteration. Two bones were altered; one is a bone tool, possibly a scraper, and is counted as a prehistoric artifact and the other is the vertebra of a *Bison sp.* with a lateral incision that remains in the faunal count. Preservation quality was fair to poor, preventing identification beyond the class level in many cases. All faunal material could be attributed to the class *Mammalia* with *Bison sp.* (unidentified species of Bison) and *Antilocapra americana* (Pronghorn Antelope) representing the only positively identified large game animals. There were also the remains of ground squirrel, vole, and two genera of pocket gophers. The complete faunal report can be found in Appendix A (Wells & Peterson 2015).

Prehistoric Material

Prehistoric material dominated the assemblage with 1,381 of the 2,083 artifacts collected. The entire prehistoric assemblage consists of lithic material with the exception of one bone tool. Of the prehistoric assemblage 1,175 pieces (85% of all lithic material) are obsidian, with 144 pieces of chert, 33 pieces of chalcedony, 22 pieces of quartzite, and 7 pieces of fire cracked rock (Figure 13).

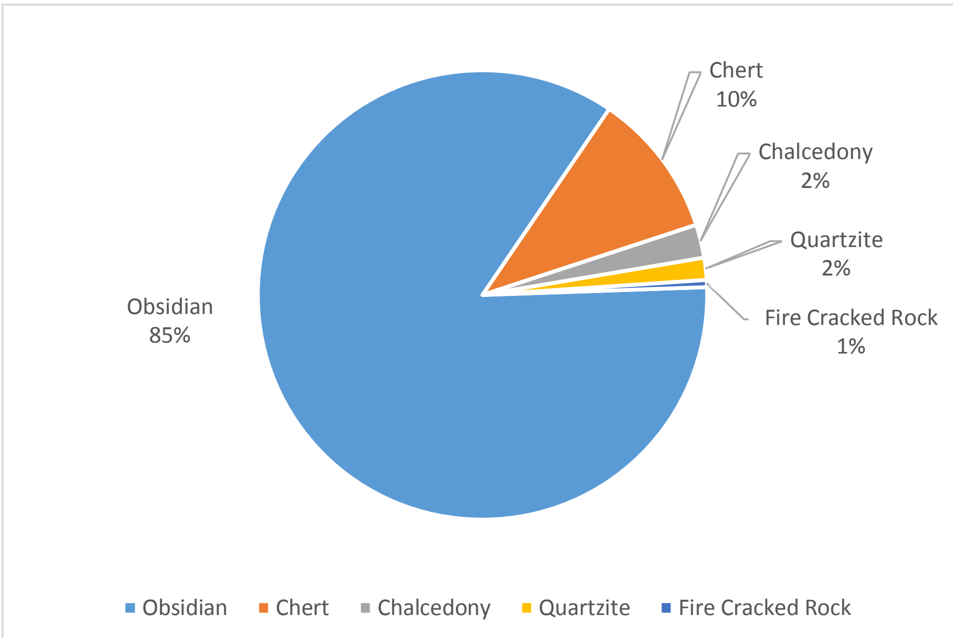

Figure 13. Chart of lithic assemblage percentages by material.

Of the obsidian artifacts, 18 were identifiable pieces of tools; 12 projectile points, 2 bifacial scrapers, 1 rectangular bifacial tool, 1 reworked flake, 1 eccentric piece, and 1 drill fragment (Table 2). The other 1,157 pieces of obsidian are classified as debitage. Debitage is considered to be the unused product of lithic tool manufacture (Andrefsky 2001).

Tool Type	Count
Projectile Points	12
Scrapers	2
Rectangular Biface	1
Drill	1
Eccentric	1
Retouched Flake	1

Table 2. Identified lithic tools.

There are 11 diagnostic lithic artifacts in the assemblage, all of which are projectile points. There are four Rose Spring Corner Notch points, three Elko Corner Notch points, three Gatecliff Split Stem points, and a Desert Side-notch point. The general date range for this set of points is 5,000-100 BP (Holmer 2009; Justice 2002).

<u>pXRF Analysis of Obsidian</u>

Bivariate plots of strontium (Sr), zirconium (Zr), and yttrium (Y) assigned 596 of the 678 (~87.9 %) artifacts analyzed to known obsidian sources. There were three artifacts assigned to multiple sources in a single plot or to a different source in multiple plots. These variable source assignments could not be resolved. The remaining 79 artifacts were not assigned to a source based on this analysis (Table 4).

The bivariate plot of Sr/Zr (Figure 11) assigned 459 artifacts to three sources; 1 to Bear Gulch, 44 to Brown's Bench, and 414 to Malad. Two artifacts were assigned to multiple sources and 217 were not assigned (Table 3). The artifacts with multiple source assignments were compared to the assignments made by the other plots to determine if a single assignment was possible. Artifact ST182a was assigned to both the Kelley Canyon and Walcott sources in this plot. It was assigned to Walcott specifically by the plot of

Y/Zr and was not assigned to a source by the Sr/Y plot. ST182a was assigned to Walcott, based on the agreement of the Sr/Zr and Y/Zr plots. The source assignment of the other artifact in question (ST154c) could not be resolved.

The plot of Y/Zr (Figure 10) assigned 518 artifacts to four sources; 23 to Brown's Bench, 484 to Malad, 1 to Pack Saddle, and 10 to Walcott. There were no artifacts that received multiple assignments using this plot. There were 160 artifacts that remained unassigned to a known source (Table 3).

The plot of Sr/Y (Figure 12) assigned 365 artifacts to five sources; 1 to Bear Gulch, 29 to Brown's Bench, 10 to Conant Creek, 320 to Malad, and 5 to Walcott. Six artifacts were assigned to multiple sources and 307 were not assigned (Table 3). The six artifacts assigned to multiple sources were compared with the results of the other plots to determine if a single assignment for each was possible. Artifact ST50c2 was assigned to Pack Saddle, Murphy Hot Springs, and Walcott in this plot. The plot of Y/Zr assigned it to Walcott and it was not assigned to a source by the Sr/Zr plot. Based on the agreement of the Sr/Y and Y/Zr plots, ST50c2 was assigned to the Walcott source. Artifact ST74c was assigned to Conant Creek, Kelley Canyon, and Pack Saddle by this plot. The plot of Y/Zr assigned it to the Pack Saddle source and it was not assigned to a source by the Sr/Zr plot. Based on the agreement of the Sr/Y and Y/Zr plots, ST74c was assigned to Pack Saddle. Artifact ST99g was assigned to Pack Saddle, Murphy Hot Springs, and Walcott by this plot. The plot of Y/Zr assigned it to the Walcott source and it was not assigned to a source by the Sr/Zr plot. Based on the agreement of the Sr/Y and Y/Zr plots, ST99g was assigned to the Walcott source. Artifact ST116e was assigned to Murphy Hot Springs and Walcott by this plot. The plot of Y/Zr assigned it to the Walcott source and it was not assigned to a source by the Sr/Zr plot. Based on the agreement of the Sr/Y and Y/Zr plots, ST116e was assigned to the Walcott source. Two artifacts, ST116f and ST170m, were assigned to Pack Saddle and Walcott by this plot. The plot of yttrium and zirconium assigned them to the Walcott source and it was not assigned to a source by the Sr/Zr plot. Based on the agreement of the Sr/Y and Y/Zr plots ST116f and 170m were assigned to the Walcott source.

Three artifacts were assigned to multiple sources. Their provenience could not be resolved using a comparison to other plots. Artifacts ST96e and ST168u were assigned to Conant Creek by the Sr/Y plot, but to Brown's Bench by the Sr/Zr plot. The Sr/Y plot did not classify these artifacts and their final assignment is listed as "Multiple". Artifact ST154c was classified by the Sr/Zr plot as Conant Creek, Kelley Canyon, and Walcott. Neither of the other plots classified this artifact and it is also listed in the "Multiple" category (Table 4).

Source	**Sr/Zr**	**Y/Zr**	**Sr/Y**
Bear Gulch	1		1
Brown's Bench	44	23	29
Conant Creek			10
Malad	414	484	320
Pack Saddle		1	
Walcott		10	5
Multiple	2		6
Unassigned	217	160	307
Total	678	678	678

Table 3. Results of each bivariate plot assignment.

Source	n=
Bear Gulch	2
Brown’s Bench	49
Conant Creek	8
Malad	525
Pack Saddle	1
Walcott	11
Multiple	3
Unassigned	79
Total	678

Table 4- Final source assignments.

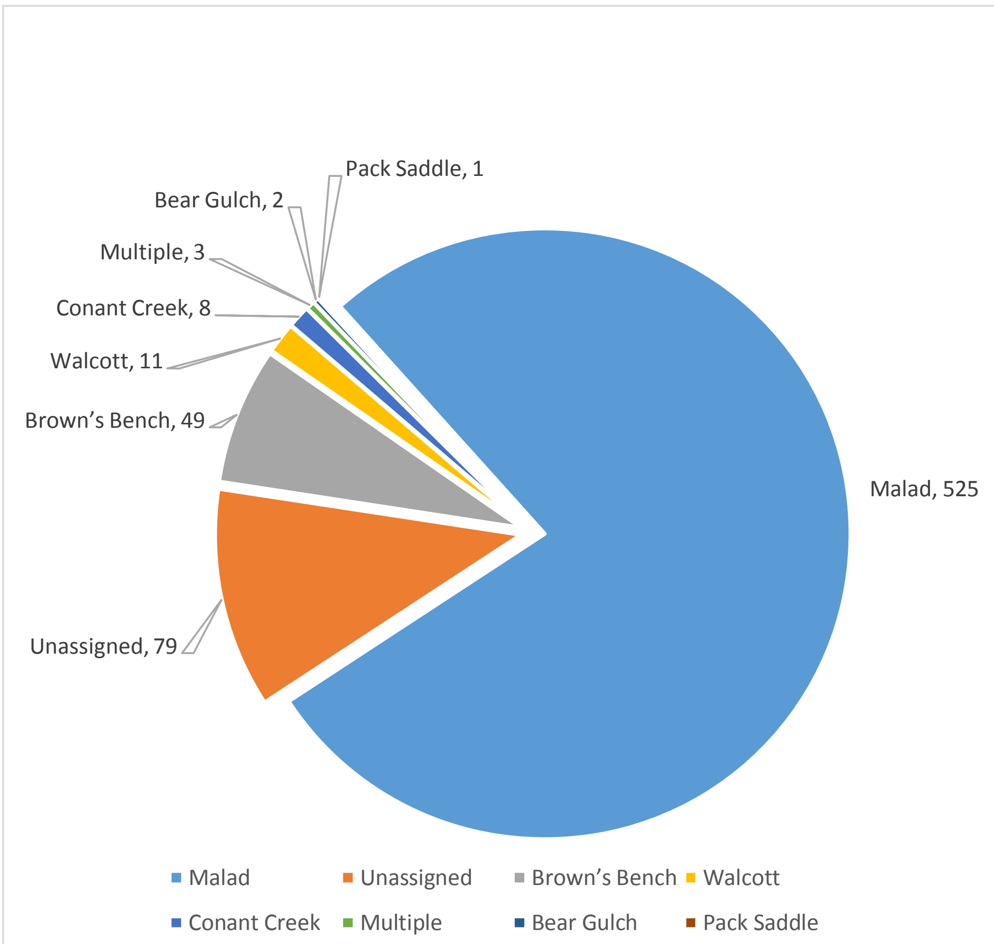

Figure 14. Chart of final source assignments.

Of the final source assignments (Table 4), 165 artifact source assignments were made by a single plot, 114 assignments were made based on the agreement of two plots, and 317 assignments were confirmed by all three plots (Figure 15).

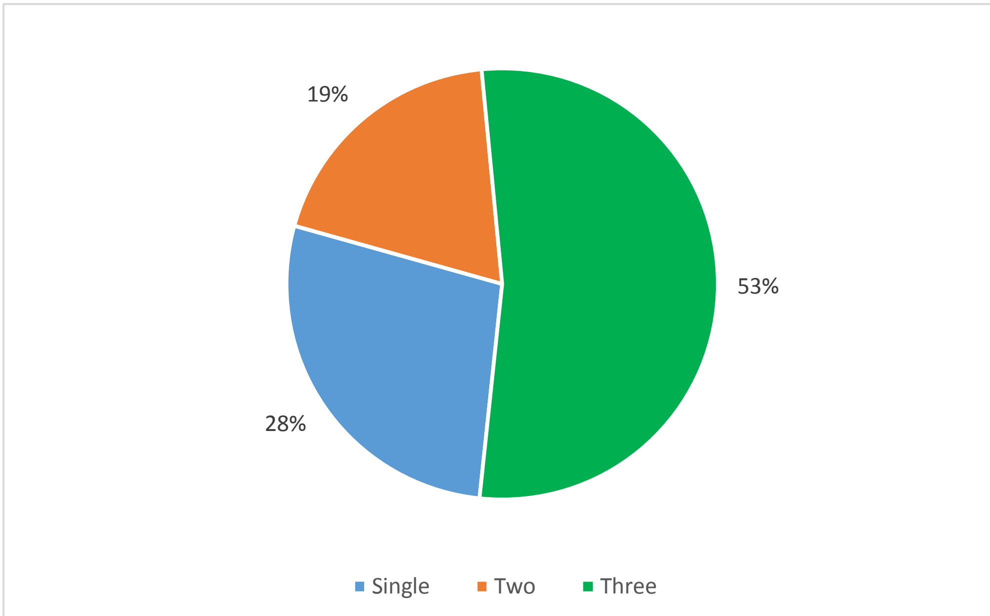

Figure 15. Chart of the agreement between bivariate plot source assignments.

Artifact Context Analysis

The context of an artifact tells us how it relates to other artifacts and fits within the assemblage as a whole. The following results include material recovered from the test units excavated at Sublett Troughs only. The artifacts found in test units were collected under controlled conditions specifically designed to preserve context. Artifacts collected from the surface, shovel tests, or wall cleans do not provide useful contextual information and are not included.

There were 17 historic artifacts collected from test units (Table 5). Two pull tabs, a shard of clear glass, and a shard of aqua glass were recovered from the first layer. Seven historic artifacts were recovered from level two; one shard of brown glass, two shard of non-olive green glass, two shards of clear glass, and two metal fragments. Layer three produced five artifacts; a shard of aqua glass, a spike, two nails, and a metal fragment. A single metal fragment was found in layer seven. The nails and spike found in level three are the most significant historic diagnostics. The earliest date they could have been deposited at the site is 1890 (Nelson 1963).

Layer	Depth	Historic	Faunal	Prehistoric	Total
1	0-10 cm	4	9	76	89
2	10-20 cm	7	72	69	148
3	20-30 cm	5	38	79	122
4	30-40 cm		21	64	85
5	40-50 cm		43	95	138
6	50-60 cm		63	93	156
7	60-70 cm	1	19	95	115
8	70-80 cm		43	87	130
9	80-90 cm		23	70	93
10	90-100 cm		19	83	102
11	100-110 cm		41	133	174
12	110-120 cm		43	93	136
13	120-130 cm		22	48	70
14	130-140 cm		27	43	70
15	140-150 cm		27	39	66
16	150-160 cm		21	17	38
17	160-170 cm		29	7	36
18	170-180 cm		15	15	30
19	180-190 cm		17	3	20
20	190-200 cm				

Table 5. Artifacts recovered from test units by class and depth.

The faunal assemblage from Sublett Troughs provides some key pieces of information regarding context. The first is that the remains of burrowing rodents, predominantly *Thomomys townsendii* (Pocket Gopher) and *Spermophilus sp.* (unknown species of ground squirrel), are present in every layer except 20 (Wells & Peterson 2015). The ability of these rodents to disturb primary depositional context is of concern, given this high frequency in the assemblage. None of the rodent bones display any signs of human alteration (Wells & Peterson 2015).

The identifiable remains of large game are limited to *Bison sp.* (unidentified species of Bison) and *Antilocapra americana* (Pronghorn Antelope). *Bison sp.* remains were recovered from seven layers from layers 2-17 (Table 6). One *Bison sp.* vertebra from layer two has possible cut marks. *Antilocapra americana* remains were recovered from six layers from 2-19, none of which have signs of human alteration (Table 6) (Wells & Peterson 2015).

There are *Artiodactyla* remains that cannot be identified beyond Order due to poor preservation (Wells & Peterson 2015). Artiodactyls are cloven-hooved mammals and include all extant species of large game animals in Idaho. These remains are found in layers 1-10, and 15. All of these remains are very fragmented, preventing the identification of the specific bone or of any human alteration that may have taken place (Wells & Peterson 2015).

Layer	**Genus species**	**Bone/s**
2	*Bison sp.*	Ulna/Molar/Vertebra
	Antilocapra americana	Phalanx/Tooth Fragments
3	*Bison sp.*	Rib
8	*Bison sp.*	Molar
	Antilocapra americana	Tibia
9	*Antilocapra americana*	Tibia/Radioulna
10	*Bison sp.*	Incisor
11	*Bison sp.*	Radioulna
	Antilocapra americana	Ischium
14	*Bison sp.*	Rib
	Antilocapra americana	Patella
17	*Bison sp.*	Molar
19	*Antilocapra americana*	Metatarsal

Table 6. Remains of *Antilocapra americana* and *Bison sp.* by layer.

Prehistoric artifacts are found in every layer of excavation except 20. This indicates frequent utilization without any significant periods of absence. There were 1,209 prehistoric artifacts recovered from test units (Table 5). There is one bone tool from layer 4, seven diagnostic points, and 1,201 pieces of debitage.

Prehistoric diagnostic artifacts were found in six layers (Table 7). Layer one produced an obsidian Rose Spring corner-notch point. A chalcedony Elko corner-notch point was recovered from layer three. Layer 6 contained two Elko corner-notch points, one obsidian and one chert. Another Rose Spring corner-notch point was found in layer eight. Two obsidian Gatecliff split stem points were collected, one from layer 14 and one from layer 16.

Type	**Layer**
Rosespring	1
Elko	3
Elko	6
Elko	6
Rosespring	8
Gatecliff split stem	14
Gatecliff split stem	16

Table 7. Prehistoric diagnostic artifacts by layer.

Malad obsidian dominates the lithic assemblage in every layer (Table 8). The Malad source accounts for over 90% of the obsidian identified in all layers except the first, where it represents ~87% of the obsidian analyzed. In layer ten, Malad is the only identified source. Obsidian from the Brown’s Bench source is found in every layer analyzed except ten. It is the only source other than Malad identified beyond layer six.

Layer	Bear Gulch	Brown's Bench	Conant Creek	Malad	Walcott	Multiple	None	Total
1		11		39	2	1	6	59
2	1	4		33	2		6	46
3		1	2	40			5	48
4		4	1	40	1		2	48
5		5		34		2	8	49
6		2	1	36	3		4	46
7		3		42			7	52
8		2		49			5	56
9		3		55			10	68
10				51			7	58

Table 8. Artifact source assignments by layer.

Walcott obsidian is found in layers one, two, four, and six. Conant Creek is present in layers three, four, and six. There was a single piece of Bear Gulch obsidian in layer two (Table 8). A single piece of obsidian recovered from shovel test F1 (STF1) was identified as from the Pack Saddle source. Though the specific context of this piece of debitage is not clear, the maximum depth of STF1 is 37 cm. making layer four the deepest layer this artifact can be associated with.

CHAPTER 5: DISCUSSION

The analysis of cultural material from Sublett Troughs is discussed below. Issues such as date ranges, prehistoric cultural continuity, and the relationship between people and things are examined. The conclusions of previous research are both consulted and critiqued. Various assumptions and limitations are acknowledged and assertions about causal relationships are presented.

The analysis of diagnostic artifacts provided possible date ranges for both historic and prehistoric site utilization. The earliest historic artifacts collected date from as far back as the early 1800's. This is simply the earliest possible date of deposition based on the manufacture of aqua glass and white-ware in the United States.

The historic artifacts provide little if any new information about historic utilization of the site. It is possible that groups traveling Hudspeth's Cutoff from 1849 on stopped at Sublett Troughs to access the springs or rest. Certainly, everyone that utilized the cutoff traveled past the site but this study did not uncover any material evidence associated with early pioneers or miners. The historic artifacts and their context allude to historical utilization of the site sometime after 1890. This date is the earliest that the wire type nails and spike from level three of the excavation were widely available (Nelson 1963). It is worth noting that wire type nails and spikes have been continually produced and highly utilized in the United States since 1890. This means that the nails and spike could be much more modern.

The question of whether Sublett Troughs was utilized by pioneers and miners of the mid to late 1800's remains unanswered for now. Sampling bias may be responsible for the lack of more specific historic evidence. Excavation was limited to four square meters of over 10,000 and both test units were closer to the hills than the road. It is possible that the concentration of activity related to Hudspeth's Cutoff and material evidence of it would be closer to the road.

The prehistoric materials from Sublett Troughs provide more substantial information about early inhabitants of the area. The time depth of the site is notable but not necessarily surprising. Idaho archaeology has identified traces of human activity over at least the last 13,000 years (Holmer 1994). Given the longevity of human occupation in Idaho it would be surprising not to find material remains of human activity at a site that has access to water and an abundance both plant and animal food.

In the warm months of the year Sublette Troughs is ripe with seed bearing grasses, berries, and small game. Small game such as rodents and rabbits were an important and more readily available source of dietary protein for many indigenous Idaho populations (Steward 1938). The bones of four different genera of rodents were identified at the site (Wells & Peterson 2015). These rodent remains were found in every layer of excavation except the last which implies that rodents were an available source of animal protein at the site as long as humans have utilized it. There was no evidence of human alteration to any of the rodent remains and no other evidence indicating humans ate rodents at Sublett Troughs. This does not mean that rodents were not harvested, just that there is no physical evidence identified by this study for their consumption at the site.

The implication that rodents have been present as long as humans deserves consideration. The most common positively identified rodent remains are of *Thomomys townsendii* (Pocket Gopher) and *Spermophilus sp.* (unknown species of ground squirrel). These are both borrowing rodents which presents the possibility that their remains being found throughout the matrix is the product of burrowing activity. Pocket gophers are known to burrow up to two meters (Wiscomb & Messmer 2010). This renders any assertions about the time depth of their presence at the site dubious without further analysis of the remains.

The extensive presence of burrowing rodent remains throughout the matrix also highlights concerns about artifact context. It is possible that many of the artifacts have been moved from their primary context by burrowing activity. The evidence of rodent burrows is noted as extensive (> 25%) in the upper four layers, minimal (< 10%) in layers 5-13, and not present in layers 14-20. With regard to artifact context, this means that anything recovered from the first four layers has at least a 25% chance of disturbed primary context and layers 5-13 have a less than 10% chance of the same. This study will continue under the assumption that these observations are accurate and acknowledges that in depth research is required to verify assertions made based on depositional context.

Large game animals are present in the faunal assemblage from the site but evidence of human alteration is limited to a single bone. The remains of large game at Sublett Troughs consist of unidentifiable artiodactyls, *Antilocapra americana* (Pronghorn Antelope), and *Bison sp.* (unknown species of bison). Though unidentified beyond Order, artiodactyl remains are significant. Artiodactyls are all large game animals and their remains were found in all but five layers of excavation (12, 13, 16, 18, and 20). This confirms the presence of large game at the site throughout its utilization.

It is also important to consider what was not present in the assemblage. Sublette Troughs is 172.6 kilometer southwest of the nearest known camas prairie and 73.1

kilometer north by northeast of piñon-nut harvesting grounds (figure 3). Both camas bulbs and piñon-nuts require roasting prior to consumption. There was no evidence of roasting pits found during excavation. This indicates that neither of these important resources was being processed at the site. In the context of seasonal subsistence movements, Sublett Troughs may have been a resting point during trips to harvest these resources.

Prehistoric diagnostic artifacts in the assemblage are limited to projectile points, which have the potential to date as far back as 5,000 BP. This date is based on the earliest known appearance of the Gatecliff Split Stem point type in the Great Basin. The Gatecliff Split Stem has a 2,300 year range (Holmer 2009, 32; Justice 2002, 144). Based on this date range we can say that the earliest utilization of the Sublett Troughs site was in the Early or Middle Archaic. The Gatecliff points found at the site were found below any other diagnostic point types, which indicates a preserved primary context.

The cultural material recovered from Sublett Troughs is predominantly prehistoric obsidian debitage. The dominance of obsidian at this site is a product of its durability as a material and its superiority as a toolstone. As the most abundant material collected from the site, the obsidian debitage is the main focus of this research. The information gained from the analysis of obsidian at Sublett Troughs provides insight about prehistoric obsidian toolstone utilization at the site.

Geochemical analysis of obsidian found that the majority of the debitage from every layer came from the Malad source. This is important when we consider cultural continuity for the people utilizing this site. The consistent use of the Malad obsidian source allows us to infer some level of cultural continuity in the area. Holmer (1994,

184) acknowledges that a consistent pattern of toolstone use over time could support an argument for cultural continuity through time. This interpretation is based on the assumption that any significant cultural change would reflect in the material record.

The fact that Malad obsidian is found in abundance in every layer analyzed defines it as the preferred obsidian source for the archaic people who frequented Sublett Troughs. Understanding why Malad was preferred is a complex issue. The most straightforward assertion that we can make at this point is that Malad was preferred because it is the closest known obsidian source. Sharon R. Plager conducted extensive research of obsidian distribution in Idaho (2001). Her research identified patterns and anomalies in the geographic distribution of obsidian across the Idaho landscape. Plager considered both Euclidian distance from source and analyzed cost path based on terrain gradient to gain a more realistic understanding of the distance obsidian material had traveled. She produced isoline maps of the frequency of obsidian source use, which showed a general trend of decline as a function of distance from source. According to these maps, the two sources most likely to be represented at Sublett Troughs are Malad and Brown's Bench. The analysis of Sublett Troughs obsidian supports her findings.

Brown's Bench is the second most common obsidian source identified at Sublett Troughs, which agrees with the relative abundance expected based on Plager's research (2001). All but the last layer analyzed for obsidian provenience contained material from Brown's Bench. Obsidian source utilization is not simply a product of distance however. The quality of obsidian also plays a role in source preference. This is evident if we consider the Walcott source in relation to Brown's Bench. The most southern exposure of Walcott obsidian is ~50 kilometer closer to Sublett Troughs than Brown's Bench but is only found in four of the top six layers and is represented by only eight artifacts.

Walcott obsidian is a widespread chemical signature with exposures appearing up to 100 kilometer apart on both the north and south sides of the Snake River Plain. It is also known for small (~1mm long) feldspar crystal inclusions (Carr & Trimble 1963). The inclusion of crystals compromises the isotropy of the material, making it very hard to control. One of the main reasons obsidian is preferred as a toolstone is that it has a very consistent conchoidal fracture pattern. When the predictability of flaking is compromised by inclusions, an obsidian's utility is severely reduced. It can still be used to a certain degree as flakes maintain the potential to be very sharp, but completing a specific tool form is difficult. The diminished utility of Walcott obsidian can be seen as a factor in the relative preference of Brown's Bench obsidian at Sublett Troughs.

Malad, Brown's Bench, and Walcott obsidians account for 98% of the obsidian assigned to a source in this study. The remaining obsidian was assigned to three other known sources, Conant Creek, Bear Gulch, and Pack Saddle. What is interesting about these three sources is that they are all located within 80 kilometer of each other over 193 kilometer north of Sublett Troughs. The geographic concentration of these sources is important to consider, particularly given the absence of available sources closer to the site. There are three known obsidian sources located closer to Sublett Troughs that are not represented in the assemblage. The Chesterfield, Big Southern Butte, and Kelley Canyon sources are 96.5 kilometer, 128.7 kilometer, and 188.3 kilometer from the site respectively (Figure 16). This pattern further supports the assertion that distance is not the only factor in toolstone procurement. The geographic concentration of these sources forces us to confront the issue of why obsidian from this area would manifest in the material record of Sublett Troughs when there was readily available toolstone much closer. The context of the artifacts reveals important information regarding this issue.

The presence of obsidian from Conant Creek, Bear Gulch, and Pack Saddle indicates a shift, however subtle, in toolstone source utilization at Sublett Troughs. Source variability doubles in the top six layers of excavation, which appears to indicate a cultural change of some type. To define when this change occurred it is necessary to refer to the diagnostic artifacts and their relative position in the matrix. Historic diagnostics are discussed above and provide a date of post-1890 for the top three layers.

The diagnostic lithics associated with the top six layers of excavation are three Elko Corner Notched points, two from level six and one from level three, and a Rose Spring Corner Notched point from layer one. The Elko Corner Notched points have a date range of 3,500-1,300 BP in the Great Basin (Justice 2002, 312). Holmer provides a much larger range for this point type in Idaho of 7,500-1,200 BP (2009, 19). Holmer also documents the utilization of Elko points in historic times at the Wahmuza and Dagger Falls sites (1994, 182). The position of Elko Corner Notched points in layers six and three, well above the Gatecliff Split Stem points found in layers 14 and 16, would seem to indicate a deposition date later in the available range. The association of Elko type points with historic artifacts supports Holmer's findings at Wahmuza and Dagger Falls.

Based on diagnostic artifacts and their context, the shift in toolstone utilization began prior to 1890. This is assuming the earliest possible date of deposition for the nails and spike found in layer three. The diagnostic lithics provide little useful information regarding the date of this change. The date ranges of all points in association with

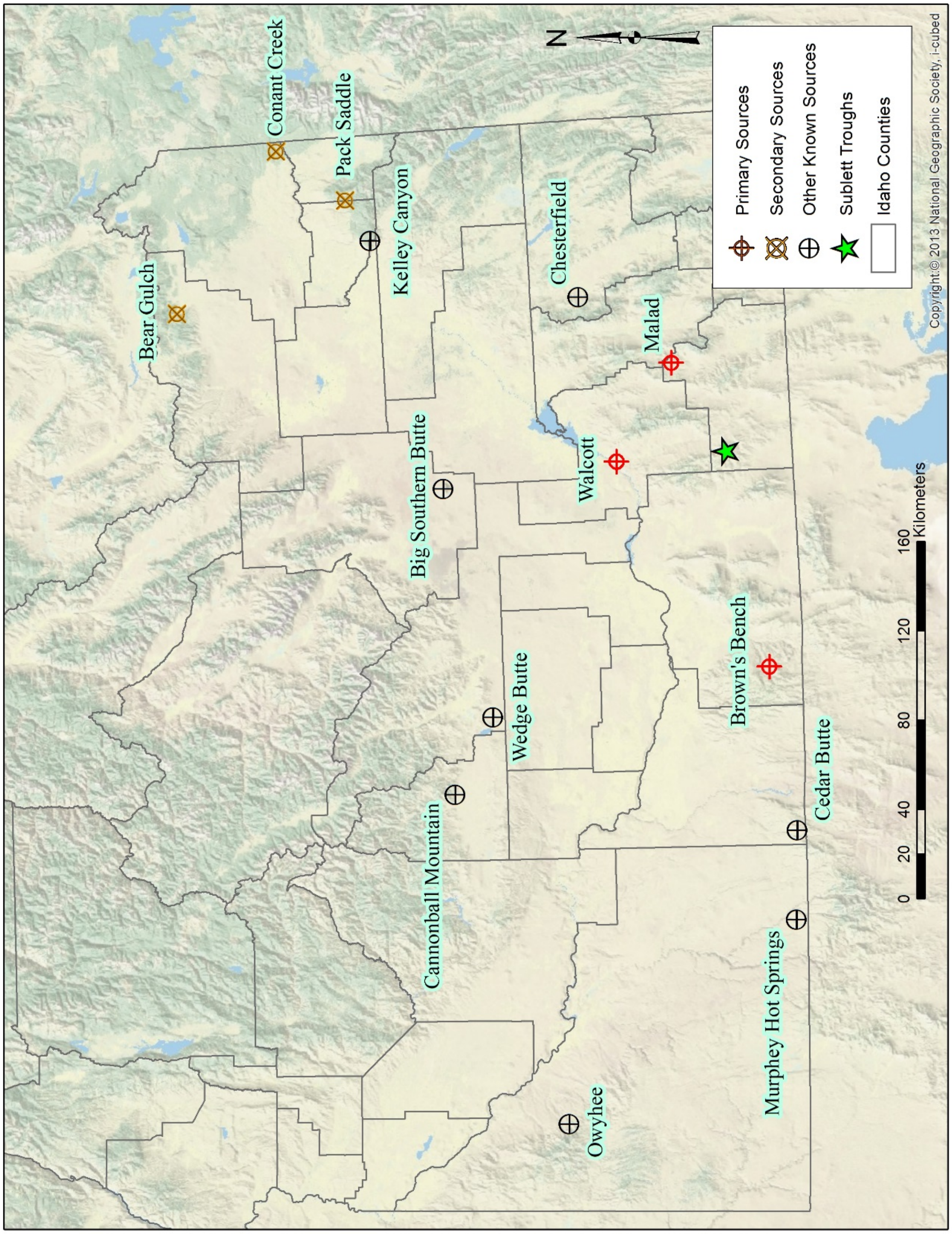

Figure 16. Map of known obsidian sources in relation to Sublett Troughs.

secondary sources extend into historic times in Idaho (Holmer 1994). This makes any further clarification of timing based on their presence unfeasible at the present time.

There are some interesting historic events to consider as possible causal elements for the appearance of new source material from the Yellowstone area. The domesticated horse was introduced to the area by the Spanish in the 1500's (Steward 1938). The utilization of horses greatly increased the range of indigenous groups. It is possible that the increased variability of obsidian sources we see in the upper six layers can be attributed to increased mobility as the horse became a part of new subsistence practices.

Increased mobility may explain the extension of ranges in general, but we are still left with the question of the geographic concentration of secondary sources. This is an anomaly that does not fit Plager's general model of source utilization (2001). It would seem that the Yellowstone area was significant in some way. Steward notes that native groups on their way to the plains to hunt buffalo sometimes stopped near Yellowstone to gather pine nuts (1938, 204). This would make the secondary sources' appearance a function of utility. There may be a more 'divine' explanation for the geographic significance of the Yellowstone area.

Yellowstone is known to have been sacred to various indigenous peoples (Whittlesey 2002). Ritual visitation of the area may account for the presence of the secondary sources. This is problematic if we assume some level of cultural continuity at Sublett Troughs based on the overall consistency of obsidian source utilization. A ritual explanation would include a more consistent material presence.

The relative frequency of the new source material is worth further attention. The Pack Saddle source is represented by a single artifact. There are two instances of Bear

Gulch obsidian and eight artifacts identified as Conant Creek. Combined, these sources account for ~1.5% of obsidian analyzed. If we limit this calculation to the top six layers, secondary sources account for ~3.7% of the obsidian analyzed. There is no specific layer where these sources are concentrated. There is one instance in layer six, one in layer four, two in layer three, one in layer two, and one that could be associated with any of the top four layers. This is a minimal contribution to the overall record of toolstone utilization at Sublett Troughs.

CHAPTER 6: CONCLUSIONS

This study has examined the archaeological assemblage recovered from Sublett Troughs in an attempt to define the site's role in the lives of past populations. General date ranges based on diagnostic artifacts were established by relative dating methods. Particular attention was paid to obsidian as the most common material in every layer of excavation and in the assemblage as a whole. The geochemical analysis of obsidian from the first ten layers of excavation was performed via pXRF and used to determine the parent sources of the obsidian artifacts collected.

The historic use of the site is defined by the presence of artifacts in the top three layers of excavation. Two nails and a spike found in level three are the most discriminant historic diagnostic elements for assigning a date range to historic utilization. Sometime after 1890 these implements entered the material record of Sublett Troughs. No definitive evidence was found that this site was used by early pioneers and miners.

The prehistoric diagnostics in the assemblage indicate an archaic population utilizing lithic technologies common to people in the Great Basin and surrounding areas. These point typologies are widespread both geographically and temporally. The earliest date that can be asserted for occupation of the site is approximately 5,000 BP. The production of lithic tools at Sublett Troughs is apparent in the large amount of obsidian debitage collected.

The consistent presence of the remains of large game, coupled with the extensive debitage of stone tool production, supports the idea that Sublett Troughs was utilized mainly for hunting. This may seem evident considering our assumptions about archaic lifeways and their primary focus on subsistence. However, the only bone identified with evidence of human alteration for consumption is a *Bison sp.* vertebrae. More evidence is needed to propose that this site was specifically the center of hunting activity.

Trace element analysis of obsidian debitage from Sublett Troughs provided the most reliable conclusions about the site. The bulk of the obsidian assigned to a source is from the Malad source roughly 48 kilometer east of the site. This confirms some of the conclusions of previous research conducted on the distribution of Idaho obsidians (Plager 2001). The general pattern of obsidian distribution in southeast Idaho is one of local source utilization. This means that the further you are from a source the less frequent instances of its use become. Plager identified certain anomalies in this distribution pattern, where the distances between source and artifact were greater than expected (2001). The obsidian from Sublett Troughs has identified two similar anomalies.

The second most common obsidian source identified at the site is Brown's Bench. This source is 98.6 kilometer west of Sublett Troughs. Although the presence of Brown's Bench obsidian is not surprising, the fact that it is more common at the site than Walcott obsidian is. The closest known exposure of Walcott obsidian is only 48.9 kilometer from Sublett Troughs. This particular anomaly is likely due to the relative quality of obsidians from these two sources. Walcott obsidian contains inclusions that make it difficult to work with. This particular issue merits further study of the relative distribution of these obsidians and their performance characteristics.

The most interesting revelation provided by the sourcing of obsidian artifacts from Sublett Troughs is the increase in the number of sources utilized over time. The top six layers of excavation contain obsidian from six different sources. Layers seven thru nine include only obsidian from Malad and Brown's Bench, and layer ten is exclusively comprised of Malad obsidian. With regard to distance from source, three of the four additional sources in the top six layers are from over 160 kilometer north of the site. These three sources are within 80.5 kilometer of each other.

The appearance of these new sources is interesting and may indicate a change in foraging range, in the extent of trade networks, or the addition of new members to the group. It is possible that ritual visits to Yellowstone are responsible for the acquisition of obsidian from the surrounding sources. It is also possible that these secondary sources are present as a product of the extended range available after horses became a central part of indigenous life. The presence of secondary sources did not affect the general pattern of tools stone procurement, which shows that this occurrence is not indicative of a significant cultural change.

Further research into this particular anomaly would reveal more about its significance. Test excavations at other sites in the Sublett Range and surrounding area would be useful in defining what the appearance of secondary sources reveals about changes in human activity. An analysis of possible patterns from the surrounding area would provide more information about the extent and significance of these secondary sources to early populations, both at the site and in the region.

A full excavation at Sublett Troughs would also be beneficial to understanding whether the appearance of secondary sources was widespread or locally anomalous. A full excavation would also provide the opportunity to further define both historic and prehistoric presence at the site. Full excavation is rarely an option due to limited funding and other resources, but there are possibilities for further research of the material collected from the site.

A full lithic analysis of the debitage could help to identify what type of tools were being manufactured at Sublett Troughs, or the form that lithic raw material was in when they reached the site. This information would help to further specify the nature of lithic tool production by archaic populations in Idaho. It would be interesting to investigate whether these people were using previously reduced blanks or cores at Sublett Troughs. This would help us understand behaviors related to the transportation of raw toolstone.

The geochemical analysis of the obsidian from layers 11-19 would also be helpful in furthering our understanding of toolstone utilization. This would provide a complete picture of toolstone use at the site over time. Confirming if the Malad source remains the preferred raw material for lithic technology would further inform assertions of cultural continuity.

The dates provided in this analysis are broad and variable due to their reliance on diagnostic artifacts. The radiocarbon dating of charcoal from the site would allow us to remedy this issue. The accurate dating of specific layers would produce more satisfying conclusions regarding the longevity of human occupation and the appearance of secondary sources in the material record.

The Sublett Troughs site was most likely a late summer camp that was part of regular subsistence rounds. It is likely that resources at the site, both flora and fauna, provided necessary supplies for trips to camas or piñon-nut harvests in preparation for the winter. The lack of evidence for the processing of camas and piñon-nuts, coupled with the dominance of local obsidian in the lithic assemblage shows that local resource utilization is the general trend at this site.

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APPENDIX A: ANALYSIS OF FAUNAL REMAINS FROM THE SUBLETT TROUGHS SITE (10-OA-33)

Authors: Charlotte Wells and David Peterson

Introduction

Faunal material was collected by the Idaho State University (ISU) Archaeology Field School in June, 2013 from the Sublett Troughs site (10OA33), located in a montane setting in the Sawtooth National Forest of southeastern Idaho. This site was also a portion of the California Trail, traveled extensively by pioneers in the mid to late 1800's. The area is near a spring regulated with modern piping and a cattle trough.

Material was excavated from two test units (see Field Collection Methods). Faunal material consisted of 652 bone or bone fragments. This material was identified to the lowest taxonomic level utilizing the Comparative Osteology collection at the Idaho Museum of Natural History (IMNH).

Field Collection Methods

A ~100 x 100 meter section was intensively mapped and surveyed by the field school. Pin flags were used to mark surface lithics, bone, and historical artifacts, as well as any cultural features. The area was sectioned off into a 25 meter (m) grid and shovel tests were performed at each 25 m mark within the survey boundaries, except on steeper slopes and areas with heavy vegetation where they were placed as close to 25 m as the terrain/vegetation allowed. Two 1 x 2 m test units were positioned based on the most productive shovel tests. These test units were further subdivided into east and west sections and excavated in 10 centimeter (cm) levels.

In the laboratory an initial inventory was taken of each specimen bag, verifying contents, field numbers, catalogue numbers, test unit number and level (depth). The specimens were separated as identifiable or unidentifiable bone fragments. The identifiable specimens were identified to the lowest taxonomic level possible under the supervision of Dr. Mary Thompson, paleontologist and Earth Sciences Collection Manager at IMNH.

Results

Detailed lists of all specimens collected during the 2013 ISU Archaeological Field School are presented in Appendix A-1.

Shovel Test Units

Forty-five specimens were collected from the 5 shovel tests (Table 1.1, Appendix A-1). The larger mammalian fragments were poorly preserved while most of the smaller bones were intact. All specimens were mammals with identifiable material catalogued as rodent or artiodactyl. Two elements were identifiable to the genus Microtus (Table 1). Seventeen were identifiable to the order Artiodactyla (Table 1).

Table 1: Summary of identifiable material collected from the five shovel tests.

Taxa	Element	Quantity
Artiodactyla	Rib	16
Artiodactyla	Phalanx	1
Microtus (Cricetidae:Rodentia)	Mandible (right)	1
Microtus (Cricetidae:Rodentia)	Molar	1

Test Unit 1

Test Unit 1 is located on the east side of the spring drainage up on a low grade hillside. This unit was divided into a 1 x 1m west (Test Unit 1- West) section and a 1 x 1 m east (Test Unit 1 – East) section.

Test Unit 1 – West

Nineteen 10 cm levels were excavated in this unit. Only minor differences were noted between levels regarding the presence or absence of taxa, and sterile soil was never reached. The faunal collection consists of 268 specimens (Table 2-1, Appendix A-1). Small broken fragments were commonplace with many of the fragments having longitudinal cracking, crumbling, and flaking. Most of the fragments were too small and deteriorated for identification. Identifiable material consisted of bones that were denser and less susceptible to weathering. Seventy-three specimens were identified to the generic level (Table 2). All species were from the class Mammalia and represent two Orders and five Families.

Table 2: Test Unit 1 – West: Summary of identified specimens to the generic level.

Order	Family	Genus species	Common Name	NISP*
Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	5
Artiodactyla	Bovidae	Bison	Bison	5
Rodentia	Sciuridae	Urocitellus	Ground Squirrel	7
Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	27
Rodentia	Cricetidae	Microtus	Vole	3
Rodentia	Geomyidae	Geomys	Pocket Gopher	26

*NISP = Number of Identified Specimens.

Identifiable bones were mainly long bones such as the tibia or humerus or, in the case of rodent specimens, mandibles including dental material. Isolated tooth material was also identified to bison. Specific designation for Bison could not be determined since no horn cores were collected during excavations that could be used for this purpose.

There were an additional 161 bone fragments, 11 of which were tooth and tooth fragments, identified as large mammal only. These are most likely attributed to Bison as this is the only large mammal identified at the site.

Test Unit 1 – East

The material from this unit consists of 148 bones or bone fragments excavated from 19 levels to a depth of 190 cm (Table 3-1, Appendix A-1). Small broken fragments were commonplace, with
many of the fragments having longitudinal cracking, crumbling, and flaking. Very minor differences were identified between each 10 cm level. Test Unit 1-East was similar in composition to material excavated to Test Unit 1-West. The notable exceptions were that no Microtus or Geomys material was identified in this unit. Forty specimens were identified to generic level (Table 3).

Again identifiable bone consisted mainly of dental and long bone elements. One interesting element was an ischium identified as a pronghorn antelope. The ends of this ischium were not fused, indicating a subadult or juvenile age. This was the only specimen for which an age determination could be made. There were an additional 90 bone fragments that could only be attributed to large mammal.

Table 3: Test Unit 1 – East: Summary of identified specimens to the generic level.

Order	Family	Genus species	Common Name	NISP
Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	5
Artiodactyla	Bovidae	Bison	Bison	10
Rodentia	Sciuridae	Urocitellus	Ground squirrel	14
Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	11

Overview Discussion on Test Unit 1

Test Unit 1 produced the largest collection of faunal material from Sublett Troughs with 416 bones or bone fragments. Six species were identified to the generic level belonging to the class Mammalia.
Fragmented bones belonging to large mammals were the most abundant. Based on the noted presence of bison and pronghorn, the majority of the unidentified bone fragments should be attributed to these genera.

Test Unit 2

Test Unit 2 was located below the spring drainage at the lowest elevation on the site. Test Unit 2 was also divided into an east and west section of 1 x 1 m each. Fifteen levels to a depth of 150 cm were excavated in this unit. The soil in this unit was much moister than Test Unit 1 due to a higher degree of clay content and less gravel. This soil structure would prevent drainage of the spring, holding moisture in the soil. The higher clay content also created difficulties with dry screening, potentially resulting in faunal bias especially with smaller vertebrates. Many small bone fragments may have remained unrecovered in the screened soil.

The faunal collection consists of 191 bones or bone fragments. Small broken fragments were commonplace, with many of the fragments having longitudinal cracking, crumbling, and flaking. No rodent material was identified in Test Unit 2.

Test Unit 2 – West

A total of 121 specimens were recovered from Test Unit 2- West (Table 4-1, Appendix A-1). One upper molar (5 pieces) and a partial ulna were attributed to Bison, and a proximal phalanx and fragmented tooth were identified as pronghorn antelope.

Test Unit 2 – East

Seventy (70) specimens were recovered from Test Unit 2-East (Table 5-1, Appendix A-1). The majority of the material was fragmentary and identification beyond the class Mammalia could not be determined; however, two tooth fragments were attributed to Artiodactyla.

Overview Discussion of Test Unit 2

In contrast to Test Unit 1, no rodent material was identified from this unit. Two possible explanations for this are 1) collection bias or 2) environmental conditions. Test Unit 2 was below the spring and the soil was much moister than Test Unit 1. The soil also had a higher clay content which could have prevented or slowed the drainage of water from the spring. The amount of clay and moisture made dry screening difficult and manual manipulation of the matrix could have led to the fragmentation of bone. Rodent material is small and fragile and could have been inadvertently destroyed or overlooked due to the soil structure, creating a collection bias. Bone preservation was very poor from this unit, also possibly attributed to soil moisture content. Alternatively, while the spring is currently piped and diverted into a cattle trough it is possible there may have been a ponding of water in this area that would have made the environment unsuitable for rodent habitation.

Conclusion

The faunal assemblage from the Sublett Troughs site (10OA33) consisted of 652 bone or bone fragments. The bulk of the faunal material was from Test Unit 1 although materials from both Test Unit 1 and 2 were generally similar. Preservation quality was fair to poor, especially under the moist conditions of Test Unit 2. In most cases this prevented identification beyond the class level.

All material could be attributed to the class Mammalia. Bison and pronghorn antelope were the only two large mammals that were identified from both test units. In addition to these, Test Unit 1 produced material that could be attributed to ground squirrel, vole, and two genera of pocket gophers. Urocitellus (ground squirrel) can burrow up to 125 cm and prefer moist, loose gravel and soils (Young et al., 1992). Both Geomys and Thomomys (pocket gophers) also prefer loose, moist soils (Williams, 1974). Test Unit 1 has a higher gravel content which would have provided better drainage and looser soil, creating a more favorable burrowing environment. Test Unit 2 had a higher clay content which would have prevented drainage and possibly led to ponding prior to spring diversion. The higher clay content also made dry screening more difficult and required manual manipulation through the screens. This could have led to the inadvertent destruction of small bones and a collection bias. Preservation quality and/or collection bias could explain the absence of rodent material from Test Unit 2 as well as no identifiable bird, reptile, amphibian, or fish material.

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Appendix A-1: Artifact Tables

Table 1.1: Shovel Tests

Test	Number	Depth (cm)	Class	Order	Family	Genus	Element	Qty	Modification
B1	5-286.0	55	Mammalia				Bone fragments	4	
C1	12-287.0	0-28	Mammalia				Bone fragments	2	
B4	30-288.0	0-6	Mammalia				Bone fragments	19	
B4	30-288.1	0-6	Mammalia	Rodentia	Cricetidae	Microtus	Mandible right, Molar	2	
B4	30-288.2	0-6	Mammalia				Bone fragment, long	1	possible cut marks
A1	109-318.0	10-30	Mammalia	Artiodactyla			Rib, phalanx, bone fragments	17	

Table 2.1: Test Unit 1- West

Level	Number	Depth (cm)	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
1		0-10								
2		10-20								
3	61-297.1	20-30	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket gopher	Humerus right, Mandible left	3	
3	61-297.2	20-30	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Rib	1	possible chew marks
3	61-297.0	20-30	Mammalia					Bone fragments	10	
4	7-281.0	30-40	Mammalia	Artiodactyla				Bone or tooth fragment	1	Possible mod.
4	66-299.1	30-40	Mammalia	Rodentia	Geomyidae	Geomys	Pocket gopher	Femur right, Humerus right	2	
4	66-299.0	30-40	Mammalia					Bone fragments	3	
5	102-315.0	40-50	Mammalia					Bone fragments	22	
5	102-315.1	40-50	Mammalia	Artiodactyla				Tooth fragments	3	
5	102-315.2	40-50	Mammalia	Rodentia	Geomyidae	Geomys	Pocket Gopher	Humerus right	1	
6	121-325.0	50-60	Mammalia	Artiodactyla				Bone fragments	12	
6	121-325.1	50-60	Mammalia					Tooth fragments	3	

Level	Number	Depth (cm)	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
6	121-325.2	50-60	Mammalia	Rodentia	Geomyidae	Geomys	Pocket Gopher	Scapula, vertebra, innominate partial, humerus distal end, ulna distal end, bone fragments 11	16	
7	107-317.0	60-70	Mammalia					Rib fragments	4	
7	107-317.1	60-70	Mammalia					Tooth fragment	1	possible burn
8	120-324.1	70-80	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Molar-upper, partial	2	
8	120-324.2	70-80	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	Mandible right, Axis, Femur right	4	
8	120-234.0	70-80	Mammalia					Bone fragments	10	
9	123-326.1	80-90	Mammalia					Tooth fragments	2	
9	123-326.2	80-90	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	Ulna, vertebra, Femur proximal end left, femoral shaft	4	
9	172-348.1	74-90	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Tibia left distal end	1	
9	172-348.2	74-90	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Radioulna, left, olecranon process	1	
9	123-326.3	80-90	Mammalia	Rodentia	Cricetidae	Microtus		Tibiofibula, distal end, vertebra	2	
9	123-326.0	80-90	Mammalia					Bone fragments	11	
9	172-348.0	74-90	Mammalia	Artiodactyla				Bone fragments	13	
10	41-285.0	90-100	Mammalia	Artiodactyla	Bovidae	Bison	bison	Incisor Lower	1	
10	134-331.0	90-100	Mammalia					Bone fragments	5	possible cut mark
10	134-331.1	90-100	Mammalia	Rodentia	Geomyidae	Geomys	Pocket gopher	Incisor 2 upper, Mandible partial right, Maxillary partial, Innominate left, Ulna distal end	6	

A 1.1

Level	Number	Depth (cm)	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
11	142-335.0	100-110	Mammalia					Bone fragments	15	possible cut mark
11	142-335.2	100-110	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket gopher	Left Innominate, 3 Molars left side mandible, cervical vert. , Mandible left	6	
11	171-347.0	100-110	Mammalia					Bone fragments	1	
11	171-347.1	100-110	Mammalia	Rodentia				Incisor, Cranial fragment	2	
11	142-335.1	100-110	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Innominate Left	1	
11	171-347.2	100-110	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Humerus right	1	
12	146-337.0	110-120	Mammalia					Bone fragments	8	
12	146-337.1	110-120	Mammalia					Tooth fragment	1	
12	146-337.2	110-120	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket gopher	Innominate left, Molar 3, P Molar 1, cranial fragment, mandible left	8	
12	146-337.3	110-120	Mammalia	Rodentia	Cricetidae	Microtus		Mandible left	1	
12	182-352.0	110-120	Mammalia					Bone fragments	4	
13	154-340.0	120-130	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Femur right, molar, Mandible left	3	
13	154-340.2	120-130	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Mandible right partial	1	
	154-340.1	120-130	Mammalia					Tooth fragment	1	
14	38-283.0	132	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Tibia right	1	
14	160-343.0	130-140	Mammalia	Rodentia	Geomyidae	Geomys	pocket gopher	Femur left	1	
14	160-343.1	130-140	Mammalia					Bone fragments	7	

Level	Number	Depth (cm)	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
15	164-346.0	140-150	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket gopher	Femur left, rib	2	
15	164-346.1	140-150	Mammalia					Bone fragments	1	possible cut marks
15	177-349.0	140-150	Mammalia	Artiodactyla				Tooth fragment	1	
15	177-349.1	140-150	Mammalia	Rodentia				Incisor, vertebra	2	
15	177-349.2	140-150	Mammalia					Bone fragments	4	
16	186-354.0	150-160	Mammalia					Bone fragments	6	
16	189-356.0	150-160	Mammalia					Tooth fragments	1	
16	189-356.1	150-160	Mammalia					Bone fragments	13	
17	44-284.0	166	Mammalia	Artiodactyla	Bovidae	Bison	bison	Molar Lower partial	1	
17	203-364.1	160-170	Mammalia	Rodentia	Sciuridae	Spermophilus	ground squirrel	Mandible partial with 3 molars present	1	
17	203-364.0	160-170	Mammalia					Bone fragments	5	
18	206-366.1	170-180	Mammalia					Tooth fragments	2	
18	206-366.0	170-180	Mammalia					Bone fragments	12	
19	216-371.0	180-190	Mammalia	Artiodactyla	Antilocapra	Antilocapra americana	Pronghorn	Metatarsal	2	
19	216-372.0	180-190	Mammalia					Bone fragments	1	
19	216-370.0	180-190	Mammalia					Bone fragments	8	

Table 3.1: Test Unit 1- East

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
1	38-290.0	0-10	Mammalia	Artiodactyla				Tooth fragment	1	
2	41-291.1	10-20	Mammalia	Artiodactyla				Tooth fragment	1	
2	41-291.2	10-20	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Vertebrate partial, centrum	1	Possible cut marks
2	57-295.1	10-20	Mammalia	Artiodactyla				Tooth fragments	2	
2	41-291.0	10-20	Mammalia					Bone fragments	11	

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
2	57-295.0	10-20	Mammalia					Bone fragments	4	
2	57-295.2	10-20	Mammalia					Bone fragments	1	
3	59-296.1	20-30	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	Femur left, proximal end	1	
3	59-296.0	20-30	Mammalia	Artiodactyla				Bone fragments	6	
4	65-298.0	30-40	Mammalia	Artiodactyla			Possibly Bison	Tooth fragment	1	
4	65-298.1	30-40	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	Mandible right, 3 teeth molar	4	
5	84-307.0	40-50	Mammalia	Rodentia				Incisor	1	
6	87-308.0	50-60	Mammalia	Rodentia				Incisor	1	
6	87-309.0	50-60	Mammalia					Bone fragments	6	
7		60-70								
8	118-322.0	70-80	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Tibia right, distal end	2	
8	118-322.1	70-80	Mammalia					Cranial fragment	2	
8	118-322.2	70-80	Mammalia	Rodentia	Geomyidae	Thomomys	Pocket Gopher	Cranium partial, femur left	2	
8	118-323.0	70-80	Mammalia					Long bone	1	possible cut mark
9	130-329.0	80-90	Mammalia					Bone fragments	2	
10	132-330.0	90-100	Mammalia	Artiodactyla				Bone fragments, 1 large possible cranial fragment	4	
10	132-330.1	90-100	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Mandible right, zygomatic arch left, atlas (c-1), axis (c-2)	4	
11	32-280.0	100-110	Mammalia					Long bone, fragment	1	Defleshing ?

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
11	145-336.1	100-110	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Mandible left with M1, M2, M3 present, cranial material	4	
11	145-336.2	100-110	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Radioulna olecranon fossa, right	1	
11	145-336.3	100-110	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Ischium right (immature)	1	
11	145-336.0	100-110	Mammalia					Bone fragments	6	
11	145-336.4	100-110	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Left mandible with P1, M1, M2 present	1	
12	31-279.0	110-120	Mammalia					Long bone, fragment	1	Defleshing?
12	148-338.1	110-120	Mammalia					Tooth fragment	1	
12	148-338.0	110-120	Mammalia				Large mammal	Bone fragments	16	
13	155-341.0	120-130	Mammalia				Large mammal	Bone fragments	5	
14	35-277.0	143	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Rib (2 sections)	2	
14	36-278.0	138	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Patella left	1	
14	157-342.0	130-140	Mammalia					Bone fragments	6	
14	157-342.1	130-140	Mammalia	Rodentia	Geomyidae	Thomomys townsendii	Pocket Gopher	Mandible right, incisor fragment, 2 Molars	4	
15	161-344.0	140-150	Mammalia					Bone fragments	4	
	161-345.0	140-150	Mammalia					Bone fragments	5	
16	188-355.0	150-160	Mammalia	Rodentia				Cranium partial	1	
17	192-358.0	160-170	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Molar Right Lower M2	6	

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Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
17	192-358.2	160-170	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Femur Left, Humerus right, bone fragment	3	
17	201-363.0	160-170	Mammalia	Rodentia	Sciuridae	Spermophilus	Ground Squirrel	Mandible, molar	2	
17	192-358.1	160-170	Mammalia					Bone fragment, long bone	4	
17	192-359.0	160-170	Mammalia					Bone fragments	5	
17	201-363.1	160-170	Mammalia					Bone fragments	3	
18	205-365.0	170-180	Mammalia					Bone fragments	1	
19	214-369.1	180-190	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Metatarsal	1	
19	214-369.0	180-190	Mammalia					Bone fragments	5	

Table 4.1: Test Unit 2 – West

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
1	47-293.0	0-10	Mammalia	Artiodactyla			Possibly Bison	Tooth fragments	8	
2	52-294.0	10-20	Mammalia	Artiodactyla				Tooth fragments	3	
2	70-301.0	10-20	Mammalia	Artiodactyla				Bone fragment	41	
2	70-301.1	10-20	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Molar upper partial	5	
2	70-301.2	10-20	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Proximal phalanx, distal end	1	
2	71-302.0	10-20	Mammalia	Artiodactyla	Bovidae	Bison	Bison	Ulna partial	1	
2	71-302.1	10-20	Mammalia	Artiodactyla	Antilocapridae	Antilocapra americana	Pronghorn	Tooth fragments	3	
2	69-300.0	10-20	Mammalia					Bone fragments	2	
3	76-303.0	20-30	Mammalia					Bone fragments	7	
3	79-305.0	20-30	Mammalia					Bone fragments	2	
3	95-313.0	25-32	Mammalia					Bone fragments	1	
4		30-40								

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
5	100-314.0	40-50	Mammalia					Bone fragments	1	
6	117-321.0	50-60	Mammalia					Bone fragments	6	
7	127-328.0	60-70	Mammalia					Bone fragments	2	
	136-332.0	60-70	Mammalia					Bone fragments	10	
8	29-282.0	74	Mammalia	Artiodactyla				Bone fragments	1	
8	139-333.1	70-80	Mammalia					Tooth fragments	2	
8	139-333.0	70-80	Mammalia					Bone fragments	7	
8	141-334.0	70-80	Mammalia					Bone fragments	2	
9	150-339.0	80-90	Mammalia					Bone fragments	2	
10		90-100								
11		100-110								
12	179-350.0	110-120	Mammalia					Bone fragments	2	
13	195-360.0	120-130	Mammalia					Bone fragments	7	
14										
15	217-373.0	140-150	Mammalia					Bone fragments	3	
15	212-368.0	140-150	Mammalia					Bone fragments	2	

Table 5.1: Test Unit 2 – East

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
1	39-289.0	0-10	Mammalia					Bone fragment	1	
1	46-292.0	0-10	Mammalia					Bone fragment	1	
2		10-20								
3	82-306.0	22-25	Mammalia					Bone fragment	7	
3	82-306.1	22-25	Mammalia					Tooth	1	
4	87-309.0	30-40	Mammalia					Bone fragment	6	
4	90-310.0	30-40	Mammalia					Bone fragment	10	
4	113-319.0	47	Mammalia					Bone fragment, long bone	5	
5	91-311.0	40-50	Mammalia					Bone fragment	7	possibly burnt

Level	Number	Depth	Class	Order	Family	Genus Species	Common Name	Element	Qty	Modification
6	93-312.0	50-60	Mammalia					Bone fragment	10	possible cut mark
6	115-320.0	50-60	Mammalia					Bone/Tooth frag.	6	
7	126-327.0	60-70	Mammalia	Artiodactyla				Tooth fragments	2	
8		70-80								
9		80-90								
10		90-100								
11		100-110								
12		110-120								
13	196-361.0	120-130	Mammalia					Bone fragments	7	
14	199-362.0	130-140	Mammalia					Bone fragments	5	
15	210-367.0	140-150	Mammalia					Bone fragments	2	