Occupational History and Land Use at Rock Creek Shelter (35LK22), Southeastern Oregon

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OCCUPATIONAL HISTORY AND LAND USE AT ROCK CREEK SHELTER (35LK22), SOUTHEASTERN OREGON

By

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the thesis of ANDREW GORDON FRIERSON find it satisfactory and recommend that it be accepted.

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OCCUPATIONAL HISTORY AND LAND USE AT ROCK CREEK SHELTER (35LK22), SOUTHEASTERN OREGON

Abstract

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Rock Creek Shelter (35LK22) is a large basalt rockshelter located within the Hart Mountain National Antelope Refuge in Lake County, Oregon. The site was excavated in 1967 by a small group of graduate students and faculty from Washington State University. This field reconnaissance led to the discovery of a rockshelter with a diverse artifact assemblage and a long occupational history, yet these significant findings remained unreported for fifty years. This thesis remedies this situation by providing an excavation report, a typological analysis of the artifact assemblage, and presenting the results of several different analyses including accelerated mass spectrometry (AMS) dating of organic material, x-ray fluorescence (XRF) geochemical characterization of obsidian, and a quantification of the faunal assemblage. Drawing on previous archaeological research from this part of the northern Great Basin, in this thesis I address three research questions: 1. What is the primary function(s) of the site? 2. What interpretations about prehistoric land use on the Refuge can be made? 3. Lastly, is there any evidence of the Numic expansion into this region (based on artifact types or inferred patterns of behaviors) in later cultural components? Based on the artifact assemblage, established chronology, and analyses conducted, I argue that the site was used for diverse activities and that this remained largely consistent for a span of approximately 8,000 years. In terms of prehistoric land use, I propose that the upland region east of Hart Mountain was utilized much more extensively and broadly than other researchers have suggested. Furthermore, the prehistoric occupants at the site were not tethered to the resource-rich lakes and wetlands in the neighboring valley to the degree that some have argued and instead, were connected to people all over the northern Great Basin. Finally, there is no evidence that Numic peoples occupied this site. Rather, site occupation appears to cease at the time of the Numic expansion in the northern Great Basin, which is thought to have taken place in the very late precontact period (after approximately 700 B.P.).

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

Dedication

For my grandfather, Manton R. Frierson.

I always admired your intelligence and character.

CHAPTER ONE

INTRODUCTION

Rock Creek Shelter (35LK22) is located in southeastern Oregon within the northern Great Basin culture area. The northern Great Basin has provided a testing ground for theories of human behavior, and regional research has provided major impacts on the archaeology of North America. For example, Luther Cressman, often considered the pioneer of Oregon archaeology, dedicated nearly an entire lifetime to the study of this region beginning in the 1930s and is most well-known for his work in the Fort Rock vicinity where he recovered the world's oldest shoes (sagebrush bark sandals) that date between 10,500 and 9,300 cal. B.P (Aikens et al. 2011). This discovery challenged the current narrative at the time by demonstrating that the northern Great Basin has been inhabited for thousands of years, possibly back to the time of the peopling of the New World (Aikens et al. 2011:31). Cressman's findings also inspired numerous other archaeological investigations in the northern Great Basin, many of which are still shaping our understanding of the earliest human occupations in North America.

Rock Creek Shelter (35LK22) is a stratified multicomponent site with a long (8000 year) history of use. As the site contains multiple occupations, with components representing the Early Archaic, Middle Archaic, and Late Archaic cultural periods, it provides a unique opportunity to learn more about the prehistory of the northern Great Basin and how humans adapted to life in such a seemingly harsh environment over a very long historic interval. Today, Rock Creek Shelter is located within the boundaries of the understudied Hart Mountain National Antelope Refuge (HMNAR), which lies just east of the Warner Valley in remote Lake County lands managed by the US Fish and Wildlife Service (USFWS). This study area will be hereafter referred to as the “Refuge.”

Initial site excavations took place in the summer of 1967, but, prior to the analyses conducted for this thesis, the site has not been reported, extensively studied, nor analyzed. A primary objective of this thesis is to remedy this situation by documenting this “orphaned” collection and bringing it to current curation standards so that the materials may be preserved and researched by others in the future. This baseline documentation includes a comprehensive description of the site, the assemblage, artifact classification, artifact photographs, artifact analysis, the creation of maps for the immediate area, an electronic catalog, and a recreation of the 1967 site excavation which involved working closely with one of the original site excavators, David Rice. The site was further documented in the summer of 2015 by taking representative photographs, measuring site dimensions, documenting surface artifacts, assessing the site for looting, and gathering location data with a handheld GPS unit. Specific analyses conducted include radiometric dating, geochemical x-ray fluorescence (XRF) sourcing, and a complete analysis of the faunal assemblage.

Through consideration of documented site findings, 1967 and 2015 field notes, the artifact assemblage, and analytical data, I address three primary research questions: (1) when was the site most intensely occupied and what was the primary function of the site during this occupation? (2) what interpretations about prehistoric land use on the Refuge can be made based on the artifact assemblage and analyses conducted? (3) is there any evidence for the Numic expansion at Rock Creek Shelter? Study results indicate that the site was occupied intermittently for at least 8,000 years and was primarily utilized in the Middle Archaic from spring to fall. The site primarily served as a seasonal base camp where people would have set out to acquire lithic raw material, pursue large and small game, and process seasonal plants. In terms of land use, Rock Creek Shelter occupants utilized this part of the northern Great Basin for a broad range of activities, most of which align with what has been previously proposed by past research (Weide 1968). However, the region's inhabitants do not appear to have always been "tethered" to the local resource-rich environment, though they do seem to have increasingly focused more heavily on utilizing the local landscape beginning in the Middle Archaic and increasingly so in the Late Archaic. Finally, there is no evidence for the Numic expansion at the site. Although, the main occupation of the site does appear to cease around the time this population movement is believed to have occurred in the northern Great Basin.

This thesis is organized into nine chapters. Chapter One provides and introduction and background information on the site, including a summary of the Great Basin climate, both past and present, with an emphasis on the northern Great Basin and Refuge. Chapter One also presents a regional ethnography and a summary of the layout of the rock shelter. Chapter Two begins with a brief background summary of previous research conducted within the Refuge and the surrounding area, followed with a discussion of the 1967 site excavation. Chapter Three describes the 2015 field work conducted at Rock Creek Shelter that initiated this study and concludes by providing a summary of the research questions addressed in this thesis. Chapter Four includes a discussion of the regional chronology, presentation of radiocarbon dating results, and interpretation of the stratigraphic record of Rock Creek Shelter in relation to the radiometric findings. Chapter Five provides an overview of the chipped stone and ground stone assemblage and Chapter Six discusses the results and interpretation of the geochemical x-ray fluorescence (XRF) sourcing of 100 obsidian samples conducted for this study. Chapter Seven provides a descriptive report of perishable materials recovered from the excavation, as well as initial interpretations of these materials with the additional objective of encouraging additional study into this important industry in the future. Chapter Eight focuses on the faunal assemblage and provides the results of analysis from a study of undertaken in the spring of 2017. This analysis included quantifying the number of individual specimens (NISP) at the site to assess subsistence patterns and analyzing cultural modifications on the faunal remains to understand human behaviors related to animal food processing. Finally, Chapter Nine provides a summary of these investigations, a discussion of what the research tells us about the occupants of Rock Creek Shelter, and then concludes with suggestions for future work.

Regional Setting

Topographic Features

The boundaries of the Great Basin have been defined in several different ways and these definitions are often used interchangeably depending on the discussion at hand. For example, Grayson (2011:11) points out that modern definitions of the Great Basin have generally consisted of the hydrographic Great Basin, the physiographic Great Basin, and the ethnographic Great Basin. He goes on to say that due to ethnographic and hydrographic boundary changes through time, the only Great Basin that has remained consistent for the past 25,000 years is the physiographic Great Basin (Grayson 2011:40). All references to the Great Basin as a region in this thesis will be to the physiographic region, the borders of which occur along the Sierra Nevada and southern Cascades to the west, the Wasatch Range and Colorado Plateau to the east, and the Columbia Plateau on the north (Figure 1-1). The southern border is more obscure due to the lack of topographic boundaries, but roughly, the border occurs just north of the Mojave River on the west and south of modern-day Las Vegas to the east. (Grayson 2011:13). The Great Basin

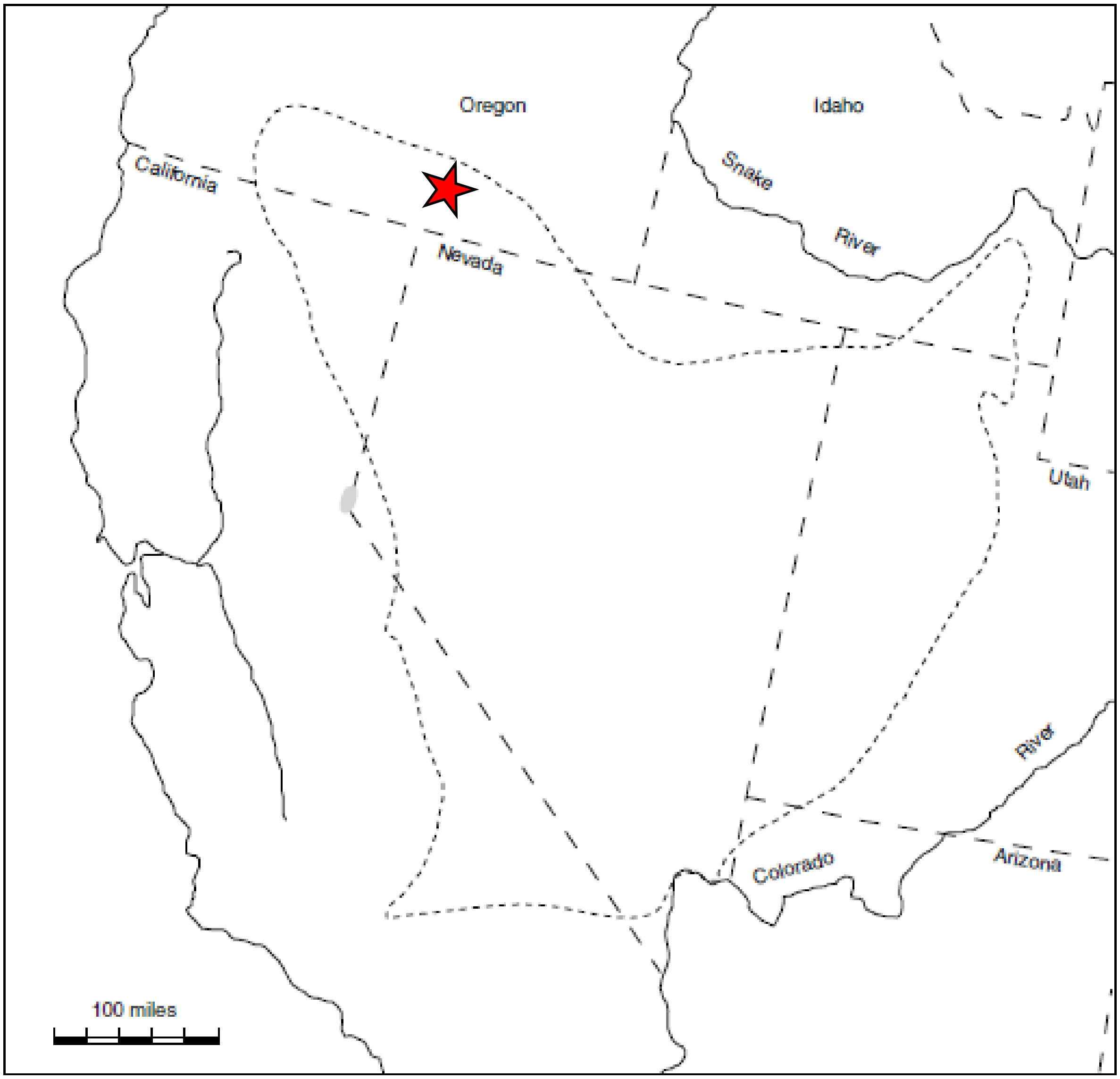

Figure 1-1. Location of Rock Creek Shelter (red star) within the physiographic Great Basin boundary. Adapted and modified from Grayson (2011).

is characterized physically by large north to south trending fault blocks that run along the landscape giving a topographic appearance that led geologist Clarence Dutton to remark that terrain appears to be “like an army of caterpillars crawling north” from Mexico (Dutton 1886). Broadly, the regional setting of the Refuge and Warner Valley is similar to the rest of the Great Basin: a dry desert environment covered by a variety of species of sagebrush and perennial grasses. However, unlike many parts of the Great Basin where fresh water sources are few and far between, numerous lakes and wetlands are present throughout the Warner Valley region—collectively named the Warner Lakes. The Warner Lakes and wetlands lie just west of the Warner Mountains and are a stopping point on the Pacific Flyway, a migratory bird path that numerous ducks, geese and other bird species follow every spring and fall. The wetlands and lakes in the Warner Valley thus serve as a significant stopping point for migratory birds given the lack of water patches in most of the region (Weide 1968:107). There is ample evidence to suggest that hunter-gatherers in this region knew about these annual migrations and exploited these avian species for subsistence (Weide 1968:107). In the uplands to the east of the Warner Valley on the slopes of the Warner Mountains, the region can be characterized as a high desert ecological zone, though in the higher elevations a distinct line of juniper trees can be observed scattered across the landscape. Like much of the Great Basin where topographic relief can vary up to 5,000 feet (ft) between mountain peak and valley floor (Aikens et al. 2011:32), the region varies considerably in elevation. For example, the highest point in the region is Warner Peak at the summit of Hart Mountain which rises to 8,065 ft above mean sea level (AMSL) while the elevation on the valley floor is less than 4,000 ft. Due to this substantial variation in elevation, as well as archaeological evidence that will be discussed later, many researchers (Weide 1968; Young 1999; Smith, Pattee, and Van Der Voort 2016) have split the area into two topographical categories: the uplands and the valley floor. The uplands refer to the entire landscape that lies east of the Warner Valley within the contemporary boundaries of the Refuge are the main area of focus in this thesis. Although topographic relief between the Warner Valley and the Refuge is considerable, for its inhabitants, the large topographic features did not inhibit movement across the landscape. For example, despite its high elevation in relation to the valley floor Hart Mountain is not considered to be an impenetrable barrier and even during “historic times Indians and ranchers moved up and down the mountain” (Weide 1968:133). Nevertheless, these topographic features still would have had a significant effect on the seasonal round of the region’s occupants given that the valley floor is occupied by a series of shallow basins which contain lakes and marshes that are more or less permanent and the resources on Hart Mountain would have been about a day’s travel from the valley floor (Weide 1968:128).

Flora and Fauna

The flora and fauna in the Warner Valley and on the Refuge are like much of the Great Basin, although there are greater numbers of lake and wetland taxa (i.e. waterfowl and fish). Both the valley floor and adjacent uplands each have associated species of flora and fauna that were important to people during prehistory for subsistence and thus play a considerable role in the types of sites we would expect to see in each environment (Fagan 1974; Jenkins 1994). Weide (1968:135) noted this distinction in her study of the region, for example describing a dense stand of grass that developed along Crump Lake in 1967 and suggesting that “grasses such as these would have important sources of seeds along with extensive marshes of tule (*Scirpuis* sp.) and cattail (*Typha latifolia*) for inhabitants along the valley floor” (Weide 1968:135). On the valley floor, other plant species such as sago pondweed (*Stuckenia pectinate*) while not known ethnographically to be a human food in the Great Basin, is an important waterfowl food, which is especially favored by dabbling ducks during the fall migration (Weide 1968:94). Other plants found in the region include currant (*Ribes* spp.), big sagebrush (*Artemisia tridentata),* arrowleaf balsamroot (*Balsamorhiza sagittata*), great basin wild rye (*Leymus cinereus*), rabbitbrush (*Ericameria nauseosa*), and spring and summer ripening roots which consist primarily of. biscuitroot or cous (*Lomatium* spp.). Other than a few wetland specific plants, many of these species are found both on the valley floor and in the adjacent uplands. Flora that are mostly found in the uplands include juniper (*Juniperus occidentalus*) and a few scattered western yellow ponderosa pines (*Pinus ponderosa*). While pine nuts (*Pinus* spp.) are a well-known staple food of much of the Great Basin and are important elsewhere where Colorado pinyon (*Pinus edulis*) and single-leaf pinyon (*Pinus monophyla*) are abundant (Weide 1968:136), they are absent on the Refuge. However, pinyon pine is present just south of the Nevada-Oregon border (Aikens 1982:141), and the occurrence here would likely have been known by the precontact inhabitants of Rock Creek Shelter.

Fauna in this region include large and small mammals such as jackrabbits (*Lepus* spp.), cottontails (*Sylvilagus* spp.), coyotes (*Canis latrans*), badgers (*Taxidea taxus*), raccoons (*Procyon lotor*), porcupines (*Erethizon dorsatum),* and many different types of ground squirrels (*Citellus* spp.). Many of these mammals were targeted for subsistence by the region's inhabitants throughout prehistory (Fowler 1986; Grayson 1988; Weide:1968). Most of the larger game is limited to the uplands, but researchers have suggested that upland game such as pronghorn (*Antilocapra Americana*) and mule deer (*Odocoileus hemionus*) were also a subsistence focus (Weide 1968; Aikens et al. 2011). Although mountain sheep (*Ovis canadensis*) were exterminated in the area by 1896 (Weide 1968:141), and bison (*Bison bison*) by 1832 (Steward

1938:37), faunal remains of both taxa have been found on the Refuge by archaeologists (Weide 1968:141). The valley floor possesses many animal species not found at higher elevations, at least not in abundance. For example, Weide (1968:142) found a substantial amount of shell at sites on the valley floor which led her to suggest that freshwater clams were frequently targeted by the region's inhabitants. Although the lakes would have contained many species of fish when lake levels were stable, Weide (1968:140) noted that ethnographic information about fish species is often vague and lacking, which likely indicates that this was not an important resource for the people that inhabited the region. This is not to suggest that this was always the case, because even in higher elevations east of the Warner Mountains, Catlow chub (*Gila bicolor*) were likely abundant prior to the 1934 drought in Rock Creek (Weide 1968:142). However, when Weide was surveying the area in 1967 she was unable to obtain a specimen despite fishing it heavily (Weide 1968:142). Instead, given that large mammals like deer, antelope, and mountain sheep are usually rare on the valley floor at least until winter, and large fish like salmon are absent (Weide 1968:141; Aikens 1982:141), it is likely that precontact inhabitants would have focused on important valley floor fauna such as waterfowl, which, with the exception of the mud hen (*Fulica americana*), were hunted with the bow primarily in the summer and fall by ethnographic hunter-gatherers (Kelly 1932:90).

Climate: Past and Present

The first peoples arrived in this area near the end of the Pleistocene, while the world's climate was transitioning from the cold of the glacial age to the warmer climate of the contemporary era, the Holocene. (Aikens et al. 2011:40). Since that time, the Great Basin has undergone a considerable amount of environmental change. Although a visit to the Great Basin today would lead one to characterize the region as generally hot and dry, in the past, the region was much warmer and drier (Grayson 2011:217). Due to the fragile nature of wetland and lakeside environments, the Warner Valley, adjacent uplands, and consequently its inhabitants, would have been particularly susceptible to these changes through time. Alternatively, there have also been times in the environmental history of the Great Basin when precipitation was much greater, and temperatures were much cooler than present (Grayson 2011:217). Efforts to characterize the environmental change the Great Basin has undergone have led researchers such as Antevs (1948, 1955) to place these conditions into one of three categories: the Ananthermal, Altithermal, and the Medithermal. As seen in Table 1-1, these categories roughly translate into the more commonly used geological epochs, the Early Holocene (10,000 to 7, 500 years ago), the Middle Holocene (7,500 to 4,500 years ago), and the Late Holocene (the last 4,500 years).

Table 1-1. Environmental categories in the Great Basin. Adapted from Grayson (2011).

Temperature Age	Age (years ago)	Climates
Ananthermal	9,000-7,000	Warm, moist
Altithermal	7,000-4,500	Hot, Dry
Medithermal	4,500-Present	Cooler, Moister

The Early Holocene, or Ananthermal, is characterized as being a warm and moist climate, though temperatures fluctuate significantly from year to year, and from season to season, so the degree of precipitation and evaporation vary (Aikens et al. 2011:33). These fluctuations would consequently influence lake levels and other water sources in the Great Basin. Therefore, it is best to characterize the Early Holocene as a time of fine-scale environmental change (Grayson 2011:282). Environmental conditions during this time would have been the most hospitable to human, animal, and plant life however, given that high annual precipitation would have kept lake levels high and rivers and creeks flowing. Cooler temperatures and high precipitation would have also made winters more severe even though these winter storms also "recharged" the lakes and marshes, so that during the summer months, little precipitation was required to keep the water levels stable (Grayson 2011:239). For example, in the Warner Valley region during the Terminal Pleistocene, pluvial Lake Warner reached a maximum elevation of around 1,450 meters (m) above sea level before receding (Weide 1975; Smith, Pattee, and Van Der Voort 2016).

During the Middle Holocene, or Altithermal, the climate was much hotter and drier than it is today. Grayson (2011:252) writes that during this time the Great Basin was mostly represented by high temperatures or low precipitation, and often, both occurred simultaneously. Low precipitation in the Great Basin would have led to droughts, caused lake levels to drop significantly, and many smaller bodies of water would have likely dried up completely. It is important to note, however, that these three environmental characterizations are generalizations about the entire region, while there was probably considerable variability within local environments. For example, even though the Middle Holocene is understood generally to be hot and arid, this pattern was occasionally interrupted by periods of somewhat greater moisture (Aikens et al. 2011:42; Jenkins, Droz, and Connolly 2004). In the Warner Valley region, warmer and drier conditions also characterized the Middle Holocene, as evidenced by a peak in saltbush pollen in the Bicycle Pond pollen record (Wigand and Rhode 2002).

During the Late Holocene, or Medithermal, environmental conditions began to stabilize around 4,500 years ago and are like current conditions in the Great Basin. Though climate in this region may seem hot and dry to some today, in geological terms this is a cool and moist period, especially when compared to the previous Middle Holocene climate (Grayson 2011:260). The Late Holocene climate, however, is not as cool and moist as was the Early Holocene and thus the lakes in the Warner Valley are currently much smaller and less stable than they once were. The

Late Holocene climate would therefore have been more attractive to human occupation then it was during the Middle Holocene, but not as attractive as it was in the Early Holocene when large bodies of water such as Pluvial Lake Warner existed. Currently, the once large pluvial lakes of the Early Holocene are only represented as shallow lakes such as Malheur, Harney, Abert, Summer, Goose, the Warner Lakes, and the "bathtub-rings" on the flanks of the surrounding hills near the once prominent shorelines of the pluvial lakes (Aikens et al. 2011:40). Nevertheless, the Late Holocene would have been highly productive ecologically compared to earlier times as these wetter conditions are believed to have led to a "rehabilitation by humans" (Nelson 1999). Although, once again, this should only be understood as a general characterization of the environment because the records for the Late Holocene also suggest a vast amount of environmental variability across space and time for the Great Basin. For example, Bluejoint Lake is the northernmost and lowest basin in the Warner Valley and of the lakes on the valley floor, it is the last to fill and the first to become dry when the water supply varies (Weide 1968:128). This lake would have no doubt been affected by climatic instability in the region, but the local water supply would have also been influenced by regionally specific climatic conditions such as heavy annual snowfall since this lake is fed by runoff by the adjacent Warner Mountains.

Environmental change through time is often evident in the archaeological record by adaptive and behavioral changes interpreted from an artifact assemblage, given that these were the environments to which the prehistoric inhabitants of the Great Basin were adapted (Grayson 2011:282). Even though environmental characterizations of the Great Basin are mostly general descriptions, variability in the archaeological record can often be understood in light of how environmental conditions may have influenced specific human behaviors. For instance, in times of drought, rockshelters or caves are believed to have been used less often because people would stay near wetlands (Beck and Jones 2008:48). As will be discussed later, this is an important point to consider given there is little evidence for an intensive occupation of Rock Creek Shelter during the Middle Holocene when droughts would have been more prevalent, and this is followed by a more pronounced period of occupation in the Late Holocene, precisely when water resources are thought to have stabilized.

Site Location and Description

Rock Creek Shelter is located on what is now known as the Hart Mountain National Antelope Refuge (Figure 1-2), which was established in 1936 by Franklin D. Roosevelt in a remote area of Lake County, Oregon. The Refuge is managed by the USFWS and consists of around 278,000 acres. Initially established as a range for remnant pronghorn antelope populations, it later expanded conservation efforts to over 300 species of wildlife including the greater sage-grouse (*Centrocercus urophasianus*) and the reintroduced California bighorn sheep (*Ovis canadensis californiana*) (U.S. Fish and Wildlife Service 2014). The Refuge contains many other archaeological sites, including the well-known Petroglyph Lake (35LK36), which is known for its diversity of rock art, rock cairns, and associated lithic scatters (Daehnke and Raymond 2008). Other than rockshelter sites on the Refuge which have subsurface cultural components such as Rock Creek Rock Shelter, pluvial lakes prevented many sites from having much depth (Rice, personal communication 2015; Aikens 1970; Heizer and Krieger 1956; Loud and Harrington 1929). Rock Creek Shelter occurs on the eastern slope of the Warner Mountains approximately 1.9 km (1.2 mi) south of Snyder Canyon in an area that Weide (1968) classified as uplands. The site is situated along a basalt outcrop on the east side of Rock Creek at an elevation

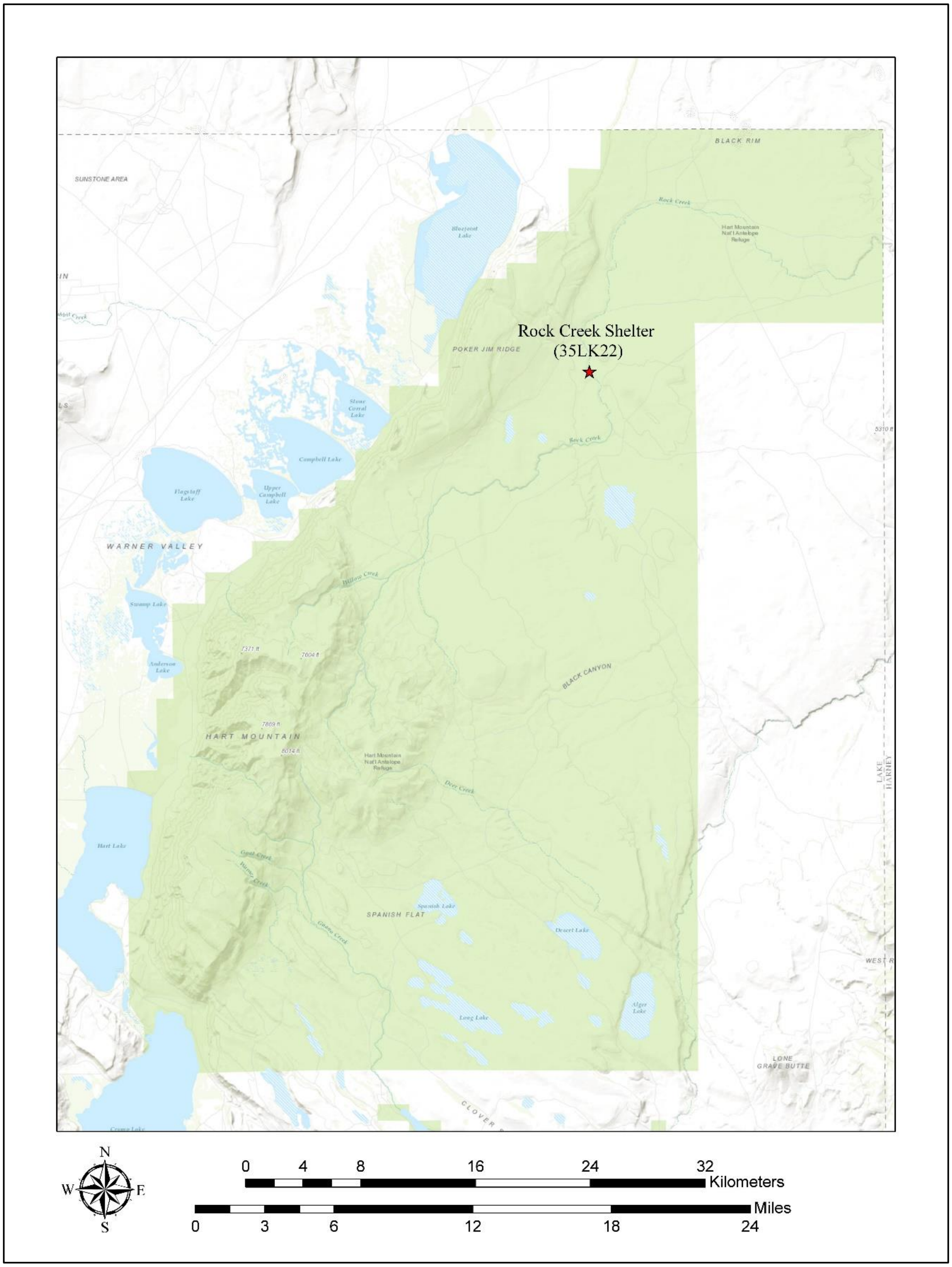

Figure 1-2. Location of Rock Creek Shelter within Hart Mountain National Antelope Refuge.

of 1,528 m (5,013 ft). The basalt outcrop slopes down from the southeast to the northwest where it ends at a bend in Rock Creek. The site is approximately 15 m above the creek bed and the shelter measures 11.3 m in depth, 15 m in width, has an area of 169.5 square meters (m^2), and the opening faces to the southwest (Figure 1-3 and Figure 1-4). The back of the rockshelter roof is lined with soot, but as will be discussed in detail later, this feature is likely not from prehistoric inhabitants. Rock Creek is a perennial stream and likely would have been a dependable water source during times of climatic stability (Rice, personal communication 2015). The creek flows in a northwestern direction and heads up on the north face of Mt. Warner before running northeast across the backslope of Poker Jim Ridge, and finally emptying into the Catlow Valley (Weide 1968:133). Other than Rock Creek, the closest major body of water is Flook Lake which is located about 4.83 miles (mi) (7.78 kilometers [km]) to the southwest. Flook Lake was likely formed by a "collapse" in the underlying flow of basalt and is often only a dry lake bed except during times of high precipitation when even then it is only a thin sheet of water (Weide 1968:1340). The vegetation in the surrounding the rockshelter includes tall sagebrush (*Artemisia tridentata*), rabbit brush (*Ericameria nauseosa*), Cheat grass (*Bromus tectorum*) and some riparian vegetation (rushes) along the creek bed. On the west bank of Rock Creek is a concentration of Great Basin wild rye (*Leymus cinereus*), a culturally significant plant whose seeds were utilized as a food source (Fowler 1986:77; Raymond, personal communication 2015). The rockshelter was utilized by prehistoric inhabitants, but how these occupants utilized this rockshelter is an intriguing question. However, before a discussion can begin about the possible functions of the rockshelter and how it can lead to a better understanding of the region, it is first important to discuss the people that occupied this region in ethnographic times.

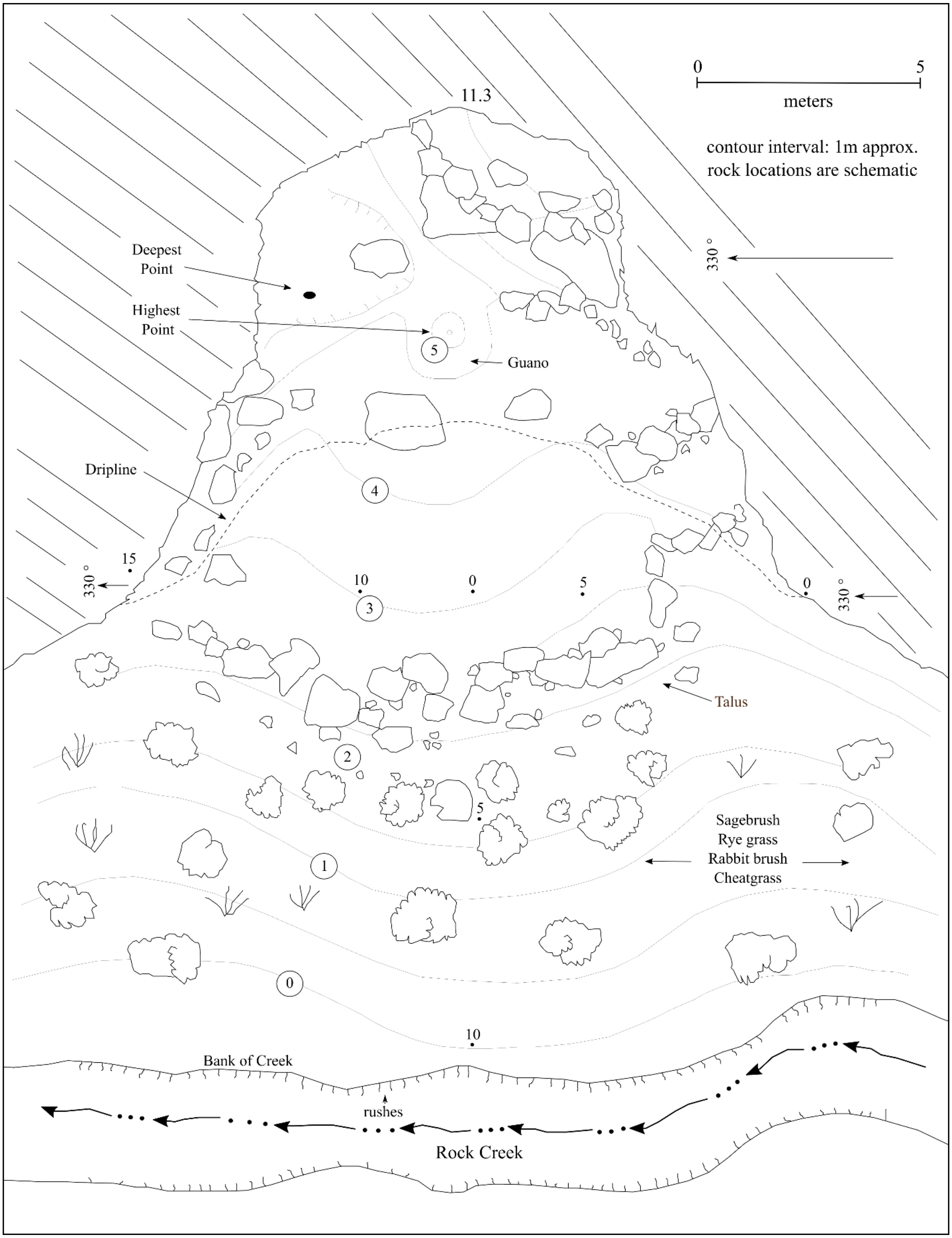

Figure 1-3. Sketch map showing dimensions of rockshelter. Numbers above points indicate measurements in meters and numbers with degrees represent aspect.

Figure 1-4. Rock Creek Shelter (35LK22) with dry Rock Creek bed in the foreground. View to the northeast.

Ethnographic Background

The first Europeans to enter the Warner Valley region referred to all Indians they encountered as "Snakes," referring collectively to the Paiute and Shoshoni in Wyoming, Idaho, Utah, and Nevada (Steward: 1938:7; Weide 1968:147). One of these first known Europeans to enter the region was Hudson Bay trapper Peter Skene Ogden, who, after a few unfortunate events, once said of the region that it is "truly a barren wretched county and happy shall I be when we are far from it" (Davies 1961:122; Weide 1968:14). However, to many, this "wretched country" was home, and the ethnographies and archaeological data compiled since that time give a more complete story by explaining that the rich cultural history of the area is associated with several different groups. For many reasons, this cultural history is as complex as it is interesting, primarily because habitation patterns have changed through time given that people usually moved and settled with respect to topographic features and the availability of different resources (Weide 1968:134). As will be discussed below, occupants of Rock Creek Shelter may have included both ancestral Northern Paiute, Klamath, and Modoc peoples, all groups known to have occupied the northern Great Basin and still do to this day. The following is by no means an exhaustive discussion of the peoples and the cultural history of the area but should provide some insight into the daily lives of the different groups who occupied this part of the northern Great Basin.

Northern Paiute

At the time of European contact, the Warner Valley was occupied by the Surprise Valley Northern Paiute, one of the most northern Great Basin culture groups that spoke a Numic language (Eiselt 1997:3). This area, now within the boundaries of the Hart Mountain National Antelope Refuge, was the traditional home of the Kidütökadö, a band of the Northern Paiute (Kelly 1932; Stewart 1939). The Northern Paiute were semi-nomadic people during prehistory; communities consisted of clusters of individual families who seasonally occupied a home tract or district, and these loosely organized family groups were usually led by a recognized headman (Aikens et al. 2011:34). When the families were not together they would form smaller groups and occupy summer and winter camps near foraging and hunting areas. Social organization among the Northern Paiute was generally dependent on the tasks at hand during a day and the division of labor was often dependent on factors such as gender, age, and social status. For example, at least during ethnographic times, Northern Paiute women were observed doing most of the seed gathering and basket weaving, though men did participate in the task of basket construction given they would often gather the necessary materials to construct them (Stewart 1939:44). Many activities practiced by the Northern Paiute, especially those directly related to subsistence, were either individual or communal and in many cases, were likely both. Hunting, for example, was an activity that could involve individual pursuit of game, or, when hunting large game such as deer, groups of younger men would drive the animals while older men hidden nearby would shoot them with a bow (Steward 1938:64). Rabbits, likely due to their abundance and speed, were usually hunted communally, given that it involved several individuals to toss a large net over a cornered group of these small mammals (Steward 1938:34). As previously mentioned, activities could also be tasked to individuals based on their status within the group, with one example of this being that often shamans in the community would place large game such as pronghorns in a trance so that they were easier to capture and kill (Fowler and Sljebad 1986; Steward 1938:34). In addition to spending their days hunting and gathering, Northern Paiute spent time processing seeds with ground stone tools and making other stone tools from raw material such as obsidian and basalt (Fowler and Sljebad 1986:436).

Over the course of a year Northern Paiute would, especially since their group composition was fluid, move freely across the landscape as was necessary to procure available resources (Fowler and Liljeblad 1986:436), and in general, people would often move to higher elevations while hunting and gathering and then return to lower elevation camps to process to prepare or process what was hunted and gathered. During the months of July and early August people would disperse into smaller groups to pursue large and small game and in late August, the seeds and berries of many plants were available to gather and process such as wada seeds (*Sueda depressa*), Great Basin wild rye, mule's ear (*Wyethia mollis*), and Indian ricegrass (*Achnatherum hymenoides*) (Aikens et al. 2011:36). In the late fall, just before the arrival of winter during the months of October and November, Northern Paiute groups used this time to hunt deer and antelopes, while once winter arrived, time was spent at encampments that provided opportunities for fishing and the hunting of waterfowl (Aikens et al. 2011:39). However, throughout the year, the Northern Paiute are thought to have placed less emphasis on fishing than other groups in the northern Great Basin due to lower fish populations in the major lakes around their ethnographic territory (Eiselt 1997:21).

Klamath and Modoc

The Klamath in historic times lived along the western periphery of the Great Basin in Oregon, just at the eastern base of the Cascade Mountain range. This is an area that, compared to the northern Great Basin, has more stable bodies of water and is more environmentally rich in resources like large terrestrial fauna. Klamath spring and summer settlements were logistically located near "prime fishing locations," and it is for this reason, among others, that Klamath groups are larger and more sedentary than the Northern Paiute (Aikens et al. 2011:39). Like the Northern Paiute, Klamath activities in ethnographic times were also observed being divided up by gender, but again, this is not meant to suggest that it was always this way in prehistory. Nevertheless, while fishing, which was in some ways a year-round activity for the Klamath, women often spent time processing caught fish and harvesting biscuitroot (*Lomatium* spp.) and camas (*Cammassia* spp.) when it was available (Spier 1930). During the summer months, Klamath women collected water lily or wocas (*Nuphar polysepala*) seed in vast quantities while men would fish, hunt small game, and catch birds with nets and bird decoys (Aikens et al. 2011:39). The late summer was when Klamath men would travel to higher elevations to pursue large game including deer, elk (*Cervus canadensis*), mountain sheep, and bear (*Ursus spp.*), while Klamath women during this time, gathered a wide variety of berries (Aikens et al. 2011:39). In the winter months fishing continued, and settlements, usually semi-subterranean earth lodges, were logistically placed along the shores of lakes and marshes where fishing and foraging would still be productive (Aikens et al. 2011:39). At the end of the winter season, the Klamath would move to spring fishing camps (Aikens et al. 2011:39), beginning a new annual round that provided them with all the resources they would need for the year to come.

Modoc territory in historic times spanned the northwestern corner of the Great Basin in Oregon near the border of present-day California (Aikens et al. 2011:37). In many ways, the annual round and social organization of the Modoc was like that of the Klamath peoples. For example, the Modoc and Klamath speak similar Penutian family languages, although they still considered themselves separate peoples based on their geographic territories (Aikens et al. 2011:38; Kroeber 1925:319). In general, the Klamath and Modoc lived in peace and intermarriage was common (Aikens et al. 2011:39), which would have led to increasing social cohesion and sharing information about resources in their respective territories. The Modoc, like the Klamath, mostly followed a two-village system, residing in a permanent winter settlement while traveling to temporary spring and summer villages usually located near important fishing locations such as Lower Klamath Lake and Tule Lake (Aikens et al. 2011:39). The annual round of the Modoc is also like the Klamath in that both groups relied on fishing year-round in addition to pursuing large game, hunting waterfowl, and gathering root crops beginning in the spring and into the late summer. The emphasis on fishing is the aspect of Klamath and Modoc life which most distinguishes them from the Northern Paiute. For example, the ideal village for the Modoc was located in popular spots such as Goose Lake where women could collect roots while men hunted, fished nearby, or hunted waterfowl (Ray 1963:208; Kroeber 1925:318). Due to this emphasis on fishing, the Klamath and Modoc both are said to have a "marsh and river culture," although all groups in the northern Great Basin exploited marshes when they were productive (Eiselt 1997:21). In terms of subsistence, the Modoc placed more emphasis on seed collection than the Klamath and were more likely to use conical baskets (Aikens et al. 2011:38).

There is a wealth of archaeological evidence in the northern Great Basin that sheds light on the daily lives on the region's prehistoric inhabitants, and archaeology, along with linguistic evidence, can also help us to understand another significant human behavior, the movement and migrations of these peoples through time.

Numic Expansion

Ethnographic data for this part of the northern Great Basin has been significantly influenced by research concerning what is known as the Numic expansion. The Numic expansion is a linguistic hypothesis that asserts that speakers of Numic languages including Uto-Aztecan are relatively recent arrivals into the northern regions of the Great Basin. Julian Steward was the first to put forth the idea that Numic speakers migrated northeast from western Nevada (Sutton and Rhode 1994), but the hypothesis was not formalized until almost a decade later by Sidney Lamb. Lamb (1958) hypothesized that speakers of the Numic dialects in the Great Basin including the Northern Paiute, Bannock, and Northern Shoshone are all descendants of a group from the Owens Valley in southeast California which began to separate approximately 1,000 years ago. The "fan-shaped" distribution (Figure 1-5) of the Numic speakers throughout the

Figure 1-5. Distribution of Numic speakers across western North America.

Great Basin has since been explored by archaeologists (e.g., Bettinger and Baumhoff 1982; Morgan and Bettinger 2012) and DNA researchers (Kaestle and Smith 2001). The focus of such research is primarily concerned with evidence for the migration and its exact timing, especially in the northern area of the Great Basin where the Numic arrival is believed to be the most recent. The timing of the expansion varies; some researchers hypothesize that it occurred as many as 5,000 years ago (Aikens and Witherspoon 1986), but generally it is thought to have commenced as recently as the last thousand years or even sooner (Morgan and Bettinger 2012:195). For example, Goss (1977) sees Numic as separate around 2,000 B.C., and the speakers of this language group arriving at their ethnographic territories by approximately A.D. 1,000. However, Bettinger and Baumhoff (1982:490) point out that the best "lexicostatiscal" estimates at the time suggest it most likely occurred between 700 and 500 years ago.

Archaeologists have contributed to this linguistic hypothesis by attempting to time the expansion by assessing if one group may have outcompeted another and determining if there are artifacts or behaviors associated with Numic speakers exclusively. Bettinger and Baumhoff (1982) have argued quite convincingly that Numic groups displaced the people that occupied the regions they migrated into by outcompeting Pre-Numic groups with a more suitable foraging strategy. Following this theory, Pre-Numic groups, who Bettinger and Baumhoff (1982) refer to as "travelers" were displaced by Numic groups or "processors" since their more efficient foraging strategy allowed them to have a broader diet which led consequently led to an increase in their population size that exceeded groups around them (Morgan and Bettinger 2012:195). This model of understanding the Numic expansion in the Great Basin is invluenced byoptimal foraging theory given that it considers the amount of energy spent for caloric return. For example, the main argument in this model is that Numic groups relied more on the intensive use of abundant seeds for their subsistence while more mobile Pre-Numic groups exploited higher return resources such as large game (Bettinger 1983; Morgan and Bettinger 2012:194).

Archaeological and ethnographic evidence for the Numic expansion is often confounding, but the replacement of one behavioral strategy by another can manifest in many ways in the archaeological record whether it be from oral histories from descendant communities or from the artifacts themselves. For instance, although ethnographic data can vary depending on several factors, Kelly (1932) was told by Surprise Valley Paiute informants that their ancestors had driven the previous Klamath (non-Numic speakers) inhabitants of eastern Oregon and claimed the land they lived on for themselves. This statement, if true, would be important ethnographic evidence supporting a recent arrival.

In the Warner Valley region, adjacent to where Rock Creek Shelter is located, the Numic speakers, and likely recent arrivals, are the Northern Paiute. As will be discussed throughout this thesis, assigning an artifact an ethnicity can be, and often is, problematic. However, evidence of the Northern Paiute way of life is often represented by milling stones, digging sticks, and carrying baskets, while their occupation sites include winter villages and special activity camps (Aikens et al. 2011:39). Again, this assessment is not clear cut, which is one of the reasons why a discussion of other groups in this region is necessary and was included in the above discussion. Perishable items such as matting and basketry, for example, were utilized by both the Klamath and Northern Paiute, though Eiselt (1997:36) points out that Klamath perishable items differ from those of Northern Paiute in that their weaving technique is usually a simple twine construction while Northern Paiute preferred willow fibers over tule. Perishable items are often analyzed when attempting to understand the Numic expansion in the Great Basin given that the biggest contrast between Numic and Pre-Numic peoples is the intensive use of seeds (Bettinger and Baumhoff 1982:496), and Numic speakers such as the Northern Paiute groups often utilized distinct perishable items to process seeds such as paddle shaped seed beaters and winnowing trays (Steward 1941:239). However, artifacts associated with Numic speakers are not just limited to perishable items and can also include lithic artifacts and rock art which is common in the Great Basin, particularly in the northern area. For example, smaller hafted bifaces such as Desert Side Notched points and Cottonwood points while not ethnically Numic, align with the time frame Numic speakers are thought to have arrived in the northern Great Basin (Bettinger and Baumhoff 1982:493). Therefore, behaviors obtained by analyzing temporally diagnostic lithic artifacts such as these can also be understood in the context of the Numic expansion. It is also thought that Pre-Numic groups are responsible for most rock art and in some cases, it has been further suggested that Pre-Numic rock art may have been intentionally defaced by Numic groups (Bettinger and Baumhoff 1982:494). There are several site types that were utilized by both Pre-Numic and Numic groups, but there are also examples of sites that were exclusively used by one or the other. For example, in the Lahontan Basin abundant evidence has been found for occupations by both Numic and Pre-Numic groups along lakes in the area, but there was also evidence that only Pre-Numic groups utilized the nearby cave to store specialized items relating to lacustrine exploitation and other purposes (Bettinger and Baumhoff 1982:499). Population movements such as the Numic expansion and many different groups like the Northern Paiute, Klamath, and, Modoc all influence the types of sites encountered in the Warner Valley and on the Refuge. However, despite what group is the topic of discussion, all people during prehistory moved all over the Warner Valley and Refuge to procure what was needed for their daily lives. Due to this frequent movement, they developed an intimate relationship with the land and were always deeply influenced by changes in their environment.

CHAPTER TWO

PREVIOUS RESEARCH

This chapter provides a presentation of previous research in the Warner Valley and Refuge, including a summary of the excavations at Rock Creek Shelter (35LK22) conducted in 1967 by WSU. This discussion is not exhaustive, though many of these previous research endeavors will be referred to in the next chapter that lays out the research design and methods conducted for this thesis and in later chapters dealing with each type of artifact type from the excavated assemblage.

Background

Archaeological investigations in the Warner Valley and within the boundaries of the Refuge have been conducted by numerous researchers over the past 80 years. The earliest known archaeological research conducted in this area took place during the summer of 1934 when Luther Cressman led a research team from the University of Oregon and Stanford University to the Guano Valley region which lies to just to the southeast of the Refuge. This effort was conducted to document petroglyphs and to record archaeological sites from the Guano Valley, Warner Valley, and the eastern slopes of Hart Mountain (Cressman 1936, 1937; Weide 1968:159).

Weide's Dissertation Research

Since that time, the most significant work done in the area was conducted by Dr. Margaret Weide, who primarily worked in the Warner Valley. Weide (1968) also conducted investigations within the Refuge during the summer of 1966 and 1967 just after WSU's excavation of Rock Creek Shelter, which, as discussed below, occurred in the spring of 1967. Her study of the area and subsequent archaeological interpretations can be found in her Ph.D. dissertation (UCLA) entitled *Cultural Ecology of Lakeside Adaptation in the Western Great Basin*. David L. Weide, her husband, joined her in the field and later published a dissertation on the postglacial environment of the Warner Valley-Hart Mountain area (Weide 1975), which has since provided paleoenvironmental data for many archaeologists in the region, particularly about the pluvial lakes. During the summer of 1966, Weide (1968) documented approximately 30 sites in the Refuge, along the valley floor, and just south of the Refuge. Most sites were located through information provided by Refuge employees and survey of places on the landscape that had a high likelihood of sites (e.g., areas near natural springs). The documented sites, including Rock Creek Shelter (35LK22), are shown in Figure 2-1 and briefly described Table 2-1. Although Weide's fieldwork provided valuable data for a previously mostly unexplored area, later regional surveys, summarized below, were more systematic, and therefore more representative of regional settlement patterns. Weide's (1968) main research question centered on understanding how wetland adaptations and settlement patterns differed from that of the Desert Culture lifeway, which is a theoretical approach put forth by Jessie D. Jennings from his interpretations of the archaeological evidence he gathered at Danger Cave between 1949 to 1954 (Aikens 2008:32). In short, the Desert Culture lifeway is characterized as a unique nomadic way of life that develops due to the absence of agricultural opportunities in arid regions such as the Great Basin and relies on a minute knowledge of seasonally available resources on local and regional landscapes (Aikens 2008:32; Jennings 1957). Furthermore, Jennings believed this same lifeway, based on the archaeological evidence gathered from Danger Cave, had continued with

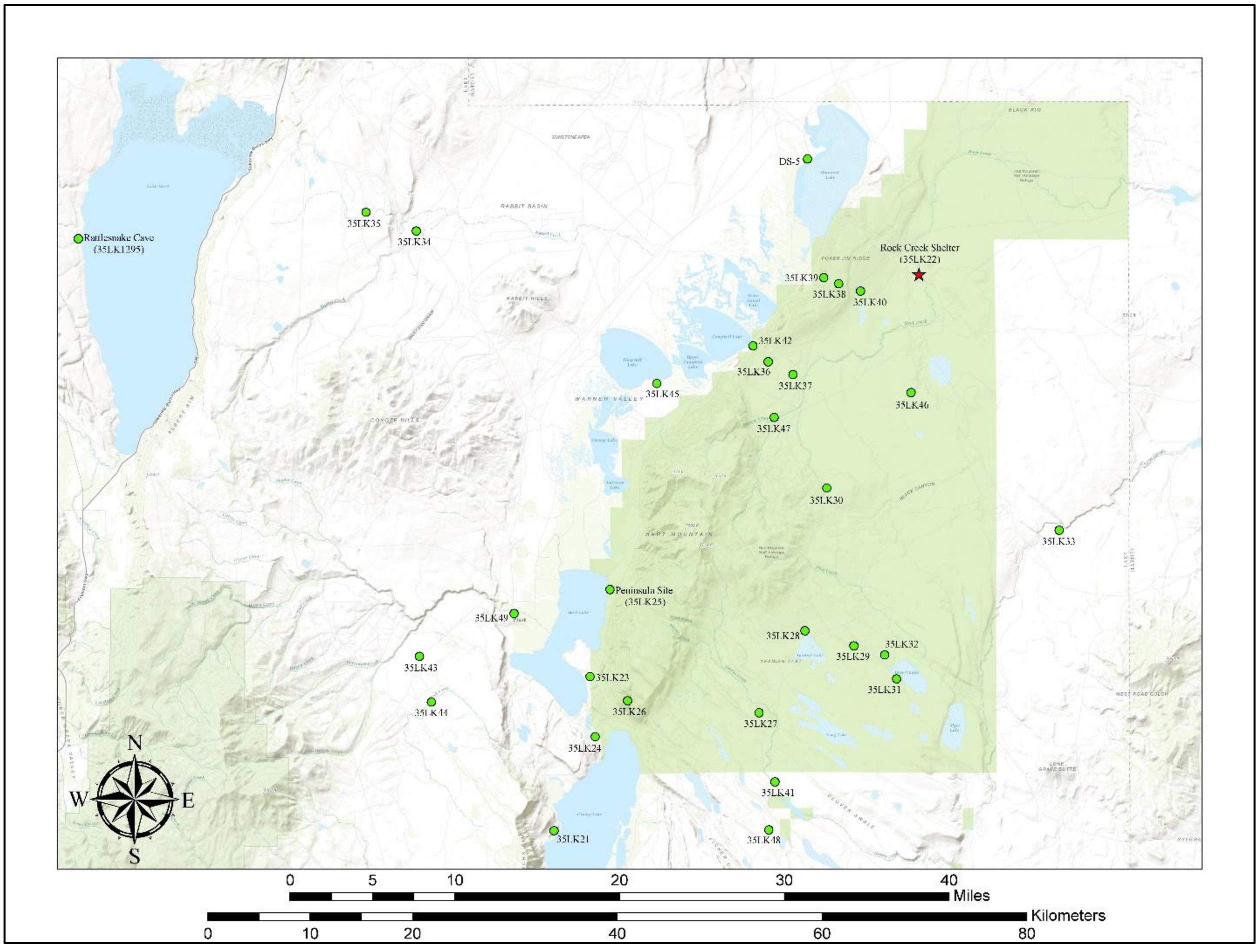

Figure 2-1. Location of sites documented by Weide (1968) and Rattlesnake Cave on the west bank of Lake Abert documented by (Connolly et al. 2016).

almost no variation for 10,000 years until European contact in many parts of the Great Basin (Fowler 1986:21).

The Warner Valley therefore provided a good opportunity to examine wetland adaptations and their relationship to Desert Culture lifeways in the Great Basin. The emphasis on lake and wetland resources supported local use of the area and a less nomadic lifestyle than that characterized by the Desert Culture lifeway paradigm. Weide (1968:265) concluded that the prehistoric inhabitants in the Warner Valley exhibited a specialized lakeside adaptation that occurred from 1500 B.C. (3450 B.P.) to A.D. 500 (1450 B.P.). At the time, the only other documented case of this type of adaptation was the Lovelock culture as determined by the work done by Loud and Harrington (1929) at Lovelock Cave. Following the argument put forth by Great Basin archaeologists such as Robert Heizer and Martin Baumhoff in the 1950s and 1960s that stated that certain regional point types could be used as time markers (Bettinger et al. 1991; Heizer and Hester 1978), Weide (1968) relied mostly on temporally diagnostic bifaces to derive

Table 2-1. Sites in the Warner Valley and Refuge. Adapted from Weide (1968).

Site Number	Location	Type
35LK21	Valley floor	Winter village
35LK22*	East slope of Hart Mountain	Rock Creek Shelter
35LK23	West face of Hart Mountain	Occupation/petroglyphs
35LK24	Valley floor	Winter village
35LK25	West face of Hart Mountain	Associated with spring
35LK26	West face of Hart Mountain	Rock shelter
35LK27*	East slope of Hart Mountain	Associated with hunting blind/petroglyphs
35LK28*	East slope of Hart Mountain	On edge of collapsed lake
35LK29*	East slope of Hart Mountain	Associated with spring
35LK30*	East slope of Hart Mountain	Site associated with spring on swale or meadow
35LK31*	East slope of Hart Mountain	On edge of collapsed lake
35LK32*	East slope of Hart Mountain	On edge of collapsed lake
35LK33*	East slope of Hart Mountain	Source and workshop for lithic material
35LK34*	Coyote Hills	Along stream
35LK35*	Coyote Hills	Along stream
35LK36*	East slope of Hart Mountain	On edge of collapse lake and petroglyphs
35LK37*	East slope of Hart Mountain	Site on swale or meadow
35LK38*	East slope of Hart Mountain	Site associated with spring
35LK39*	East slope of Hart Mountain	On swale or meadow
35LK40*	East slope of Hart Mountain	On edge of collapsed lake
35LK41*	East slope of Hart Mountain	Associated with hunting blind
35LK42	West face of Hart Mountain	Rockshelter
35LK43	Drake's flat	On edge of collapsed lake; has petroglyphs
35LK44	Drake's flat	On swale or meadow; has petroglyphs
35LK45	Valley floor	On shoreline higher than present levels
35LK46*	East slope of Hart Mountain	On edge of collapsed lake
35LK47*	East slope of Hart Mountain	Site on swale or meadow
35LK48*	East slope of Hart Mountain	Site with petroglyphs
35LK49	Valley floor	Winter village

*Sites located within the Hart Mountain National Antelope Refuge.

the periods of occupation and population numbers at a given time. For example, she found that bifaces such as Cascade foliates, Large Side Notched, and Humboldt Concave-base points represented occupations before 3,500 years ago; Elko Eared and Elko Corner Notched points represented occupations from 3,500 to 1,500 years ago; and Rose Spring, Eastgate, and Desert

Side Notched points represented occupations after 1,500 years ago (Aikens et al. 2011:117). Based on the occurrence of these point types found during her dissertation research, Weide (1968) found little evidence to suggest intensive occupation of the region after 1,500 years ago, a finding she attributed to a fluctuation in lake and marsh productivity and the arrival of Numic speaking the Northern Paiute (Smith, Pattee, and Van Der Voort 2016:5).

For the most part, Weide (1968) interpreted settlement patterns, and assessed evidence for a specialized lakeside adaptation through survey and research of areas on the valley floor. Absent from the study was a systematic investigation of the upland sites or consideration of how these places may have fit into the tethered subsistence/settlement model she developed. The upland sites she argued, possessed the only evidence of an occupation before 3,500 years ago based on the diagnostic bifaces she recovered (Weide 1968).

In summary, Weide (1968) argued a for strategy of lowland-upland land use where sites along the valley floor near the wetlands and lakes were residential sites where people targeted wetland resources, while the uplands were primarily visited to procure raw material, process plant material, and hunt large game. Furthermore, Weide (1968:222) suggested that the uplands were not used as intensively as the valley floor but rather the pattern of use of this area was "flexible" in comparison to the regularly used Warner Valley where permanent lakes were present.

University of Nevada, Reno

Beginning in the late 1980s and into the 1990s an archaeological field school based out of the University of Nevada, Reno conducted numerous surveys and excavations in the Warner Valley. This field school spawned many publications, theses, and dissertations (Cannon et al.

1990; Tipps 1998), including Young's (1998) examination of the relationship between prehistoric land morphology and site types in relation to ecological changes that occurred over the last 4,000 years. Young (1998) concluded that despite significant ecological change over time, human subsistence strategies and focus on marsh resources when available remained largely consistent (Aikens et al. 2011:118). Furthermore, Young (1998) argued that this adaptive strategy was highly flexible and could adapt to any significant ecological changes, especially those that influenced the productivity levels of wetland resources.

Rock Art Studies

Although rock art is not a focus of this thesis, it is a common site type found throughout the Warner Valley and on the Refuge, especially around Petroglyph Lake. Rock art has been studied in the Warner Valley and on the Refuge by several archaeologists and is argued to be associated with specific landscapes, located at places groups would gather, and was likely created during ritual activities that took place at seasonal gatherings (Ricks 1996, 2000; Daehnke and Raymond 2008; Aikens et al. 2011:124).

1967 Excavation

Rock Creek Shelter was excavated during the spring break of April 1967 by Dr. David Rice, Pat McCoy, Henry Irwin, and at least four other anthropology graduate students from Washington State University (Rice, personal communication 2015). The field crew lodged each night at the nearby, Flook Ranch, transporting most excavation equipment from here to the site (approximately 3.0 mi [4.8 km]) by hand each day (Rice, personal communication 2015). Excavations took place within three trenches that were systematically laid out in the rockshelter

(Figure 2-2 and Figure 2-3). Only one trench (Trench 2), extended beyond the drip line outside of the shelter's interior. Many of the trenches had to be laid out irregularly due to heavy rockfall that could not have been moved without heavy equipment (Rice, personal communication 2015). In many cases bedrock was reached after excavating known cultural deposits that ranged from 2.8 to 3.8 m in depth. During the excavation, 1/8-inch screens were used (Rice 2015, personal communication) to screen the matrix and all artifacts were collected in brown paper bags containing provenience information. Ten distinct cultural strata were identified and documented for Trench 1, six Trench 2, and four Trench 3. Excavations followed natural and cultural stratigraphic layers and deposits, a method that was common practice in archaeology fieldwork during this time. Each of these stratigraphic layers and the specific locations of each trench will be discussed thoroughly in Chapter Four. Dr. David Rice and Pat McCoy returned to Rock Creek Shelter in June of the same year but did not conduct any additional extensive excavations.

Figure 2-2. Excavations at Rock Creek Shelter in 1967. View to the southeast.

Instead, they focused only on artifact and feature recovery (Rice, personal communication 2015). Based on the 1967 field notes, Dr. Rice's impression at the time was that the site was occupied sporadically between 3,000 B.P. and 1,000 B.P., and it is likely that additional cultural material laid beneath the unmovable rockfall (Rice, personal communication 2016). Although this last point is currently unknown, it is hoped that additional studies at the site will one day lead to discovering if additional cultural material actually lies below the heavy rockfall.

Figure 2-3. Excavation trenches within Rock Creek Shelter. View to the northwest.

Summary

In summary, other than Weide's (1968) research and a few studies focused on the regional rock art (Ricks 1996; Daehnke and Raymond 2008), most research conducted in this part of the northern Great Basin has taken place at sites on the Warner Valley floor near the lakes and marshes. This includes even the most recent research which began in the summer 2011, when the University of Nevada, Reno in collaboration with the Lakeview Bureau of Land Management began a multi-year survey project in the Warner Valley, that has produced many recent publications (Smith, Pattee, and Van Der Voort 2016; Middleton et al. 2014). In contrast, very little research has been conducted in the uplands of the Refuge. Thus, Rock Creek Shelter, a multicomponent site located in this understudied area, provides a unique opportunity to examine the patterns and interpretations that other archaeologists have derived over the years about the region and its inhabitants. The assemblage recovered during the 1967 excavation is currently held in the Museum of Anthropology at Washington State University and until the start of this research in 2015 was considered an “orphaned” collection.

CHAPTER THREE

FIELD WORK AND RESEARCH DESIGN

This chapter summarizes the field work that was conducted for this thesis in the late summer of 2015. While the field work was mostly conducted to more thoroughly document the site, it also provided me with the opportunity during our time on the Refuge to speak with Dr. David Rice, one of the site's excavators and a member of my thesis committee. These interactions helped to guide my research and assisted me in understanding the history of the site and its structure, as well as the type of questions that could be addressed through my study of the site materials. Later in this chapter I discuss how this field work, combined with consideration of previous research (see Chapter Two), helped me in the development of my research questions and study design.

2015 Field Visit

In August 2015, Dr. David Rice and I visited the site along with two U.S. Fish and Wildlife Service archaeologists, Anan Raymond and Patrick Rennaker. The main objective of the visit was to assess the site for evidence of any disturbances since the last visit in July 8, 2001 by Anan Raymond, Virginia Parks (USFWS), and Jon Daehnke from the University of California, Santa Cruz. Dr. Rice had not visited the site since the 1967 field season (Chapter Two), and he provided valuable information about the excavation and site content that was instrumental to the development of this thesis.

Rock Creek Shelter is accessed by following the dry Rock Creek bed for approximately three miles when departing from the now dilapidated Flook Ranch. Upon arrival, more than 100 obsidian and cryptocrystalline (CCS) flakes were documented on the surface of the site, along with many ground stone tools (Figure 3-1), including four manos/hammerstones, five metates, six hopper mortars, a pestle preform, and one large mammal long bone with a spiral fracture. Most of the obsidian and CCS flakes were observed at the mouth of the shelter just beyond the rockshelter drip line. Ground stone was found both within and outside of the shelter. Additionally, seven wood lathe stakes—evidence of the 1967 excavation—were observed within the shelter along the interior walls. Unfortunately, the faint writing observed on the stakes was illegible, so the provenience information on them could not be matched up with the 1967 field notes. Anan Raymond noted that during his visit in 2001, a few wood lathes had “4L,” “5,” and “17” written on them, but it is currently unknown what this refers to since these designations are also not mentioned in the 1967 field notes.

Figure 3-1. Two metates/hopper mortar bases found on the slope in front of the opening.

Large amounts of bat guano and swallow nests were observed covering the floor, ceiling, and walls of the rockshelter. Pack rat middens were found along the walls at the back of the shelter. Towards the back of the rockshelter soot was observed on the ceiling, but it is unknown if this was produced from fires by the shelter's original occupants or from more recent visitor(s). It seems the latter possibility is true as there was no mention of soot in the 1967 field notes or clear photographs taken of this area prior to our visit. Despite concern that the site may have been looted since the 1967 excavations, this did not appear to be the case.

After assessing the site's integrity and documenting all the surface artifacts, the remaining field time was spent determining the exact coordinates for the site using a handheld GPS unit and producing a sketch map, which Raymond later included with an updated Oregon site record. This sketch map was recreated digitally for this thesis (Figure 1-4), and a comparison of the 2001 and 2015 GPS location of the site is shown in Figure 3-2. This 2015 site visit, along with later discussions with Dr. David Rice, were instrumental in reinvigorating interest in this "orphaned" collection and allowed me to develop interpretations and answers to research questions that are discussed in the following sections.

Research Design and Study Methods

While Margaret Weide visited Rock Creek Shelter (35LK22) in 1967, and briefly mentions the site in her dissertation (Weide 1968), she did not conduct excavations or surface collections at the site. Beyond this, there is there is no published or unpublished literature that details the site or the 1967 WSU excavations that took place there. Considering this fact and working with the research background laid out in Chapter Two, three objectives were thus developed for this study: (1) The main objective of this study is to determine when the site was

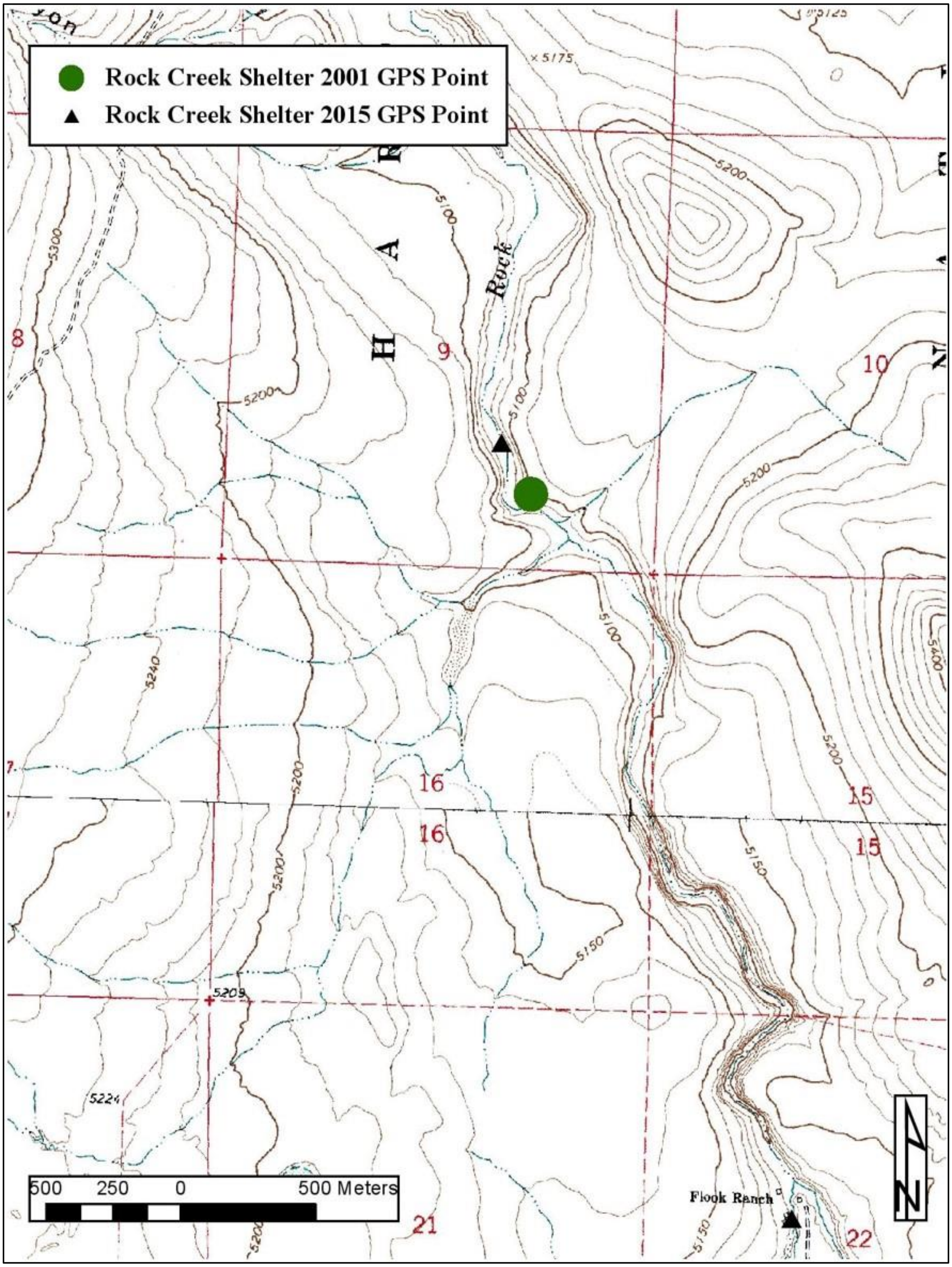

Figure 3-2. Topographic map showing 2001 GPS point and 2015 GPS point.

most intensely occupied and interpret the primary function of Rock Creek Shelter. An assessment of the site stratigraphy, radiocarbon dates, and temporally diagnostic artifacts indicated that the site was occupied to some extent since the Early Archaic but only intensively during the Middle Archaic. The intensive occupation in the Middle Archaic is highlighted not only by the number of radiocarbon dates that fall within this period, but also the higher frequency of artifacts within cultural strata dated to the Middle Archaic in comparison to other strata from other components.

The site primarily functioned as a seasonal and logistical base camp where its occupants could return with hunted game, gathered edible plants, and procured raw materials. Interpreting this function involved assessing the diversity of the overall artifact assemblage, considering the site's location in relation to important resources, and looking for indications of seasonality (i.e., ethnographic hunting seasons, seasonal resource availability, etc.). As will be discussed in the following chapters, the site assemblage is made up of a diverse group of artifacts ranging from lithic tools that indicate hunting and game processing, ground stone implements that indicate plant processing, tule matting which allowed the site to have an occupational surface, and cordage that may have been used in the construction of netting for capturing small game. The abundance of rabbit remains, and a few ground stone implements indicate that the site was used from spring to fall since rabbit drives were conducted in preparation for winter (Fowler 1986), and spring is when plants and root crops would have become available for processing. The site was interpreted as a logistical camp since it is located to important resources such as Rock Creek and several raw material sources. This would have allowed its occupants to have a dependable source of fresh water and be near numerous locations where they could obtain raw materials needed during the duration of their occupation.

(2) The second objective in this study was to assess the artifact assemblage and analytical results to better characterize and understand patterns of land use and occupation in the upland area (east of the Warner Mountains) of the Refuge. This objective was realized by building upon previously conducted research in the area and considering how upland sites such as Rock Creek Shelter fit into the established pattern of land use in the developed by Weide (1968). It has since been argued that the uplands were utilized more intensively than Weide proposed (Cannon et al. 1990), and it has been suggested that in the Late Holocene an adaptive strategy was utilized that could account for changes in wetland productivity (Young 1998). Despite these findings, in general, the settlement and land use pattern Weide (1968) established for the area is still widely accepted by most Great Basin archaeologists (Aikens et al. 2011; Couture et al. 1986; Fowler et al. 1989; Smith, Pattee, and Van Der Voort 2016; Tipps 1998; Young 1998), with the only major change to date being how far back in time this pattern is attested (Smith, Pattee, and Van Der Voort 2016; Middleton 2014). Although much of the land use and settlement pattern has been reaffirmed by researchers working with the data compiled by Weide (1968), most of this work has focused on sites along the valley floor outside of the Refuge. Therefore, this research objective and the following interpretations could potentially contribute significantly to what we know about the archaeology on Refuge as opposed to only the Warner Valley.

(3) The third, and final, objective of this study was to examine whether there is evidence of the Numic expansion at this site in later cultural components. As mentioned, Weide (1968) argued that the intensive occupations in the Warner Valley ceased approximately 1,500 years ago, but more recent studies have found conflicting evidence. For example, in contrast to a decrease in occupations after 1,500 years ago, other archaeologists (Tipps 1998; Young 1998;

Eiselt 1997, 1998; Smith, Pattee, and Van Der Voort 2016), have since argued that residential sites like the Peninsula site (35LK2579) became more common after that time and in some cases, even saw more intensive occupations during the last 200-400 years. Furthermore, the evidence for a pattern of intensive use of valley floors after 1500 B.P. is present in the Warner Valley and has also been noted in the nearby Lake Abert/Chewaucan Basin (Oetting 1989, 1990; Oetting and Pettigrew 1985), which lies approximately 25 mi (40.2 km) to the east. Although this evidence is likely enough to disprove Weide's (1968) interpretation that the patterns of land use and settlement ceased around 1500 B.P., it is still interesting to note that one explanation she gave for this interruption could be due to the arrival of the Northern Paiute given that this is still a relevant topic in Great Basin archaeology. Although evidence for the Numic expansion can be hard to demonstrate given the difficulty of assigning artifacts ethnicity (Eiselt 1997) or attributing certain behaviors to particular groups (Bettinger and Baumhoff 1982), this question was addressed in this study by comparing the Rock Creek Shelter artifact assemblage to those from other sites with similar assemblages that were also assessed for evidence for the Numic expansion. For example, Connolly et al. (2016) has recently argued that certain basketry types in the northern Great Basin may be specifically attributed to Klamath peoples who likely inhabited regions such as the Warner Valley and the adjacent uplands which lie east of their ethnographic territory. By examining the assemblage from Rattlesnake Cave (35LK1295) on the west shore of Lake Abert (Figure 2-1), Connolly et al. (2016) revisited an ethnographic question first posited by Kelly (1932:72) who suggested that the Klamath and Modoc may have once inhabited regions east of their ethnographic territory to Steens Mountain. Although this hypothesis does not address the Numic expansion directly, it does have the potential to lead to a better understanding of the people who likely inhabited this region prior to the arrival of Numic speakers.

To understand the function of Rock Creek Shelter, interpret how it fits into the pattern of land use in the region, and investigate whether there is evidence of the Numic expansion at the site, several analyses were conducted on the artifact assemblage. First, since many recent studies have questioned the periods of occupation put forth by Weide (1968) including her evidence for the earliest occupation and latest occupation, radiocarbon dates were acquired from 14 organic materials recovered from the 1967 excavation. Next, obsidian sourcing was conducted on 100 obsidian samples to better understand site function, prehistoric patterns of land use, and explore other patterns the data would provide. Specific types of perishable artifacts such as basketry and cordage are thought to be most representative of ethnicity, and thus the artifact types and construction techniques of the perishable assemblage were analyzed in relation to previously conducted research. Although not abundant in the Rock Creek assemblage, the type of ground stone represented in the assemblage will also be discussed in relation to the research objectives for this study. Lastly, in the spring of 2017, an analysis of the faunal assemblage was conducted to understand site function, subsistence, and patterns of behavior centered around animal processing activities.

The analyses conducted for this thesis provided a wealth of information about Rock Creek Shelter, the Refuge, and its inhabitants. All the results from these analyses were intriguing, but by far, the most interesting results were the range of radiocarbon dates obtained for the site which indicated that it was inhabited for a span of nearly 8,000 years.

CHAPTER FOUR
SITE AGE AND STRATIGRAPHY

Rock Creek Shelter (35LK22) is a multicomponent site with a record of occupation that extends to at least the Early Archaic. In this chapter I summarize the site's chronology, which is based on consideration of temporally diagnostic artifacts in the assemblage (n=24), field notes from 1967 site excavations, as well as accelerated mass spectrometry (AMS) radiocarbon dating results of 14 organic samples obtained from the site, including the oldest date on a fragment of wrapped z-twist cordage dated to 7490 ± 40 (8385 – 8200 cal B.P.).

Despite the lack of site report, excavation methods, soil types, artifacts encountered, and the overall stratigraphic integrity were reconstructed based on 1967 field notes compiled by Dr. David Rice and Henry Irwin. The stratigraphic distribution of major artifact classes will be summarized in this chapter in relation to the dates obtained, but a more in-depth interpretation will follow in subsequent chapters dealing with each artifact type specifically. However, before discussing the dates that were obtained for Rock Creek Shelter, it is necessary to begin by explaining the methodology and sampling strategy utilized in this analysis.

Archaeological Dates and Site Stratigraphy

It is common in the Great Basin for chronological control to be established by the presence of diagnostic biface types when a site lacks stratigraphic control. However, this method can be somewhat imprecise given that many point types remained in use for thousands of years (Justice 2002; Oetting 1994; Smith et al. 2013). Unlike many sites in the northern Great Basin, which largely consist of lithic scatters distributed across the landscape with no stratigraphic deposition, the 1967 excavation at Rock Creek Shelter established that the site contained intact cultural deposits that ranged from 2.8 to 3.8 m in depth. At the same time, rockshelters often have perplexing mixed stratigraphic sequences (Weide 1968:162), and many noteworthy shelters and caves in the Great Basin attest to this fact. For example, well known sites such as Fort Rock (35LK1) and Paisley Caves (35LK3400) are not clearly stratified and temporal relationships are often difficult to discern (Weide 1968:160). This is mainly due to krotovinas (animal burrows filled with soil from other horizons), living floor modifications, and other anthropogenic disturbances (e.g., cache pits for mobile hunter gatherers who would often dig down in the soil within the shelter to store items they may need at a later point in time [Jenkins et al. 2004:20]). These actions would, of course, disturb cultural materials and make it difficult for archaeologists to understand the temporal sequence of mixed deposits. Nevertheless, in a region such as the Great Basin where much of the archaeology manifests itself only on the surface, rockshelters and caves can be instrumental in establishing a chronology if the factors that make the stratigraphic sequence confusing are taken into consideration during interpretation.

Tephra Dating

An initial attempt to obtain a date for Rock Creek Shelter was done by submitting a tephra sample from Trench 3 Level I for identification to the Washington State University GeoAnalytical Lab in the School of the Environment (Appendix A). The analytical results revealed that the tephra sediment contained very little glass (only nine fragments), all of which were found to have an unusually high concentration of potassium oxide (K2O) for a tephra glass. Unfortunately, these compositions could not be matched to any tephra compositions in the lab's database of western U.S. tephras (Foit, personal communication 2016).

AMS Dating

Despite the disappointing tephra dating results, the Rock Creek Shelter assemblage includes many organic artifacts suitable for dating such as cordage and textile fragments constructed from tule and sagebrush bark. A total of 15 of these samples were submitted to Beta Analytic Inc. in Miami, FL for accelerator mass spectrometry (AMS) radiocarbon dating to define the periods of occupation/cultural components of Rock Creek Shelter. These include three mammal bones, two pieces of plant charcoal, ten pieces of organic basketry, modified wood, and cordage. Although one of the mammal bone samples (Inv. #1575) could not be dated because a reliable collagen fraction could be isolated or purified during the pretreatment process. A full list of the type and provenience of the samples is shown in Table 4-1, and the AMS dating report us presented in Appendix B.

Table 4-1. List of samples submitted for radiocarbon dating.

Inventory #	Trench	Stratum	Description
1793	3	3	Open simple twine basketry
1429	2	2	Wrapped z-twist cordage
1917	3	1	Close simple twine basketry
1880	1	5	Open simple twine basketry
1942	3	4	Open simple twine basketry
1575*	1	10	Mammal bone
1471	1	1	Z-twist cordage
1739	1	9	Modified wood fragment
1727	1	8	Mammal bone
1871	1	2	S-twist bark bundle
1408	2	4	Charcoal (plant)
1409	2	4	Charcoal (plant)
604	2	1	S-twist cordage
1820	2	6	Wrapped z-twist cordage
1674	1	7	Mammal bone

*Unable to be dated.

The sampling strategy utilized in selecting the samples was to choose at least one organic sample from each stratum (10 total layers), and with the five remaining samples get additional dates for the same levels in different trenches (3 total trenches). The idea behind this sampling strategy was to get a date for each level identified during the original 1967 excavation, and to assess whether the same layers could be combined from each trench. For example, artifact 1917 and 604 are both from Stratum I, but one sample is from Trench 2 and the other from Trench 3. It was hoped that these dates would be similar which would allow it to be said that all artifacts from Stratum I are of similar age regardless of the trench. Dates from each stratum would allow an overall occupation chronology to be established for the site and allow inferences to be made about behavioral patterns evident from the artifact types recovered. However, as will be discussed, the presumption that the same strata from different trenches would be similar in age proved to be incorrect and it was therefore necessary to evaluate the stratigraphy and associated date obtained for each trench independently before inferences could be made about the site chronology.

In all cases, perishable artifacts (i.e. tule basketry and sagebrush bark cordage) was selected from each stratum when there was a sample available. This was done because almost all other organic material from each trench consisted of small mammal bones that, at the time, had not been analyzed thoroughly and a preliminary analysis suggested that many were small rodent bones which were believed to be later disturbances. When perishable material was not available larger bone fragments were selected given that they more likely represent fauna that was brought in by the site's inhabitants for subsistence rather than pack rats or other rodents that could have disturbed the site once abandoned. Perishable material was also selected for this analysis since these types of artifacts possess the most information about their provenience given that the 1967 field notes from the excavation contain sketches of perishable material within the stratigraphy. For example, even though rodent disturbances were documented in Trench 3, the stratigraphic drawings indicate that all the matting/basketry material was not located near these disturbances.

Therefore, it is likely that this represented an undisturbed deposit of perishable material. Lastly, diagnostic perishable material was selected when possible that can be compared to similar collections in the northern Great Basin (Connolly 1994; Connolly and Barker 2004; Smith, Ollivier, Barker et al. 2016). The basketry assemblages from these studies is stylistically very similar to those recovered from Rock Creek Shelter and thus served as an important comparative part of the analysis.

The only samples submitted for dating that were neither bone nor basketry/cordage are artifacts 1408 and 1409. These samples are two pieces of charcoal (burned tule) debris that were set aside during the original excavation for radiocarbon dating and were wrapped in tinfoil. Although both samples were recovered from the same trench and same stratum, both samples were submitted for radiocarbon dating since they were identified as dateable material during the 1967 excavation and therefore may have been intentionally taken from an undisturbed area that the field crew believed would provide reliable dates. The remainder of this chapter will discuss the results from the radiocarbon dating and assemblage classification conducted for this study. Each trench and stratum description will begin with a summary of what was noted about each in the 1967 excavation field notes. Figure 4-1 shows the location of the three trenches where excavations took place and the stratigraphic data and field notes from 1967 can be found in Appendix C.

Trench 1

Trench 1 was located within the shelter just beyond the dripline and excavations in this trench identified 10 distinct cultural layers within a 2 x 1.6-m square (Figure 4-2). Field notes for this trench from 1967 are the most limited. For example, there are very few descriptions about

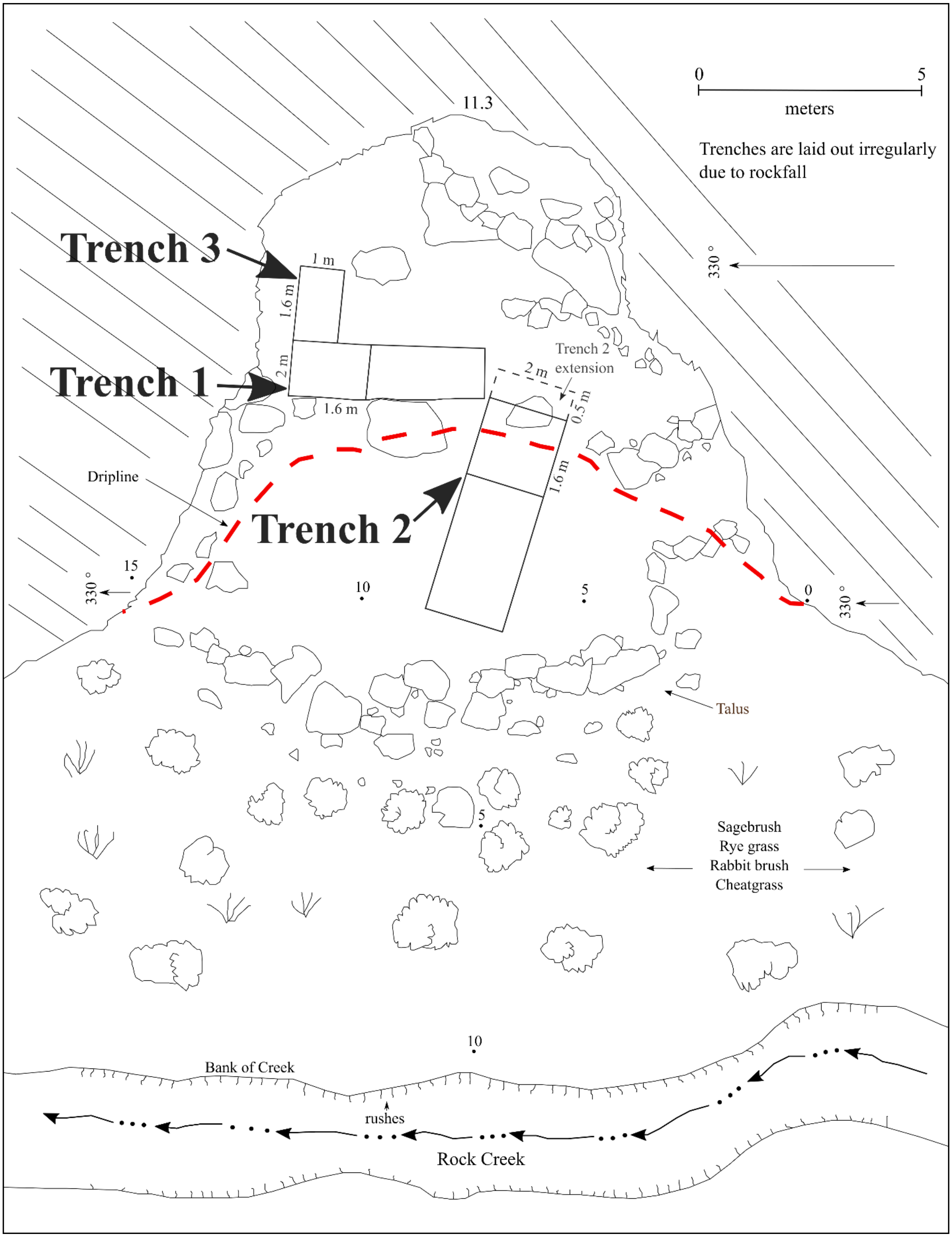

Figure 4-1. 1967 trench locations within Rock Creek Shelter. Drip line outlined in red.

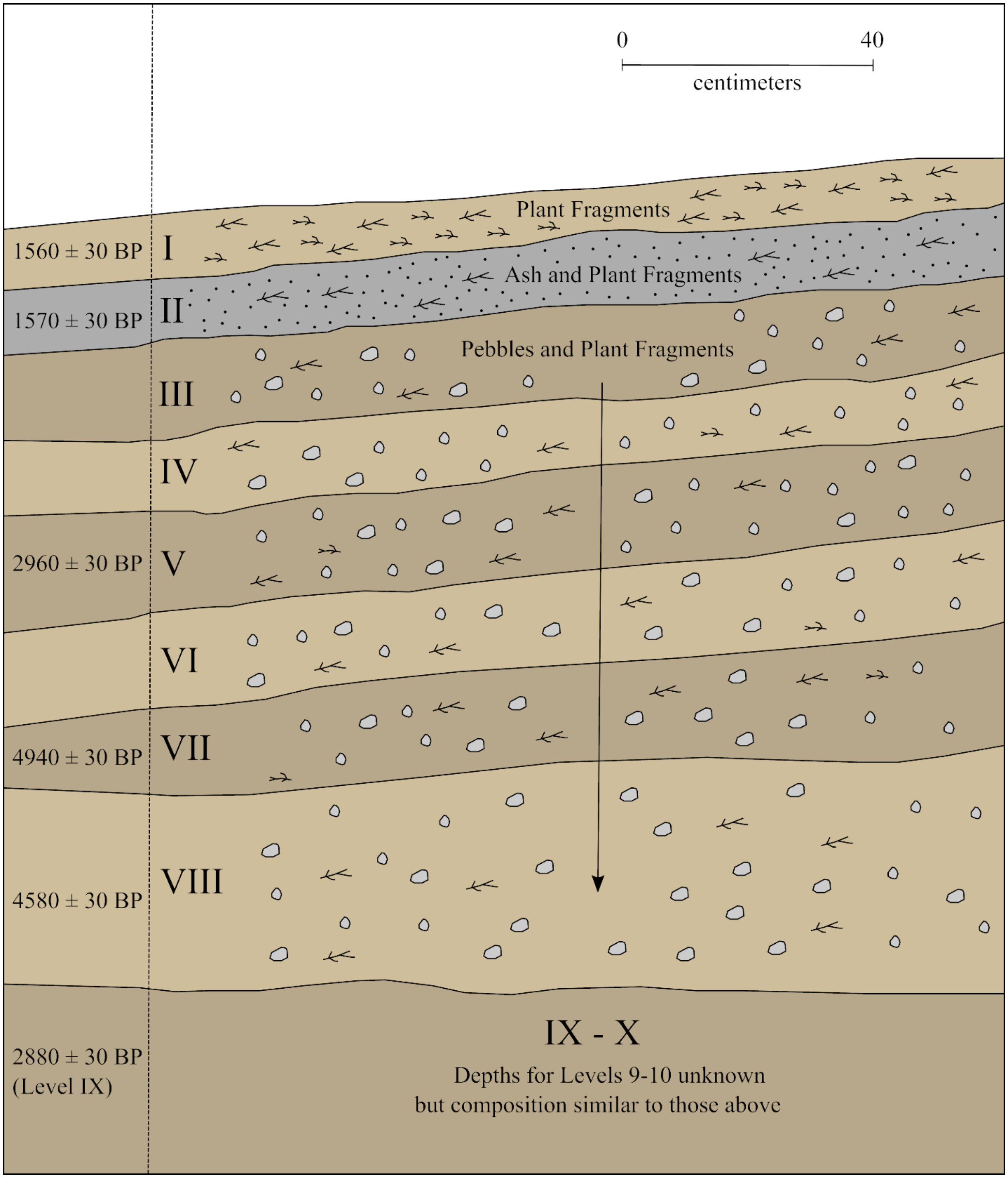

Figure 4-2. East wall of Trench 1 showing strata identified during 1967 excavations.

the matrix composition and color of the Trench 1 strata. However, a summary of this trench noted that in general, each layer consisted of unconsolidated loose dirt, many plant fragments, and unfortunately, was very disturbed by rodent burrowing. The following is a summary of the major artifact classes, the 1967 field data, and radiocarbon dates obtained from each stratum within this trench.

Stratum I

The stratum was recorded as being 8 centimeters (cm) thick and the matrix color brown (Appendix C). A date of 1560 ± 30 B.P. (1530 – 1380 cal B.P.) was obtained from this stratum by dating a small fragment of z-twist cordage. Artifacts from this stratum include z-twist (n=7) and s-twist cordage (n=1). No chipped stone or ground stone is present in this stratum.

Stratum II

This stratum was noted as being ashy, gray in color, and measured 8 cm in thickness (Appendix C). A small portion of a s-twist bark bundle was dated to 1570 ± 30 B.P. (1535 – 1390 cal B.P.) for this stratum. There is no chipped stone or ground stone recovered present in this level, but perishable artifacts included z-twist (n=2) and s-twist cordage (n=2). Although an ash lens is noted in the field notes (Appendix C), there is not a sample of ash from this stratum in the assemblage.

Stratum III and Stratum IV

There are no data about the soil composition or color in the field notes, but it was noted that Stratum III measured 8 cm in thickness and Stratum IV measured 10 cm (Appendix C).

No samples were dated for these strata and the only artifacts present are faunal remains from Stratum III and hide fragments from Stratum IV. One of the hide fragments has a fragment of z-twist cordage attached. Despite no dates being obtained, it is likely that Stratum III is a Late Archaic level and Stratum IV is a Middle Archaic level based on their stratigraphic position to dated strata.

Stratum V

There are no data about the soil composition or color for this stratum, but the stratum was noted as measuring 22 cm in thickness (Appendix C). A date of 2960 ± 30 B.P. (3210 – 3005 cal B.P.) was obtained by dating a fragment of open simple twine basketry with a z-twist weft, a diagnostic artifact type that has been directly dated before in this region (Connolly 1994). Other artifacts from this level include z-twist cordage (n=2), s-twist cordage (n=1), bark bundles (n=2), and several hide and fur fragments.

Stratum VI

There are no data about the soil composition or color for this stratum, but the thickness of this stratum measured 20 cm (Appendix C). No date was obtained for this level, but it is important to note that this is the first stratum in Trench 1 where chipped stone material is present and includes debitage (n=50), flake tools (n=2), and hafted bifaces (n=3). Two of the hafted bifaces are diagnostic point types with one being an Elko Eared point and the other a Rosegate point. As will be discussed in Chapter Five, Elko series points have a broad temporal range, but Rosegate series points are believed to mark the appearance of bow-and-arrow technology in the Great Basin (Justice 2002; Bettinger and Eerkens 2003; Hildebrandt and King 2014). Based on its stratigraphic position, it is likely that this is a Middle Archaic stratum and thus the Rosegate series point is a result of stratigraphic mixing. There is no ground stone or cordage present in this stratum, and the only perishable material other than small fragments of hide and fur, is a modified wood fragment.

Stratum VII

No data was recorded about the soil composition or color for this stratum, but it was noted that the stratum measured 20 cm in thickness (Appendix C). A date of 4940 ± 30 B.P. (5730 – 5600 cal B.P.) was obtained for this stratum by dating a medium to large mammal bone fragment from an unidentifiable animal species. The chipped stone assemblage for this stratum consists of debitage (n=11), one flake tool, one scraper, one core fragment, one non-diagnostic biface, and one non-diagnostic biface tip. The only perishable material from this stratum consists of a few bird feather fragments and one piece of deteriorated cordage. One ground stone artifact is also present in this stratum.

Stratum VIII

There is no data from the 1967 field notes about the soil composition or color, but the stratum measured 40 cm in thickness (Appendix C). For this stratum, a mammal bone fragment from an unknown animal species was dated to 4580 ± 50 B.P. (5450 – 5055 cal B.P.). Artifacts in this level include debitage (n=31) and one core fragment. No perishable material or ground stone material is present in this level. This was the first out of sequence date returned for this trench and may likely be due to a rodent disturbance, but unfortunately, this cannot be determined since stratigraphic data from 1967 about this stratum is lacking.

Stratum IX

The soil composition for this stratum was described as a sticky, sandy loam, and light brown in color. The thickness of this stratum measured 30 cm (Appendix C). A modified wood fragment was dated to 2880 ± 30 B.P. (3105 – 2925 cal B.P.) for this level, a date that is out of chronological sequence. Artifacts from this level consists of debitage (n=28), core fragments (n=2), and bifaces (n=4), including two Elko Eared points and one Rosegate point. Perishable material consists of two modified wood fragments. No ground stone artifacts are present in this level. Although the date obtained for this stratum is out of sequence, the presence of these biface types makes the assemblage appear somewhat like Stratum VI which was just below Stratum V, which dated to a similar time.

Stratum X

In the 1967 field notes, there is no data about the soil composition, soil color, or thickness (Appendix C). No date was obtained for this stratum. Artifacts from this level include debitage (n=6), one cobble with a retouched edge, and bifaces (n=4), including Elko Corner Notched points (n=2), one Cascade point, and one Gatecliff Split Stem. No ground stone or perishable artifacts are present in this level. Based on these diagnostic point types and the stratigraphic position of this level in relation to dated strata, it is likely that this is a Middle Archaic level.

Trench 2

Trench 2 was located partially within the shelter and partially beyond the dripline towards the talus slope to the southwest, and it is the only area where excavations in 1967 took place outside of the rockshelter. Excavations within Trench 2 took place initially within a 2 x

1.6-m square where seven strata were documented and identified (Figure 4-3), but since Stratum IV did not extend into the south margin of the square, it was extended northeast by approximately 0.5 m into an area that was noted as being slightly disturbed.

Stratum I

The 1967 field notes described this stratum as being a grayish brown (10YR5/2), very fine, silt, that was not sticky nor churned by rodent activity. Inclusions in this stratum included many plant remains, scatological remains, rodent nests, bird shells, a few pebbles, and some heavy rocks that were believed to have collapsed from the roof of the rockshelter. The field notes also mention that the artifacts from this stratum mostly consisted of cordage and flakes, and that the stratum varied in thickness from 8 – 14 cm (Appendix C). A date of 2240 ± 30 B.P. (2340 – 2155 cal B.P.) was obtained for this level by dating a fragment of s-twist cordage. Chipped stone artifacts

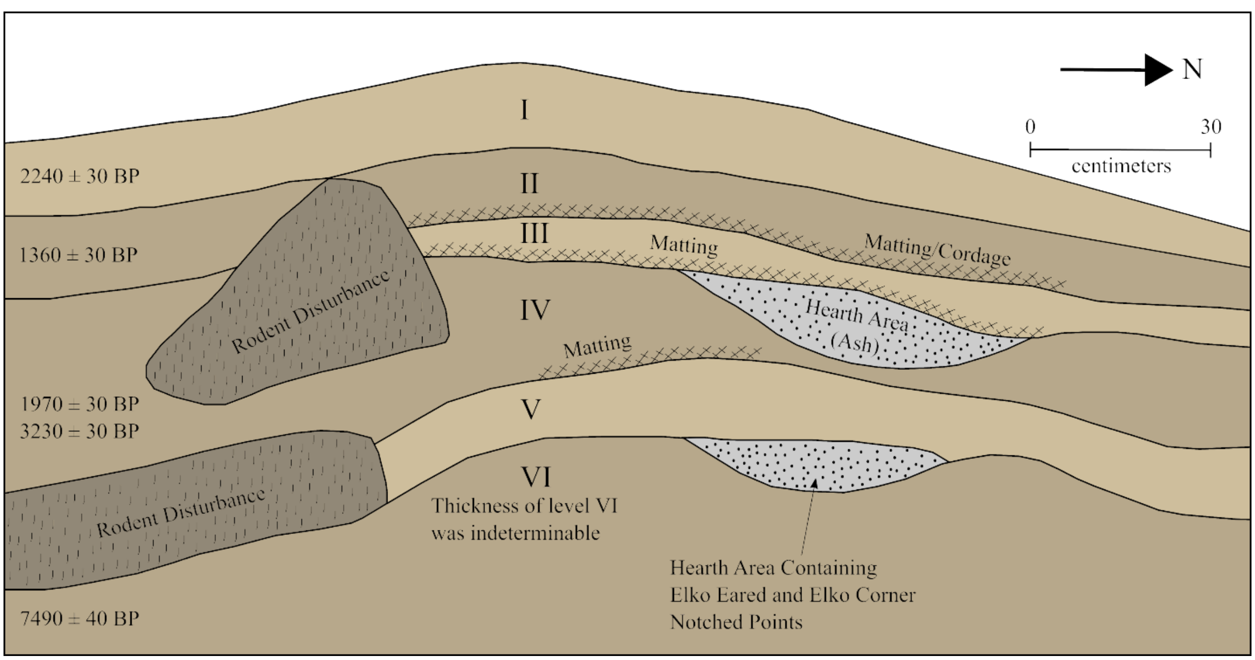

Figure 4-3. Cross section of Trench 2 showing the strata identified and hearth location.

include debitage (n=100), flake tools (n=4), core fragments (n=2), and bifaces (n=4), two of which were classified as being Gatecliff Contracting stem points. Perishable artifacts consist of s-twist cordage (n=1) and modified wood fragments (n=2).

Stratum II

The field notes for this stratum described the soil as being a very fine, grayish brown (10YR5/2), compacted silt, with little evidence of rodent activity. Inclusions noted included a heavy mat of plant fragments, a concentration of cordage at the bottom, some scatological remains, and a few pebbles. The thickness of this stratum varied in thickness from 5 – 10 cm (Appendix C). A fragment of wrapped z-twist cordage was dated to 1360 ± 30 B.P. (1310 – 1270 cal B.P.) for this level. Artifacts from this level include debitage (n=104), flake tools (n =4), and bifaces (n=5). Two of these bifaces were identified as Rosegate series points. Perishable artifacts include z-twist cordage (n=11), one close simple twine basketry fragment with a z-twist weft and warp, s-twist cordage (n=2), one modified wood fragment, and one hide fragment.

Stratum III

The 1967 field notes described the soil from this stratum as being a very fine, compacted silt, with little evidence of rodent activity. No descriptive data about the soil color was recorded for this stratum, but the thickness varied from 4 – 8 cm. Inclusions consisted of matting fragments located near the bottom of the stratum. The 1967 field notes also mention the presence of a hearth feature in this stratum in the northwest corner of the trench where a concentration of flakes was observed near the bottom of the feature (Appendix C). This hearth feature was mostly contained within Stratum IV and will thus be discussed mostly in association with that level.

No date was obtained for this stratum due to the absence of organic material, though it is believed that it is a Late Archaic stratum based on its stratigraphic position to dated strata. Chipped stone artifacts from this level include debitage (n=62), flake tools (n=3), and one biface midsection. There is no perishable or ground stone present in this stratum.

Stratum IV

The 1967 field notes described the soil from this stratum as being a compact, fine silt, that varied in thickness from 10 – 12 cm. No soil color was recorded for this stratum but matting and a rodent nest near the bottom were noted as in the field notes. This stratum was noted as being very rodent disturbed as depicted in Figure 4-3 and noted in Appendix C. Two dates were obtained for this level by dating two charcoal samples that were set aside during the 1967 excavation. The first charcoal sample (Inv. # 1408) dated to 3230 ± 30 B.P. (3555 – 3385 cal B.P.) and the second sample (Inv. # 1409) dated to 1970 ± 30 B.P. (1990 – 1870 cal B.P.). Chipped stone artifacts from this stratum include debitage (n=86) and one flake tool. Perishable artifacts include z-twist cordage (n=10), s-twist cordage (n=6), and modified wood fragments (n=2). It is believed that the charcoal sample, which produced a later radiocarbon date, could have entered this level from a level above it due to rodent burrowing or it may have been part of the hearth area that was noted in Stratum III. For example, the sample could have come from either Stratum II which dated to a similar point in time, or Stratum III which may have yielded a date slightly older than Stratum II had a sample from this level been submitted. For this reason, it is believed that this is a Middle Archaic stratum.

Stratum V

The soil from this stratum was described in 1967 as a very fine, grayish brown (10YR5/2), loose silt, that varied in thickness from 10 – 12 cm. Inclusions documented for this stratum consisted of plant remains, scatological remains, bird feathers, egg shell fragments, and several krotovinas filled with plant remains. The field notes also mention that three hand stones (manos) associated with the hearth feature were observed but were believed to have fallen from a different stratum (Appendix C). No date was obtained for this level. The chipped stone artifacts include debitage (n=113), flake tools (n=3), scrapers (n=3), and bifaces (n=4), including one Elko Eared and one Rosegate point. The only perishable artifact present in this level is a z-twist cordage fragment. Ground stone artifacts (n=2) are also present in this level. Although this stratum was not dated, it is designated as a Middle Archaic stratum based on its stratigraphic position.

Stratum VI

There is no data in the 1967 field notes about the soil composition or soil color, and the thickness of this stratum could not be defined. However, the field notes do mention that this was the first arbitrary stratum encountered, as evidenced by little differentiation in the natural stratigraphy and a decrease in the frequency of artifacts. The field notes also mention that there was a metate observed in this stratum approximately 15 – 18 cm below the hearth in Stratum III (Appendix C). A date of 7490 ± 40 B.P. (8395 – 8200 cal B.P.) was obtained for this stratum by dating a small fragment of wrapped z-twist cordage. The chipped stone assemblage from this stratum consists of debitage (n=141), flake tools (n=8), scrapers (n=2), one core fragment, and bifaces (n=10). One of these bifaces is a Rosegate series point. Perishable artifacts from this stratum include z-twist cordage (n=7). There are also ground stone artifacts (n=6) present in this stratum.

Trench 3

Trench 3 was placed in the northeast corner within the rockshelter. Excavations in Trench 3 took place within a 2 x 1.6-meter square and four distinct strata were identified (Figure 4-4). Trench 3 was the only trench that returned radiocarbon dated samples that were in chronological order. A sample from this stratum also returned the latest radiocarbon date which could indicate the most recent, and possibly last, significant occupation at Rock Creek Shelter.

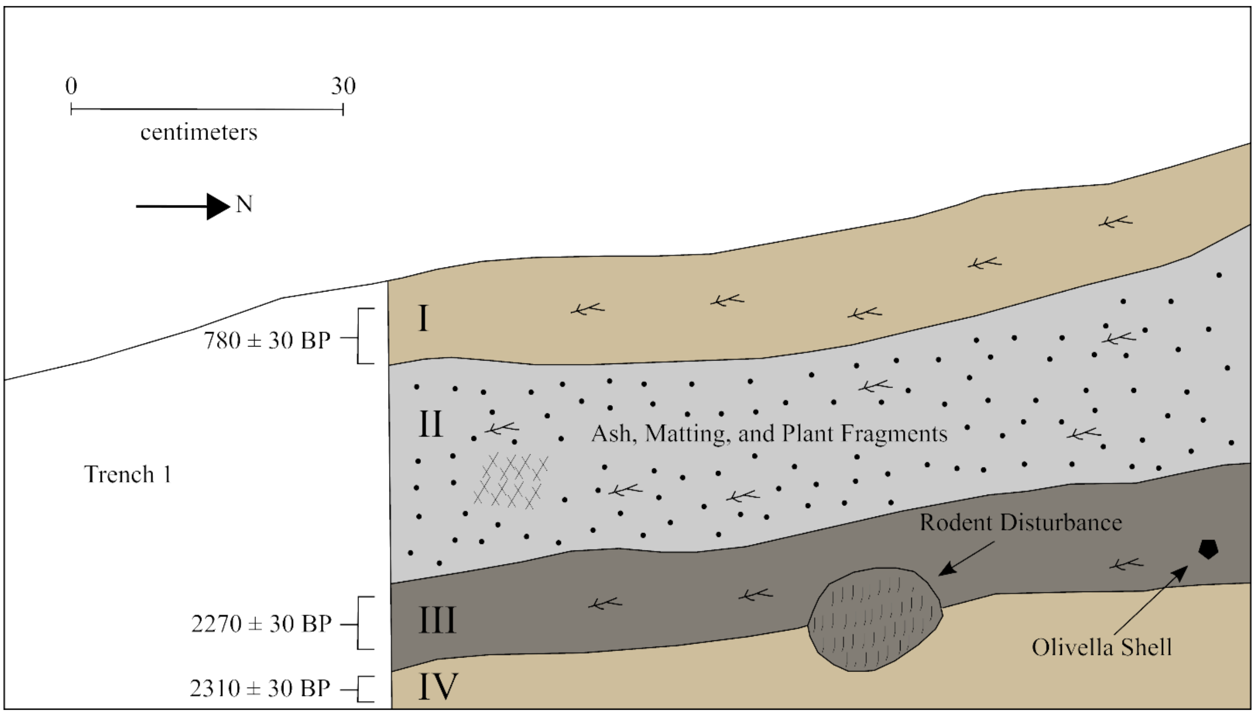

Figure 4-4. Cross section of Trench 3 showing strata identified and location of Olivella shell.

Stratum I

The soil from this stratum was documented as a very fine, loose, grayish brown (10YR5/2), silt, and the thickness of the level varied from 12 – 24 cm. The 1967 field notes documented natural inclusions consisting of plant fragments and scatological remains. The field notes also mention that artifacts observed in this stratum include a mano, flakes, and cordage (Appendix C). A small fragment of close simple twine basketry was dated to 780 ± 30 B.P. (735 – 670 cal B.P.) for this stratum, the latest date from the collection. The chipped stone assemblage from this stratum includes debitage (n=196), flake tools (n=12), one core fragment, and bifaces (n=6), including one Northern Side Notched and one Elko Corner Notched point. Perishable artifacts consist of the close simple twine basketry fragment that was radiocarbon dated for this stratum, z-twist cordage (n=2), s-twist cordage (n=2), and modified wood fragments (n=2). There are also ground stone artifacts (n=4) present in this stratum.

Stratum II

stratum. The field notes from 1967 indicate that there were many small flakes and an expanding stemmed point recovered from this stratum (Appendix C). Despite these remarks, there are no artifacts from this level in the assemblage held at Washington State University and thus no date could be obtained for this stratum.

Stratum III

The soil from this stratum was described as a very fine, dark gray (10YR4/1), silt, that varied in thickness from 22 – 24 cm. Inclusions documented for this stratum included matting, plant fibers, some ash, and a rat's nest in the central portion of the level (Appendix C). Although not documented in the text of the 1967 field notes, an ash deposit was depicted in the 1967 stratigraphy sketch for this trench (Figure 4-5). A date of 2270 ± 30 B.P. (2245 – 2160 cal B.P.) was obtained for this stratum by dating a fragment of open simple twine basketry. The chipped stone assemblage from this stratum consists of debitage (n=72), flake tools (n=14), one core fragment, and bifaces (n=10), including two Elko Eared points and one Rosegate point. Perishable artifacts include z-twist cordage (n=30), s-twist cordage (n=4), open simple twine basketry (n=4), and modified wood fragments (n=3). Additionally, there is one ground stone artifact and one Olivella shell present in this stratum.

Stratum IV

No description of the soil composition was recorded in the 1967 field notes and the thickness of the stratum could not be defined, but the soil color was noted as being grayish brown (10YR5/2). Inclusions in this stratum consisted of pumice material at 95 cm below the surface at the south end of the excavation square. The 1967 field notes also mention the presence of matting and

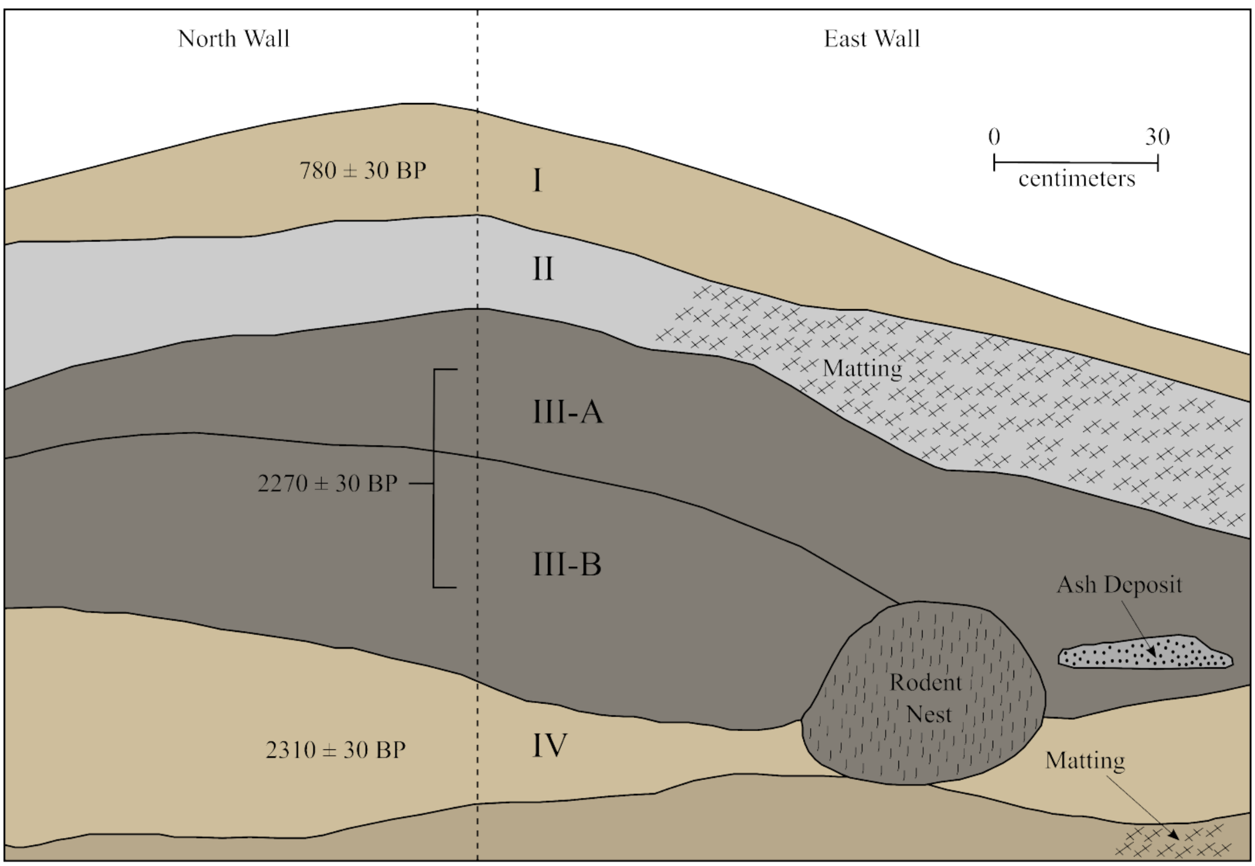

Figure 4-5. East wall of Trench 3 showing strata identified in 1967.

basketry material entangled within a rat nest, a leaf-shaped knife at approximately 75 cm below the surface near the south end of the square, and basketry and cordage at 140 cm below the surface near the north end of the square within a rodent nest (Appendix C). A fragment of open simple twine basketry was dated to 2310 ± 30 B.P. (2355 – 2310 cal B.P.) for this stratum. The chipped stone assemblage consists of debitage (n=67) and flake tools (n=2). Perishable artifacts include z-twist cordage (n=9), s-twist cordage (n=2), and open simple twine basketry (n=4), which include the sample that was radiocarbon dated.

Summary

Based on the range of dates obtained for the three trenches, as well as consideration of temporally diagnostic bifaces (covered in the following chapter), it is evident that Rock Creek Shelter was occupied, at least to some extent, from 7490 ± 40 B.P. (8395 – 8200 cal B.P.) to 780 ± 30 B.P. (735 – 670 cal B.P.), or for a period of roughly 7,600 years. Despite the very long cultural sequence, occupations at Rock Creek Shelter are only manifested substantially during the Late Holocene (the last 4,500 years), a time when the regional climate was similar to what a contemporary visitor would experience in the region today. More specifically, the site was occupied throughout the Archaic, but was most intensively used during Middle Archaic times (5750 – 2000 cal B.P). The Early Archaic (8000 – 5750 cal B.P) component is only attested by the date of 7490 ± 40 B.P. (8395 – 8200 cal B.P.) that was obtained for Trench 2 Level VI and by one Northern Side Notched and one Cascade point. Northern Side Notched and Cascade points are often associated with Early Archaic behaviors and occupations in the northern Great Basin (Oetting 1994), though since there are so few of these Early Archaic artifacts in the assemblage, interpretations about an Early Archaic occupation at Rock Creek Shelter must be conservative. The Middle Archaic is the most represented at Rock Creek Shelter based on diagnostic artifacts and the frequency of the cultural material within strata that fall within this time frame. The Late Archaic (2000 – 150 cal B.P.) is the next most well represented as evidenced from the organic material that dates to 2000 B.P. or later and the presence of Late Archaic diagnostic points such as Rosegate points (Justice 2002; Bettinger and Eerkens 2003; Hildebrandt and King 2014).

Based on their stratigraphic position and corresponding radiocarbon date, all artifacts in this study were organized by placing them into one of these chronological periods (Early, Middle, and Late Archaic Periods (Table 4-2). In cases where artifacts were from an undated stratum, they were placed in the most likely cultural period associated with that the stratum (as above). Although potentially problematic— Rock Creek Shelter, much like many rockshelters in the Great Basin, underwent many natural taphonomic processes that likely displaced artifacts and caused mixing of native sediments, making interpretations about change through time difficult—I have done my best to exercise caution in my interpretations of the archaeological record. Despite limitations, much of the stratigraphic distribution of artifacts and dates make chronological sense and can thus shed light on the research questions in this study.

The following chapters summarize the timing and nature of the lithic, perishable, ground stone, and faunal assemblages, and addresses what these assemblages say about the site's occupants, the site's function, and prehistoric land use patterns on the Refuge.

Table 4-2. Rock Creek Shelter artifact assemblage.

	Component			
Artifact Category and Type	Early Archaic	Middle Archaic	Late Archaic	**Total***
Lithic Material				
Hafted biface	2	19	5	**30**
Biface tip or midsection	8	6	6	**22**
Other biface	-	6	1	**9**
Endscraper	-	4	2	**7**
Unimarginal flake tool	-	23	18	**50**
Bimarginal flake tool	1	4	1	**6**
Multidirectional core	-	3	1	**5**
Utilized core	-	5	1	**6**
Flake debitage with cortex	13	47	31	**99**
Flake debitage without cortex	22	135	75	**272**
Angular shatter with cortex	3	19	5	**33**
Angular shatter without cortex	4	21	13	**39**
Flake shatter with cortex	23	87	49	**176**
Flake shatter without cortex	76	255	163	**554**
Perishable Material				
Open simple twine basketry with z-twist weft	-	10	-	**11**
Close simple twine basketry with z-twist weft	-	-	2	**3**
Open simple twine with s-twist weft	-	-	-	**2**
Z-Twist cordage	7	52	22	**98**
S-twist cordage	-	16	7	**25**
Bark bundles	-	8	2	**17**
Modified wood	-	12	3	**17**
Hide fragments	1	11	2	**18**
Feathers	-	2	-	**2**
Coprolites	1	6	2	**11**
Sinew strips	-	2	-	**2**
Ground Stone Material				
Manos/hammerstones	3	4	4	**17**
Metates	3	1	-	**6**
Faunal Material (NISP)				
Large mammal	30	140	98	**270**
Leporidae	32	155	70	**257**
Rodentia	14	110	67	**191**
Small/medium mammal	8	130	28	**178**
Marmota spp.	2	38	20	**60**
Aves	1	30	8	**40**
Reptilia	-	1	12	**13**
Total	**254**	**1362**	**2546**	**2546**

*Includes artifacts without provenience.

CHAPTER FIVE

CHIPPED STONE AND GROUND STONE ASSEMBLAGE

Lithic material is one of the most commonly encountered materials recovered in archaeological investigations, particularly in areas like the Great Basin where raw materials suitable for stone production are numerous. Lithic analysis therefore has been frequently utilized in archaeological research in this region for what it can tell us about human behavior in prehistory. The lithic material from Rock Creek Shelter includes diagnostic and non-diagnostic bifaces, flake tools, scrapers, cores, debitage, and ground stone implements such as manos and metates. This chapter will provide an overview of this chipped stone and ground stone assemblage with an emphasis on the temporally diagnostic bifaces and what the remaining artifacts suggests about occupational history and site function.

Chipped Stone Artifacts

The chipped stone assemblage from Rock Creek Shelter consists of 1308 artifacts of which 135 (10%) are classified as tools. The assemblage is dominated by flakes and tools made from obsidian (87%), but also contains a substantial amount of basalt (10%), cryptocrystalline silicate (CCS) (2.6%) and quartzite (0.4%). There are 44 chipped stone artifacts that have an unknown provenience and were either found on the surface during excavation or do not have a trench or stratum designation listed in the 1967 site catalog. Most of the chipped stone artifacts that do not have a known provenience consist of debitage and flake tools (n=38). Other than debitage and flake tools, there are non-diagnostic bifaces (n=2), a scraper (n=1), a multidirectional core (n=1), a Rosegate point (n=1), and an Elko Eared point that do not have a known provenience.

For this part of the study, the entire chipped stone assemblage was documented and classified, including the artifacts without a known provenience. The chipped stone assemblage from Rock Creek Shelter was classified by following Andrefsky (2005:76-85) and his classification system is summarized as follows:

Hafted bifaces: an objective piece that has been modified to have two sides or faces to form a single edge that circumscribes the entire artifact and possesses a haft element that articulates with a shaft or handle.

Other biface: an objective piece that has been modified to have two sides or faces to form a single edge that circumscribes but lacks a haft element that articulates with a shaft or handle. The entire artifact shows evidence of flake removal from both sides.

Endscraper: A flake tool with retouched area on the distal end that has an edge angle that is approximately 60° to 90°.

Unimarginal flake Tool: a flake that has been modified by retouch and/or by use wear on a single side.

Bimarginal flake Tool: a flake that has been modified by retouch and/or by use wear on both sides.

Multidirectional core: an objective piece of lithic material that has flake scars (detached pieces) that originate from multiple directions and have more than a single striking platform.

Utilized core: an objective piece of lithic material that has flake scars indicating it is a source of detached pieces, but also has signs of use from chopping, cutting, of some other activity.

Flake debitage with/without cortex: pieces that are detached during the reduction process that have a recognizable striking platform or point of applied force. This category includes both pieces that do and do not possess chemical or mechanical weathering on the surface (cortex).

Angular shatter with/without cortex: debitage that does not possess a single recognizable dorsal or ventral surface and in some cases, may just be considered a blocky chunk of lithic material.

Flake shatter with/without cortex: pieces that are detached during the reduction process that do not have a recognizable striking platform or point of applied force. This category includes both pieces that do and do not possess chemical or mechanical weathering on the surface (cortex).

As seen in Table 5-1, the chipped stone assemblage from Rock Creek Shelter consists mostly of debitage, and, compared to other sites in the northern Great Basin (Aikens 1970; Loud and Harrington 1929), possesses relatively few temporally diagnostic bifaces (i.e. hafted bifaces).

Table 5-1. Classified chipped stone assemblage from Rock Creek Shelter.

Artifact Type	Obsidian	Basalt	CCS	Quartzite	Total
Hafted biface	28	1	1	-	**30**
Biface tip or midsection	18	4	-	-	**22**
Other biface	8	-	1	-	**9**
Endscraper	6	1	-	-	**7**
Unimarginal flake tool	46	4	-	-	**50**
Bimarginal flake tool	6	-	-	-	**6**
Multidirectional core	4	-	1	-	**5**
Utilized core	5	1	-	-	**6**
Flake debitage with cortex	91	7	1	-	**99**
Flake debitage without cortex	252	16	4	-	**272**
Angular shatter with cortex	10	15	7	1	**33**
Angular shatter without cortex	19	14	5	1	**39**
Flake shatter with cortex	144	28	4	-	**176**
Flake shatter without cortex	500	42	10	2	**554**
Total	**1137**	**133**	**34**	**4**	**1308**

Diagnostic Bifaces

Before discussing the types of diagnostic bifaces in the Rock Creek Shelter assemblage, it is important to point out some issues when classifying a biface to a certain established type, especially in cases where a particular type is believed to be temporally diagnostic. All of this is not to discount the types discussed in this thesis and their importance to the site chronology but is rather a way to suggest that all interpretations about chronology made from a type of biface alone, will have to be conservative or backed up by supporting evidence. For example, it has been said archaeologists working as taxonomists do not have the benefit of observing the life history of tools (Andrefsky 2010:14), and therefore are only able to observe the final form the tool was left in at the time it was discarded. When archaeologists state that certain bifaces are temporally diagnostic, they are reconstructing the life histories of tools under the assumption that "points were manufactured, used, and lost or discarded without substantial modification of typologically diagnostic attributes during their use-lives" (Thomas 1981:15; Flenniken and Wilke 1986). However, beginning with the initial gathering of the raw material needed to make a tool, the life of this artifact undergoes significant changes and the morphological transformation that any single stone tool undergoes is considered the tool's life history (Andrefsky 2010:13). Morphological transformations of tool types can therefore happen at any point during a tool's life given that during its life a tool can be made from different quality grades of raw material, resharpened, reshaped, damaged, discarded and then reused for an entirely different purpose. This can lead to unstable typological classifications that are determined by archaeologists thousands of years later who are only able to observe the final form of the biface in question. Additionally, archaeologists cannot assume that patterns of morphological attributes have definitive chronological significance when simple changes of shape during a tool's life may change the temporal assignment of a tool by thousands of years (Flenniken and Raymond 1986:609). This can be particularly problematic when trying to understand or time the arrival and effects of new technologies such as the bow-and-arrow which is mostly considered to be marked in time by the appearance of Rosegate points in the Great Basin (Justice 2002). Another concept related to the life history of a tool is function. What the tool was used for during its life also can determine its final shape. For example, experimental studies have shown that using a projectile point for different tasks can lead to significant changes to the shape of a tool especially when points were made of glassy or otherwise brittle stone and were affixed to the distal ends of projectile weapons (Flenniken and Wilke 1989:156).

The following diagnostic bifaces were classified to their respective type by comparing the measurements of their various attributes to the existing typological classifications in the Great Basin (Justice 2002; Thomas 1981, 1983; Heizer and Hester 1973; Flenniken and Wilke 1989). Diagnostic bifaces with a known provenience in the Rock Creek Shelter assemblage consist of a single Cascade point, a single Northern Side Notched point, Gatecliff points (n=3), Elko Eared points (n=7), Elko Corner Notched points (n=4), and Rosegate points (n=10). Many of these hafted bifaces (n=16) show signs of impact damage and although it cannot be said for certain, based on stone tool experimental studies and use-life observations (Flenniken and Raymond 1986; Andrefsky 2010), this indicates that many were utilized as projectiles. The stratigraphic distribution of each diagnostic biface is shown in Table 5-2. In this table, all the diagnostic bifaces are placed in the cultural component that corresponds to the date assigned to the stratum from which each biface was recovered. Only the diagnostic bifaces that have a known stratigraphic position will be discussed in this section and are included in this table. Given that Rock Creek Shelter is a stratified site, the diagnostic bifaces will be discussed in relation to the temporal range established for each respective type in the region (Oetting 1994; Smith, Pattee, and Van Der Voort 2016).

Table 5-2. Stratigraphic position of temporally diagnostic bifaces from Rock Creek Shelter.

	Component			
Point Type	Early Archaic	Middle Archaic	Late Archaic	**Total**
Northern Side Notched	-	-	1	**1**
Cascade/Foliate	-	1	-	**1**
Gatecliff	-	3	-	**3**
Elko Eared	-	6	-	**6**
Elko Corner Notched	-	3	1	**4**
Rosegate	2	5	2	**9**
Total	**2**	**18**	**4**	**24**

The single Northern Side Notched point in the chipped stone assemblage from Rock Creek Shelter is the only temporally diagnostic type that represents the Early Archaic cultural period at the site, but as seen in Table 5-2, falls within the Late Archaic component and further highlights stratigraphic mixing. Although, the date ranges for these point types vary, it is generally thought that this point type dates between 8000 – 5000 B.P. (Justice 2002; Oetting 1994). Northern Side Notched hafted bifaces are defined as having a lanceolate to triangular shape with moderate to deep notches on the side above a usually concave base. This point type was named after specimens recovered from Wilson Butte Cave in Idaho (Justice 2002:168). As pointed out by Justice (2002:169), replication and use studies have found that dramatic typological changes likely occurred during the use life of this point type. For example, Flenniken and Wilke (1986) found through experimental use studies that this point type often fractures along the neck between the two notches. Given that the base of a hafted biface is often the most diagnostic characteristic, this type of damage can undoubtedly lead to a typological classification error which has been pointed out by Justice (2002:169). This can lead archaeologists to confuse this point type with Elko Eared or other Elko series points. Coincidentally this point in the assemblage is heavily retouched along the neck and the lateral margin with much of its original shape being diminished, and while analyzing the bifaces in the assemblage, this point was initially classified as being an Elko Corner Notched point. This highlights the typological issues that can arise when points are heavily reworked and the significant morphological changes a tool can undergo during its life history.

At Rock Creek Shelter, this point was recovered from Trench 3 Stratum 1 which was dated to 780 ± 30 B.P. The appearance of this point type in this stratum does not make chronological sense given the temporal range established for this type. This discrepancy could be due to post-depositional disturbance such as rodent burrowing that may have displaced its original location. It also could mean, though less likely, that this point was utilized by occupants at a later time during prehistory. For example, the point could have been found in the rockshelter by later occupants which could explain the significant amount of resharpening that was present on this point.

The Cascade point has been problematic in terms of classification and in some literature, points with similar morphology have been simply referred to as foliates (Smith et al. 2012). The Cascade point, or foliate, is generally thought to be an Early Archaic point but also has been found to persist into Late Archaic (Oetting 1994; Smith et al. 2012). On the Columbia Plateau where the Cascade point is more common, Butler (1961:28) originally defined the point as long, narrow, leaf-shaped specimen that is usually thick in proportion to its width and averages 6.5 cm in length. However, this definition has expanded on since that time (Nelson 1969; Ozbun and Fagan 2010). As mentioned, missing from the Rock Creek assemblage are an abundance of Northern Side Notched points which are almost always considered to be Early Archaic points. This is surprising given the earliest date obtained from Rock Creek Shelter, but previous researchers in this region have also documented their absence and rarity (Smith, Pattee, and Van Der Voort 2016:9). For example, in a survey of the northern Warner Valley, Smith, Pattee, and Van Der Voort (2016:12) did not recover any Paleoindian points in the surrounding uplands and canyons.

In terms of the Rock Creek Shelter assemblage, it is possible that a few of the larger broken bifaces in the assemblage could have once been this type given their large size and stratigraphic position. However, these bifaces lack the necessary attributes to confidently designate them as such. Therefore, the only other biface that can be said at all to be from the Early Archaic, is the foliate point, but given the issues mentioned and that there is only one foliate and one Northern Side Notched point, it is hard to suggest an intensive Early Archaic occupation at Rock Creek Shelter. Additionally, in this part of the northern Great Basin the Cascade or foliate point type is generally thought to be a poor temporal marker given that they have been recovered from contexts dated to all cultural periods (Smith et al. 2012). There is evidence in this region that Cascade points may pre-date other diagnostic point types recovered from Rock Creek Shelter such as the Elko Eared and Elko Corner Notched points. For example, in the northern Warner Valley, four foliates were recovered from the well-stratified Little Steamboat Point (LSP-1) rockshelter (35HA3735). Based on the stratigraphic location and source provenance of these four foliate points, Smith et al. (2012:27) suggested an Early to Middle Holocene age for this point type in the Warner Valley. However, they also suggest that this point type likely persisted for a long time in the region and may have extended into the Late Holocene based on one of the points association with a Late Holocene feature at LSP-1 (Smith et al. 2012:27).

As seen in Table 5-2, the foliate point was placed with Middle Archaic component based on its stratigraphic position alone. This point was recovered Trench 1 Stratum X, which was not dated but is considered to be a Middle Archaic stratum based on its artifact assemblage and that the stratum above it was dated to 2880 ± 30 B.P. Considering these factors, this indicates that this point type dates to at least 2880 ± 30 B.P., but in terms of its temporal range in this region and the disturbances at the site, it cannot be said whether this point persists throughout the Archaic or was displaced from an earlier cultural stratum at Rock Creek Shelter.

Gatecliff series points were first defined by Thomas (1981) and include the once independent Pinto point and Elko contracting stem. Gatecliff series now consists of two morphological types: the Gatecliff Split Stem and the Gatecliff Contracting Stem. The Pinto series became the Gatecliff Split Stem and is identified as being basal notched and possessing a bifurcated base. The Elko Contracting Stem became the Gatecliff Contracting Stem and its attributes consist of a contracting stem, basal notching, and a basal indention ratio greater than 0.97 (Thomas 1981). Although some archaeologists have placed the Gatecliff Contracting Stem into the Gypsum cluster (Justice 2002), for this study this type was considered part of the Gatecliff series since most studies in the northern Great Basin have referred to it as such (Grayson 1993; Oetting 1994; Wingard 2001). Regardless, Gatecliff series points are almost always considered to be Middle Archaic points and in the northern Great Basin have a temporal range of 5000 to 2000 B.P. (Oetting 1994; Smith et al. 2013). Two of the Gatecliff series points in the Rock Creek Shelter chipped stone assemblage are Gatecliff Contracting Stem points and the other is a Gatecliff Split Stem point. Gatecliff series points at Rock Creek Shelter were recovered from Trench 1 Stratum X Trench 2 Stratum I. Of these strata, the only one that dated is Trench 2 Stratum 1. The date obtained for this stratum was 780 ± 30 B.P. (735 – 670 cal B.P.).

This is obviously problematic considering the temporal range for this point in the northern Great Basin and almost certainly indicates that this artifact was displaced by a natural taphonomic factor post-deposition.

Elko series points were defined by Heizer et al. (1968) based on the artifact assemblage from South Fork Shelter in Nevada. The series consists of Elko Corner Notched, Elko Eared, Elko Side Notched, and Elko Split Stem, although, classifying Elko series beyond Elko Corner Notched or Elko Eared is often problematic and thus anything other than these two types usually falls into another category (Justice 2002:298). The Elko Corner Notched and Elko Eared point types in this part of the Great Basin, are usually considered to be Middle Archaic points (Weide 1968, 1974; Oetting 1994; Grayson 1993; Smith et al. 2013). However, Elko series points have also been said to persist into the Late Archaic and are the subject of many debates that discuss whether the point is a significant chronological or cultural marker or if it is just a product of retooling a damaged point (Justice 2002; Flenniken and Raymond 1986). For example, Elko Eared points are thought to be a derivative of the earlier Gatecliff Split Stem and the Elko Corner Notched, a technological evolution of the Elko Corner Notched (Justice 2002). However, this last point would suggest that we should see Elko Corner Notched points in cultural stratum that precedes a stratum that possess Elko Eared points, which is often not the case, and as will be discussed, is not the case at Rock Creek Shelter. One Elko Eared point was recovered from Trench 1 Stratum IV, one from Trench 1 Stratum IX, two from Trench 2 Stratum V, one from Trench 3 Stratum I, and two from Trench 3 Stratum III. Based on the dates obtained for these strata, this would indicate that the Elko Eared points range temporally from to 2880 ± 30 B.P. (3105 – 2925 cal B.P.) to 780 ± 30 B.P. (735 – 670 cal B.P.). Two Elko Corner Notched points were recovered from Trench 1 Stratum X, one from Trench 1 Stratum IX, and one from Trench 3

Stratum I. At Rock Creek Shelter, this would give the Elko Corner Notched points the same temporal range of 2880 ± 30 B.P. (3105 – 2925 cal B.P.) to 780 ± 30 B.P. (735 – 670 cal B.P.). This temporal range would indicate that Elko Corner Notched points were used into the Late Archaic and thus would also be have used contemporaneously with other Late Archaic points such as those in the Rosegate series.

The Rosegate series now encompasses what were once two separate point types. The first previous type, Rose Spring, was originally defined by Lanning (1963) at a site in California which shares same type name. Eastgate points were first identified at the Wagon Jack Shelter site that is near present-day Eastgate, Nevada (Heizer and Baumhoff 1961). After finding many morphological similarities between the two types and that the types were difficult to distinguish consistently, Thomas (1981) combined these two into a single type: the Rosegate Series. Rosegate series points are corner notched points that are usually defined in relation to the morphologically similar, but larger, Elko series points. In fact, they are often so morphologically similar to Elko Corner Notched points that they could represent a "conceptual path in the development of the bow-and-arrow" (Justice 2002). Rosegate series points are always considered to be Late Archaic points and as mentioned, are thought to be, along with Desert Side Notched points, markers of the use of bow-and-arrow technology in the Great Basin (Justice 2002; Bettinger and Eerkens 2003; Hildebrandt and King 2014; Yohe 1998). Although Rosegate points are the most common point type in the chipped stone assemblage, Desert Side Notched points are not present in the assemblage which is further evidence that the site was not occupied as extensively during the Late Archaic as it was in the Middle Archaic or possibly not at all after 780 ± 30 B.P., the latest dated stratum at Rock Creek Shelter and around the time when this type begins to appear in the northern Great Basin (Justice 2002; Oetting 1994; Wingard 2001; Weide

1968, 1974). One Rosegate point from the Rock Creek Shelter assemblage was recovered from Trench 1 Stratum VI, one from Trench 1 Stratum IX, two from Trench 2 Stratum II, one from Trench 2 Stratum V, two from Trench 2 Stratum VI, and two from Trench 3 Stratum III. Based on their stratigraphic position alone, this would give the Rosegate points a temporal range of 7490 ± 40 B.P. (8395 – 8200 cal B.P.) to 1360 ± 30 B.P. (1310 –1270 cal B.P.). While this of course would be very significant if accurate, it is highly unlikely that is the case. The appearance of the two Rosegate points in the stratum that is dated to 7490 ± 40 B.P. were most likely displaced from another stratum by a type of disturbance which could have been the rodent disturbances noted in the two strata above Stratum VI in Trench 2. However, if the stratigraphic position of these two points is discarded, the Roseate points would still have a temporal distribution of 2880 ± 30 B.P. (3105 – 2935 cal B.P.) to 1360 ± 30 B.P. (1310 – 1270 cal B.P.). This still predates the temporal range for this point put forth by Oetting (1994) but this is a much more reasonable time frame for this biface type. This is not to say that this temporal range is correct, but rather that when natural taphonomic factors that occur post-deposition are accounted for, the stratified record at Rock Creek Shelter can become more accurate.

Other bifaces and biface fragments

There are many other bifaces in the assemblage that do not possess enough attributes to type or did not possess attributes that would allow them to be placed confidently into a type based on their respective measurements. In many cases, these are bifaces that do not possess a base or a hafting area which are the critical attributes involved in any morphological classification (Justice 2002). Most of these bifaces are tip fragments and midsection fragments, which although not diagnostic, indicate their respective function. These biface tips and midsections are likely what remains of a hafted biface that was used as a projectile from either an atlatl or bow-and-arrow and sustained impact damage. For example, Flenniken and Raymond (1986) have shown in experimental studies with projectile implements that hafted bifaces often break at the midsection or lose the tip upon impact. They go on to state that this type of damage alters the morphological attributes of a potentially diagnostic hafted biface since once broken, it may have been "rejuvenated" and served another purpose (Flenniken and Raymond 1986:609). However, diagnostic potential aside, it is interesting that the inhabitants at Rock Creek Shelter almost certainly used many of these bifaces as projectiles based on this type of damage and then kept these tips and midsections which to them probably served a variety of functions.

It is more difficult to speak to the function of the other non-diagnostic bifaces that are in the assemblage that are not tips or midsections. This is mostly due to the fact that they were likely tools that were multifunctional (i.e. knives or expedient cutting tools). It is tempting to suggest that these bifaces likely did not function as projectiles since none of them possess a distinguishable hafting element, though it has also been found that hafted bifaces served as cutting and butchering tools through microwear functional analysis (Andrefsky 2005:205). There are also no bifaces in this classification that have distinguishable signs of impact damage which, as mentioned, can more definitively indicate that a biface was used as a projectile. Given these circumstances, a more directed functional analysis (i.e., microwear analysis, residue analysis, etc.) would be necessary to determine the function of these bifaces. Although, it can be said that these bifaces do highlight the overall diversity of the lithic assemblage at Rock Creek Shelter and indicate that a variety of lithic tools were incorporated into the toolkit of the site's inhabitants to complete different tasks.

Flake Tools, Scrapers, Cores, and Debitage

Other tools in the chipped stone assemblage from Rock Creek Shelter consist of flake tools (n=56), endscrapers (n=7), and cores (n=11). Flake tools in the assemblage are worked on a lateral margin either along one side (unimarginal) or along both sides (bimarginal). Most of the flake tools are unimarginal (n=50) while only a few are classified as bimarginal (n=6). In all cases, these flake tools are usually minimally retouched and were not formed into a specific shape. The minimal retouch in combination with the low count of bimarginal flake tools, indicates that these tools were likely manufactured as expedient cutting tools and could have served a variety of purposes ranging from game processing, plant processing, or basketry construction. As is the case with the non-diagnostic bifaces just discussed, this cannot be said definitively without a more in depth functional analysis which exceeds the scope of this study. However, while working on the Refuge, Weide (1968:231) found that flake scrapers are much more numerous in the uplands as opposed to the Warner Valley. This indicates that the purposes these tools served were for an activity that was more restricted to the uplands, possibly large game processing.

In the original site catalog from the 1967 excavation, almost all the flake tools were classified as scrapers. However, during the re-classification of the chipped stone assemblage for this thesis, it was decided to only classify artifacts as scrapers if they met the definition at the beginning of this chapter put forth by Andrefsky (2005). Scrapers, like flake tools, were probably multifunctional tools at the site, but often these tools are believed to be associated with the “scraping or “working” of animal skin (Andrefsky 2008:205). Therefore, based on the functional similarity to flake tools and Weide’s (1968) observations, it is likely these tools were also primarily used during animal processing.

The cores in the assemblage were classified as either multidirectional (n=5) or utilized cores (n=6). Most of the cores are small fragments with only one weighing more than 10 g. The small size indicates that either most raw material used for tool manufacturing was not left behind by the site's occupants or that many tools were made away from the site. It is also possible that mostly small cores are present in the assemblage since core shape and size only represents the last time of use before being deposited into the archaeological record (Andrefsky 2005:144). It therefore, could be that these small cores are only the discarded raw material that was deemed too small by the site's inhabitants to manufacture additional tools. However, the small cores may speak to the size of the tools that were manufactured at the site since in general, large blanks are used to manufacture large tools and small blanks to manufacture small tools (Andrefsky 2005:151). Furthermore, Andrefksy (2005:153) has suggested that core size may be associated with strategies for maximizing raw material consumption. This association may have influenced the small core size present in the Rock Creek Shelter assemblage since the primary obsidian source used by the site's inhabitants, discussed in the preceding chapter, is not too far away from the site. It is not difficult to imagine that it was unnecessary to transport large pieces of raw material back to the site since high quality obsidian could be obtained quickly. The utilized cores in the assemblage all have an unimarginally retouched edge, which given the multifunctional nature of lithics is not surprising. For example, Andrefksy (2005:155) and Byries (1988) have suggested that it is not unlikely to encounter cores utilized as cutting or scraping tools. As is the case with all of the tools discussed here it is not possible to assign these cores a definitive function without additional analysis.

Most of the chipped stone assemblage at Rock Creek Shelter consists of debitage (n=1,173). Debitage can be analyzed to tell archaeologists many things about site function and human behavior (Andrefsky 2001, 2005; Magne 2001). For example, debitage analysis can provide information about reduction sequences and construction methods such as whether soft hammer (bone or antler) or hard hammer (stone) percussion was utilized (Andrefsky 2005:118). Although this type of analysis was not performed this study, the frequency of debitage does suggest that an important function of the site was as a place where occupants would manufacture tools. Most of the debitage (95%) in the assemblage is very small (< 5 grams [g]) and does not possess cortex (74%), which indicates that most tool manufacturing conducted at the site consisted of resharpening previously formed tools or constructing new tools from an objective piece in a stage of production where all the cortex had been removed. This, along with the small core size just discussed, further indicates that the site's inhabitants likely prepared cores at the source location and only transported enough material needed for tools they planned to later manufacture. Many pieces of debitage in the assemblage possess distinguishable platforms and bulbs of percussion (32%), and while this could indicate whether soft hammer or hard hammer percussion was utilized, the thickness of the bulbs of percussion were not measured for this study. What was noted about the debitage, is that compression rings only originated from one end of each flake. This indicates that the inhabitants at the site were likely not manufacturing flakes by way of bipolar flaking (Andrefksy 2005:125). Bipolar flakes are defined as being flakes produced by breaking an objective piece between a hammer and an anvil stone and is also a technique said to be more commonly utilized when toolmakers try to maximize the use of raw materials (Andrefsky 2005:123; Knudson 1978). However, since no flakes in the Rock Creek Shelter assemblage were noted as having either striking platforms or compression rings originating from two sides, it is likely this technique was not employed because raw material was so readily available.

Summary

The Rock Creek Shelter chipped stone assemblage highlights several things about the site's occupational history and function. Despite the morphological problems mentioned that arise during biface classification, the temporally diagnostic bifaces in the assemblage, along with the radiocarbon dates, provide evidence that the site was primarily occupied during the Middle Archaic. In combination with the radiocarbon dates, the temporally diagnostic bifaces also indicate site occupation and use during the Early and Late Archaic, albeit less intensive than that of the Middle Archaic. Unfortunately, the temporally diagnostic bifaces also indicate the mixing of cultural strata. As indicated in Table 5-2, in most cases, diagnostic bifaces recovered at Rock Creek Shelter are associated with the cultural strata or deposits they are expected to fall within based on their respective temporal range in the northern Great Basin. Some diagnostic bifaces, however, were recovered out of sequence, which is a testament to the stratigraphic disturbances so common with Great Basin rockshelters. For example, most Rosegate points were recovered in stratum dated to the Middle Archaic, which is perplexing given that most would agree that this biface type is does not appear in the Great Basin until approximately 2000 B.P during Late Archaic times (Hildebrandt and King 2014; Oetting 1994; Smith et al. 2013).

The chipped stone assemblage also speaks to the function of the site. The specific function of the hafted bifaces is hard to pinpoint exactly given that hafted bifaces can be multifunctional (Andrefsky 2005), but the impact damage observed does suggest many could have been utilized as projectiles. It is more difficult to assign a function to the tools other than hafted bifaces given that they do not possess the type of diagnostic damage that can be observed macroscopically. However, these tools do highlight that several activities like animal processing, hide scraping, an even the cutting of plant material for construction of cordage and basketry was likely taking place at the site since these tools could serve any of these purposes. While this again cannot be said for certain without a more in-depth analysis, the diversity of tools in the assemblage suggests that upland region inhabitants were likely utilizing this area for more than simply a place to pursue large game, as was proposed by Weide (1968). Although the debitage assemblage was not analyzed beyond weight classifications and general observations about manufacturing techniques, the overall frequency of the debitage in the assemblage suggests that the site functioned as a place where occupants would bring sourced raw material to manufacture tools. As most debitage are small interior flakes that do not possess cortex, most lithic activities likely consisted of tool resharpening and the making of small multipurpose tools. Furthermore, the flake characteristics, in combination with the small size of cores and debitage, indicate that raw material scarcity was likely never an issue for the site's inhabitants. Although this is probably due to the proximity of obsidian sources in relation to Rock Creek Shelter, as will be discussed in the following chapter, not all the raw material from the site was procured from nearby sources.

Ground Stone Artifacts

There are 23 ground stone artifacts in the assemblage recovered from Rock Creek Shelter of which 15 (65%) have a known stratigraphic provenience while the remaining eight were either recovered from the surface or do not have a trench designation in the 1967 site catalog or excavation notes. The presence of several more metates were also noted and photographed during the 1967 excavations, but these artifacts were likely left in situ since they were not present among the recovered/curated assemblage. Additionally, 17 ground stone artifacts were noted on the surface just outside of the rockshelter beyond the drip line during the 2015 field visit. The ground stone assemblage consists of metates and manos and were classified as such based on the system of classification found in Kolvet and Eisele (2000). Kolvet and Eisele (2000:37) define manos (or hammerstones) as being the moveable stone used in conjunction with a stationary grinding surface. Manos, which can vary in size and shape, often have a battered end since they were used to crack seeds or nuts on a stationary surface (Kolvet and Eisele 2000). Kolvet and Eisele (2000:40) define metates (or millingstones) as being the lower shaped or non-shaped stationary component of the ground tool set and often have evidence of use wear (i.e. abrasion) on both sides or both. Most of the manos and metates from the Rock Creek Shelter assemblage are fragmented as can be seen in Figure 5-1, but evidence of their use is still identifiable due to the presence of battered ends and abrasions on the manos and metates. Raw material types used for ground stone implements vary depending on raw material availability and location which would likely influence their morphological characteristics and what function they served. In the Great Basin, Kolvet and Eisele (2000) point out that the most common rock types used to make ground stone implements are igneous rocks such as basaltic, granitic, and felsitic; sedimentary rocks such as conglomerates, sansdstone, tuff, and limestone; and metamorphic rocks such as quartzite, schale, and schist. The ground stone implements from the Rock Creek Shelter assemblage appear to all be made from a light gray basalt. This basalt is likely the aphanitic basalt that Weide (1968:248) stated was widely distributed throughout the uplands, particularly at sites adjacent to Poker Jim Ridge. Rock Creek Shelter lies approximately 5.9 km (3.7 mi) east from this geographic feature and therefore was in a prime location for the procurement of this raw material.

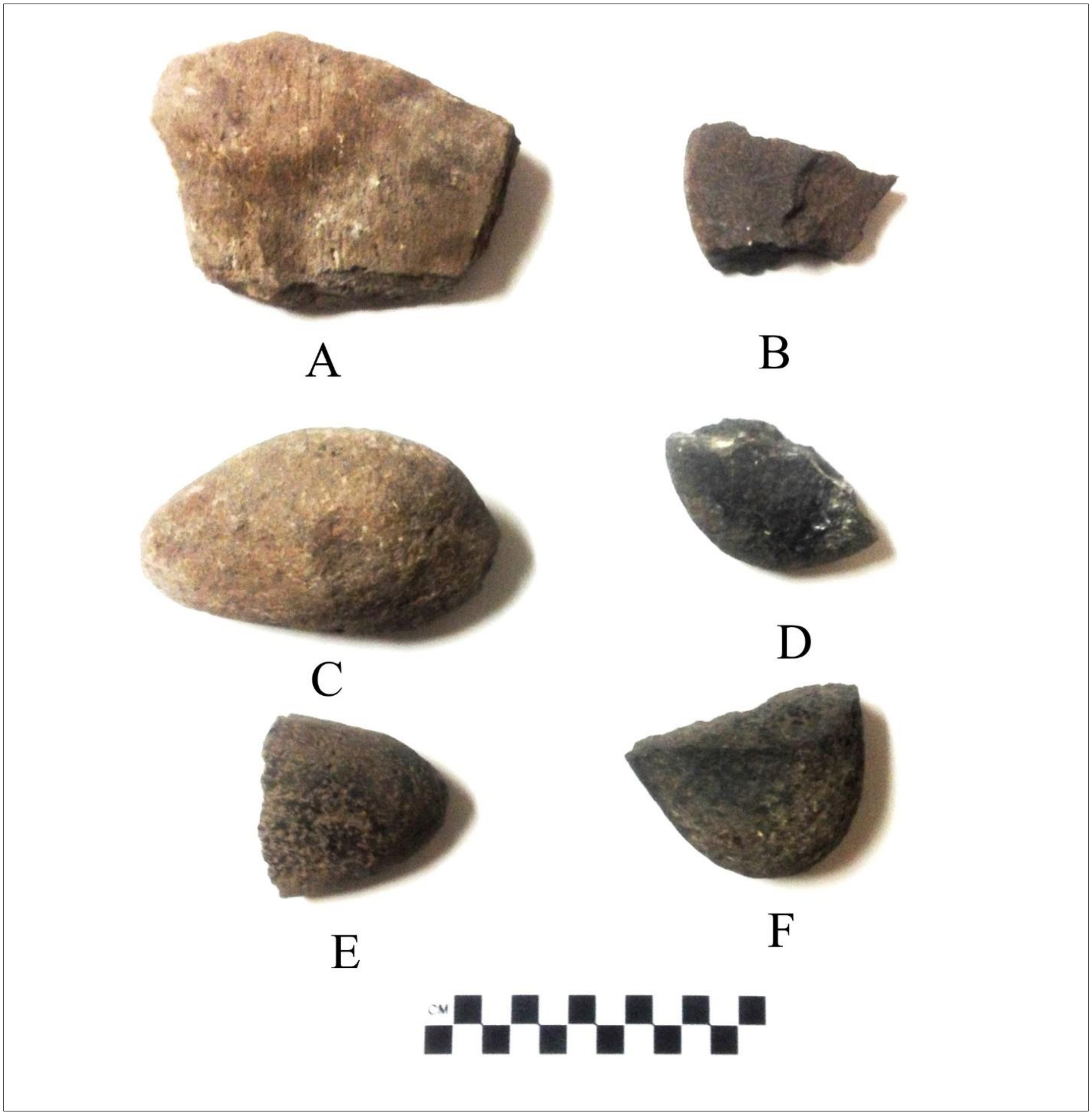

Figure 5-1. Ground stone artifacts from Rock Creek Shelter. A: Inv. #129 (metate) B: Inv. #130 (metate) C: Inv. #118 (mano) D: Inv. #117 (mano) E: Inv. #114 (mano)

As shown in Table 5-3, the distribution of the ground stone artifacts is similar across all three components indicating that grinding activities were conducted at least to some degree, during the entire occupation span at the site. What is interesting to note about the component distribution of ground stone material is that the frequency of this artifact type is distributed more equally across all three cultural components than most of the other artifact types where the highest frequency usually occurs in the Middle Archaic. If there were not a lot of evidence for disturbances at Rock Creek Shelter, this could be a significant finding that would suggest an uninterrupted activity pattern of plant processing utilizing manos and metates. However, there are many stratigraphic disturbances at Rock Creek Shelter, and given this factor combined with the small sample of ground stone material, an interpretation such as this would require additional evidence.

Table 5-3. Ground stone artifacts from Rock Creek Shelter by cultural component.

	Component			
Artifact Type	Early Archaic	Middle Archaic	Late Archaic	**Total**
Manos/Hammerstones	3	4	4	**11**
Metates	3	1	-	**4**
Total	**6**	**5**	**4**	**15**

Summary

The chipped stone artifacts along with the ground stone artifacts discussed in this chapter, further highlight the diversity of assemblage recovered from Rock Creek Shelter. Like the chipped stone, the ground stone also represents an activity directly related to prehistoric land use and site function. For example, the presence of the ground stone material indicates that the rockshelter was likely used at some point for processing plant material which could have been a variety of *Lomatium* species which come into full bloom during the summer months on the Refuge. (Raymond, personal communication 2015). Interestingly, Weide (1968:228) found a large distribution and quantity of grinding tools on the valley floor but noted that they were scarce at upland sites on the Refuge (Weide 1968:228). Although the ground stone assemblage recovered from the excavation at Rock Creek Shelter is small, ground stone implements are present, and based on the fieldwork conducted in 2015 it seems likely that many more could be found in the surrounding area around the rockshelter. Due to the small sample size of ground stone material it is difficult to interpret many additional subsistence activities from these specimens alone. However, if the stratigraphic record at Rock Creek Shelter is accurate it could mean that plant processing was an activity that was practiced during the entire occupation of the site. Furthermore, due to the morphological similarities of these materials throughout cultural components, it appears that this technology did not change through time.

CHAPTER SIX

OBSIDIAN SOURCE ANALYSIS

Obsidian is the most frequently encountered raw material type recovered from sites located in the Great Basin, and Rock Creek Shelter is no exception. The ubiquity of obsidian recovered from regional sites is likely due to it being a preferred toolstone due to its nature: it can be chipped, shaped, and fractured to create extremely sharp edges with relatively little effort in comparison to harder materials such as chert and basalt. Obsidian is also widely available throughout most of the Great Basin, and for this reason it has inspired a plethora of raw material procurement studies (e.g., Andrefsky 2010; Bouey and Basgall 1984; Ericson 1977, 1981; Gilreath and Hildebrandt 1997; Hughes 1982, 1983, 1985, 1986, 1988, 1989, 1994a, 1994b 2001, 2015; Jones et al. 2003; Jackson and Ericson 1994; Nelson 1984). In this study, obsidian sourcing studies were primarily conducted to shed light on raw material provisioning strategies and how they relate to diagnostic bifaces and prehistoric land use in the Warner Valley and on the Refuge. In this chapter I begin with an explanation of the obsidian sourcing sampling strategy and results. This is followed with a discussion of two broad patterns of obsidian source use that were indicated by these results.

Methods

For this part of the study, 100 obsidian samples were selected and submitted to Northwest Obsidian Studies Laboratory in Corvallis, Oregon for geochemical analysis. All samples were processed by a Thermo NORAN QuanX-EC energy dispersive x-ray fluorescence (EDXRF) spectrometer which quantitatively analyzed elements ranging from sodium to uranium that are reported in parts per million (ppm). These results were then compared to known sources in the region that possessed similar geochemical signatures (Nyers, personal communication 2017). The full results from this analysis can be found in Appendix D.

All obsidian bifaces in the assemblage were sourced in this study because many of these bifaces are temporally diagnostic and thus can shed light on how technology and provision strategies correlate through time. A total of 48 diagnostic and non-diagnostic bifaces were sources; the remainder include 52 pieces of debitage. The objective of this sampling strategy was to assess debitage source use in relation to diagnostic and non-diagnostic biface source use and examine raw material provision strategies that are often reflected by distances to sources (Andrefsky 2010). The diagnostic bifaces, non-diagnostic bifaces, and biface fragments that were submitted for XRF analysis are shown in Figures 6-1 – Figure 6-3.

Sourcing Results and Interpretation

Results

The obsidian samples submitted for geochemical characterization were sourced to 13 distinct source locations that vary in distance, geologic coverage, and direction from Rock Creek Shelter (Figure 6-4). As seen in Table 6-1, 75 (75%) of the obsidian samples were sourced to Beatys Butte which lies approximately 32.8 km (20.4 mi) east of Rock Creek Shelter with the next most utilized source being Buck Mountain which lies approximately 118.9 km (73.9 mi) south-southwest of the site. The obsidian sources used by the site’s inhabitants range from 13.6 km (8.5 mi) to 122.9 km (76.4 mi) distant. However, Beatys Butte, Buck Spring, Indian Creek Buttes, Massacre Lake/Guano Valley, and Tank Creek are considered source areas (shaded polygons) and indicate that obsidian with these specific geochemical compositions can

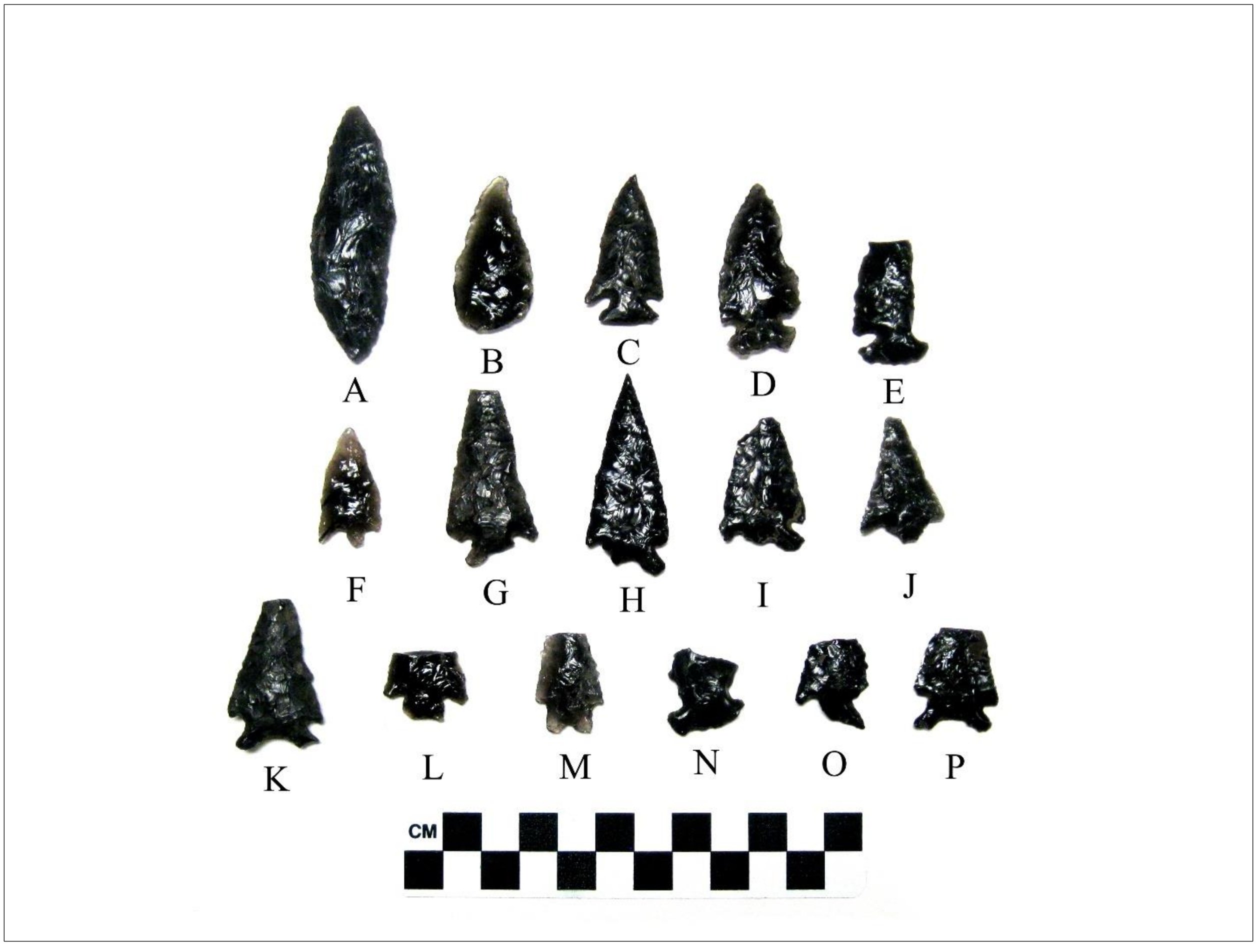

Figure 6-1. Bifaces submitted for XRF analysis. A: Inv. # 108 (Cascade) B: Inv. #92 C: Inv. #1113 (Elko Corner Notched) D: Inv. #750 (Northern Side Notched, heavily worked) E: Inv. #1954 (Elko Corner Notched) F: Inv. #8 (Gatecliff Contracting Stem) G: Inv. #1956 (Elko Eared) H: Inv. #24 (Elko Eared) I: Inv. #124 (Elko Eared) J: Inv. #9 (Gatecliff Contracting Stem) K: Inv. #26 (Elko Eared) L: Inv. # 109 (Elko Corner Notched) M: Inv. #1953 (Gatecliff Split Stem) N: Inv. #1955 (Elko Corner Notch*) O: Inv. #60 (Elko Eared) P: Inv. #79 (Elko Eared)

Figure 6-2. Bifaces submitted for XRF analysis. A: Inv. #123 (Rosegate) B: Inv. #110 (Rosegate) C: Inv. #80 (Rosegate) D: Inv. #25 (Rosegate) E: Inv. #804 (Rosegate) F: Inv. #42 G: Inv. #43 H: Inv. #82 I: Inv. #14 (Rosegate) J: Inv. #13 (Rosegate) K: Inv. #301 (Rosegate) L: Inv. #61 (Rosegate) M: Inv. #40

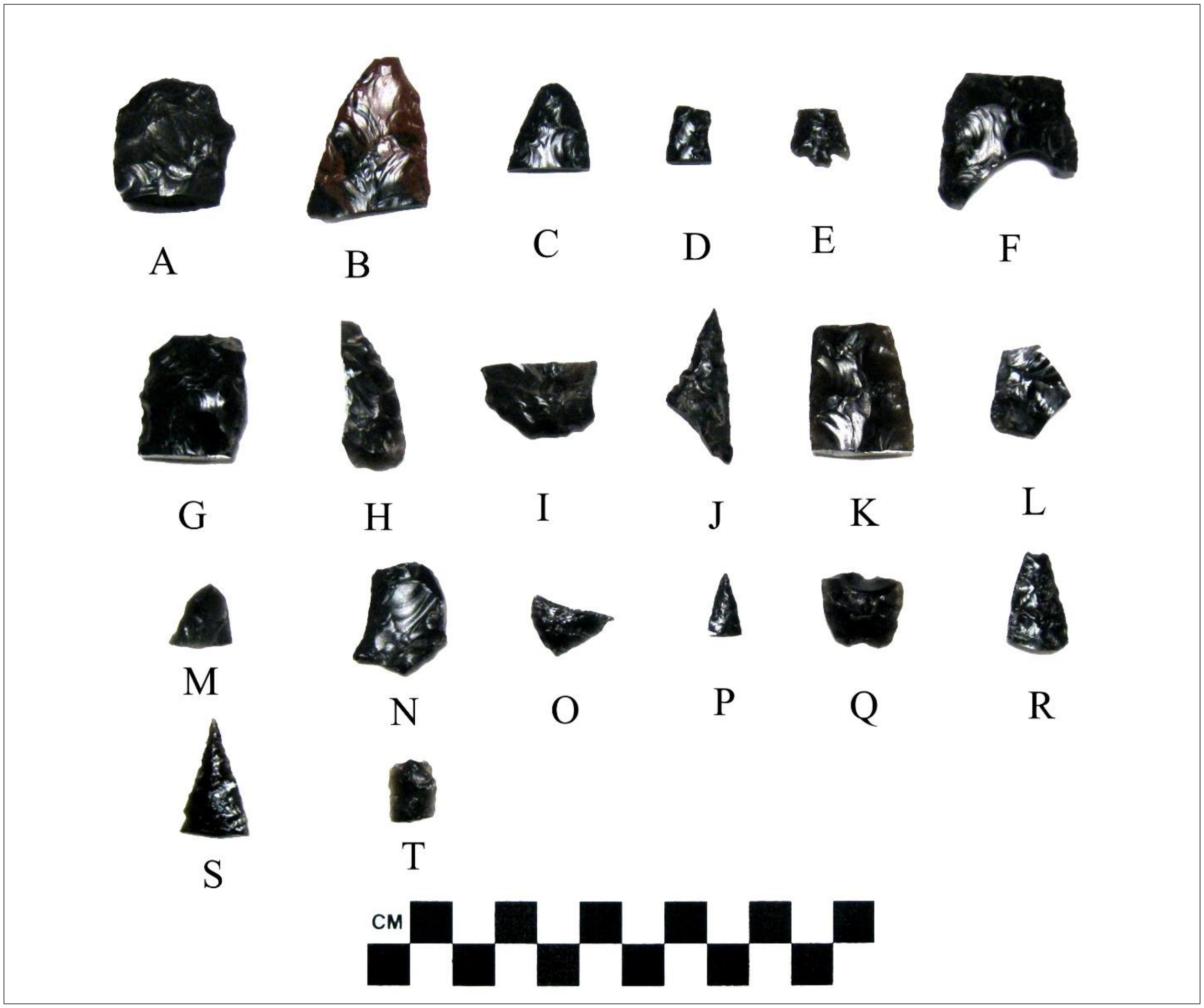

Figure 6-3. Biface fragments and one Rosegate base submitted for XRF analysis. A: Inv. #745 B: Inv. #744 C: Inv. #743 D: Inv. #741 E: Inv. #742 (Rosegate) F: Inv. #746 G: Inv. #120 H: Inv. #38 I: Inv. #46 J: Inv. #71 K: Inv. #73 L: Inv. #37 M: Inv. #500 N: Inv. #882 O: Inv. # 751 P: Inv. #300 Q: Inv. #122 R: Inv. #44 S: Inv. #94 T: Inv. #494

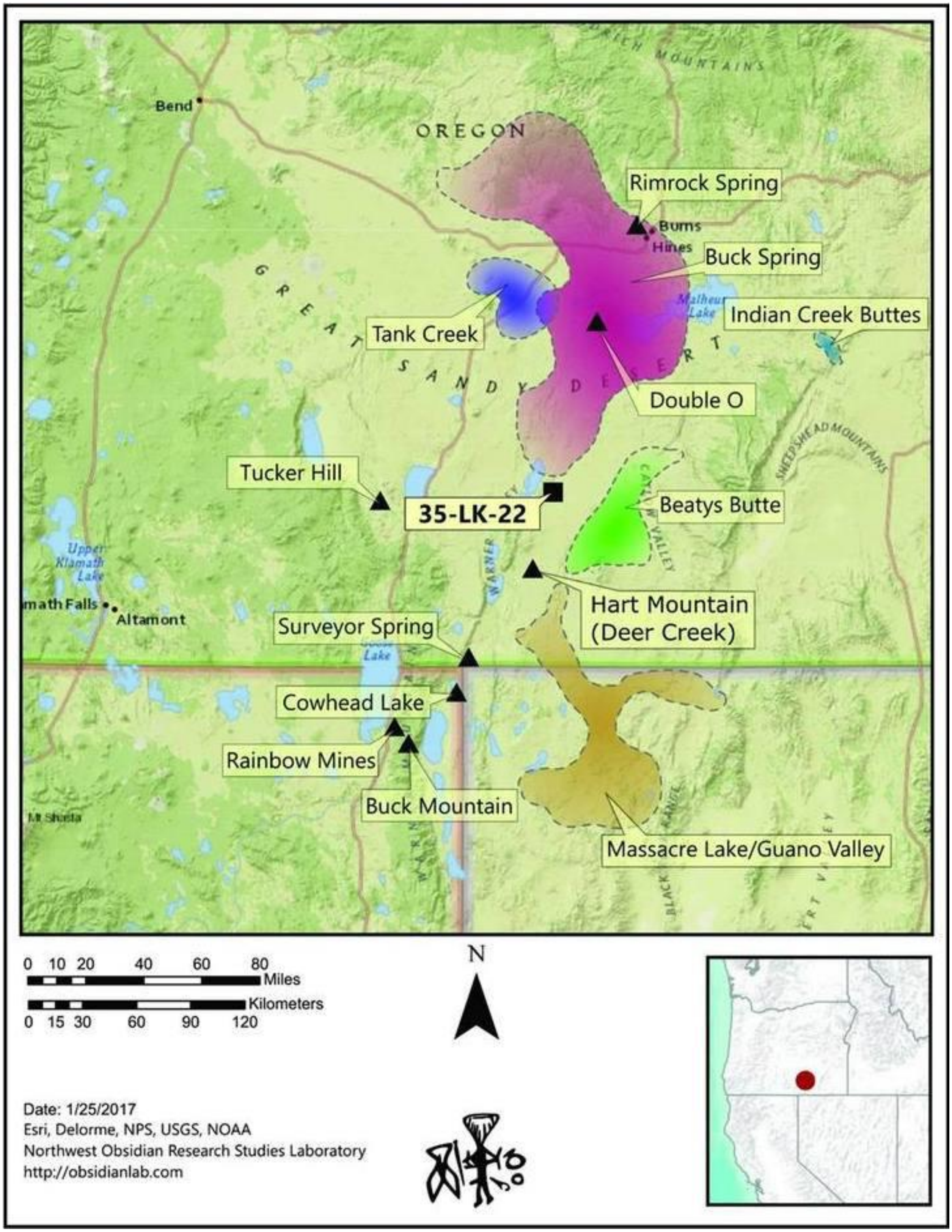

Figure 6-4. Obsidian source locations in relation to Rock Creek Shelter.

be found over a broad geographic area (shaded polygons in Figure 6-4). This is in contrast to the sources (black triangles) Buck Mountain, Cowhead Lake, Double O, Hart Mountain (Deer Creek), Rainbow Mines, Rimrock Spring, Surveyor Spring, and Tucker Hill, which are more restricted in their geologic coverage (Figure 6-4). Although the source areas can vary in distance from Rock Creek Shelter since they cover a large geographic area, it was decided to assign them geographic area, it was decided to assign them the closest distance from the site at which material from these sources could be obtained (Table 6-1). Lastly, the results indicate that most of the obsidian sources fall along a predominantly north-south trajectory, apart from Beatys Butte and Tucker Hill which lie east and west of the site, respectively.

Table 6-1. Frequency of obsidian from each source and distance/direction to source.

Geochemical Source	N =	Percentage	Distance to Source (km)	Direction to Source
Beatys Butte	75	75%	32.88	E
Buck Mountain	9	9%	118.99	SW
Buck Spring	3	3%	13.68	NE
Cowhead Lake	1	1%	91	SW
Double O	2	2%	71.46	N
Hart Mountain (Deer Creek)	1	1%	22.29	S
Indian Creek Buttes	2	2%	122.95	NE
Massacre Lake/Guano Valley	2	2%	46.26	SE
Rainbow Mines	1	1%	108.58	SW
Rimrock Spring	1	1%	113.32	NE
Surveyor Spring	1	1%	75.86	SW
Tank Creek	1	1%	91.07	NW
Tucker Hill	1	1%	71.68	E
Total	**100**	**100%**	-	-

Conveyance Patterns and Local/Non-Local Sources

The north-south trajectory of obsidian sources direction from Rock Creek Shelter generally follows the distribution of resource rich-wetlands adjacent to the Warner Mountain range, a conveyance pattern demonstrated for other Great Basin hunter-gatherers that seems to be influenced by microenvironmental changes (Jones et al. 2003), such as wetland productivity.

This seems to fit with the idea proposed by Weide (1968) that the prehistoric inhabitants were "tethered" to this important resource rich area; it also suggests that people were willing to travel long distances to procure raw material. This conveyance pattern also suggests that the people who utilized the rockshelter and surrounding landscape were keenly aware of resource availability not only in the Warner Valley and surrounding uplands, but also in areas as much as approximately 120 km (74.6 mi) away from the site. Furthermore, this finding indicates that the people who occupied Rock Creek Shelter were not only familiar with a landscape that covered great distances, but also often came into frequent contact with other groups of people great distances away which would have given them an expansive social and economic network throughout the northern Great Basin. This is a similar finding to other findings in the northern Warner Valley. For example, at the LSP-1 rockshelter, Smith et al. (2012:29) also found obsidian that was sourced to Buck Mountain and Tank Creek, and Beatys Butte and suggested that these diverse sources indicate that the occupants likely had socioeconomic ties to regions throughout present-day southcentral Oregon, northwestern Nevada, and northeastern California (Smith et al. 2012:29).

Data from obsidian source analysis has been used to interpret many different behaviors including settlement patterns, mobility, and patterns of land use, and change through time (Andrefsky 1994, 2008, 2010; Connolly and Jenkins 1997; Hughes 2015; Jones 1984; Jones et al. 2003). However, when examining prehistoric land use and change through time, researchers frequently assess patterns in relation to local and non-local sources (Andrefsky 2008, 2010; Hughes 2015). Based on the ethnographic data gathered by researchers in the area, 30-40 km is within the normal daily one-day circulation range of Northern Paiutes in the Great Basin (Fowler 1982; Kelly 1964) and since the Northern Paiutes unquestionably occupied this region, it was decided to utilize this range during interpretation. This circulation range has been utilized by lithic analysts to examine land use practices and change through time by considering raw material sources less than 40 km to be local while sources outside of a 40-km radius to be non-local (Andrefsky 2008, 2010).

Based on this circulation range and as indicated in Table 6-1, Beatys Butte, Buck Spring, and Hart Mountain are the only sources that would be considered local given they are less than 40 km away while the sources Buck Mountain, Cowhead Lake, Double O, Indian Creek Buttes, Massacre Lake/Guano Valley, Rainbow Mines, Rimrock Spring, Surveyor Spring, Tank Creek, and Tucker hill would be considered non-local given that they are more than 40 km from Rock Creek Shelter. As also shown in Table 6-1, most of the obsidian analyzed from Rock Creek Shelter was procured from the local source Beatys Butte which lies approximately 30 km to the east. Only 8% of the debitage from Rock Creek Shelter is from a non-local source, with the most common source for debitage being Beatys Butte (88%), which indicates the importance of this obsidian source for the manufacturing of tools utilized at the site. Smith et al. (2012) found that Buck Spring was the most common source utilized at LSP-1 in the northern Warner Valley for debitage (Smith et al. 2012), which, even though this source covers a large geographic area, suggests this is a local source to the Rock Creek Shelter inhabitants since debitage is more often from a local source than are formal tools (Andrefksy 2008, 2010). Lastly, although not certain, Beatys Butte seems to have been identified by Weide (1968) given that she highlights an obsidian source location associated with site 35LK33 which lies near the western boundary of Beatys Butte.

Change Through Time

As mentioned, the local and non-local framework can also be utilized to assess change through time from sourcing data. Often the obsidian sources that people utilized at a site can change through time, which can indicate many behaviors including patterns of mobility or social network expansion (Hughes 2015). An initial attempt to assess source change through time at Rock Creek Shelter, was done by examining the frequency of local and non-local obsidian within each cultural component. Only 91 samples out of the 100 are included in this table since nine diagnostic bifaces without a known provenience were sourced for their temporal potential. As the frequency data in Table 6-2 shows, there appears to be source use consistency and little change through time, but it is once again important to point out, at Rock Creek Shelter, there are a considerable number of stratigraphic issues which make interpretations about change through time difficult to state confidently. Fortunately, there are many temporally diagnostic bifaces

Table 6-2. Local and non-local obsidian by component.

	Component			
	Early Archaic	Middle Archaic	Late Archaic	**Total**
Local	12	46	12	**70**
Non-Local	2	16	3	**21**
Total	**14**	**62**	**15**	**91**

present in the Rock Creek Shelter chipped stone assemblage which provide an additional way of assessing source use through time. Therefore, due to the stratigraphic issues, and the availability of diagnostic bifaces, it was decided to examine change through time using only these diagnostic bifaces while disregarding their provenience.

One example of assessing source change through time only by diagnostic bifaces can be found in a study conducted by Richard Hughes (2015). Hughes (2015:293) pointed out that obsidian sourcing of points from Danger Cave (42TO13), indicated that a change in source use had occurred after the time bow-and-arrow points replaced dart points (Hughes 2015:293). To examine this pattern in more detail, Hughes (2015) sourced and analyzed a sample from Hogup Cave (42BO36). What Hughes (2015) determined is that once bow-and-arrow technology replaced dart technology in this part of the Great Basin there was an increase in the number of raw material sources and an increase in the distance these sources were from the site. Hughes (2015:293) suggests that this in turn would have "expanded social contracts, increased the foraging radius and material conveyance opportunities, and contributed to the altering the social organization of peoples using the new technology." Although, Hughes (2015:293) quantifies his argument by stating that this phenomenon occurred "at least in this part of the eastern Great Basin," it was interesting to find the opposite seems to have occurred on the Refuge based on the sourcing data for the diagnostic bifaces from Rock Creek Shelter. For example, as shown in Figure 6-5, Early Archaic diagnostic bifaces from Rock Creek Shelter are all from non-local sources while in the Middle Archaic raw material begins to be sourced from more local sources. Although what is the most interesting, is that during the Late Archaic raw material from local sources becomes more common than non-local sources. The significance of this pattern is that the Late Archaic (2000 – 150 cal B.P.) is the cultural period that Rosegate points, which are believed to be the marker of the introduction of bow-and-arrow technology, are temporally associated with in the northern Great Basin (Hildebrandt and King 2014; Justice 2002; Oetting 1994). Before discussing this pattern in detail, it is first important to point out that the diagnostic biface sample size from Rock Creek Shelter is very small (n=25), especially when compared to the data that Hughes was working with in his study (n=208). Furthermore, this pattern does not present itself in the overall stratigraphic distribution of all sourced obsidian (Table 6-2).

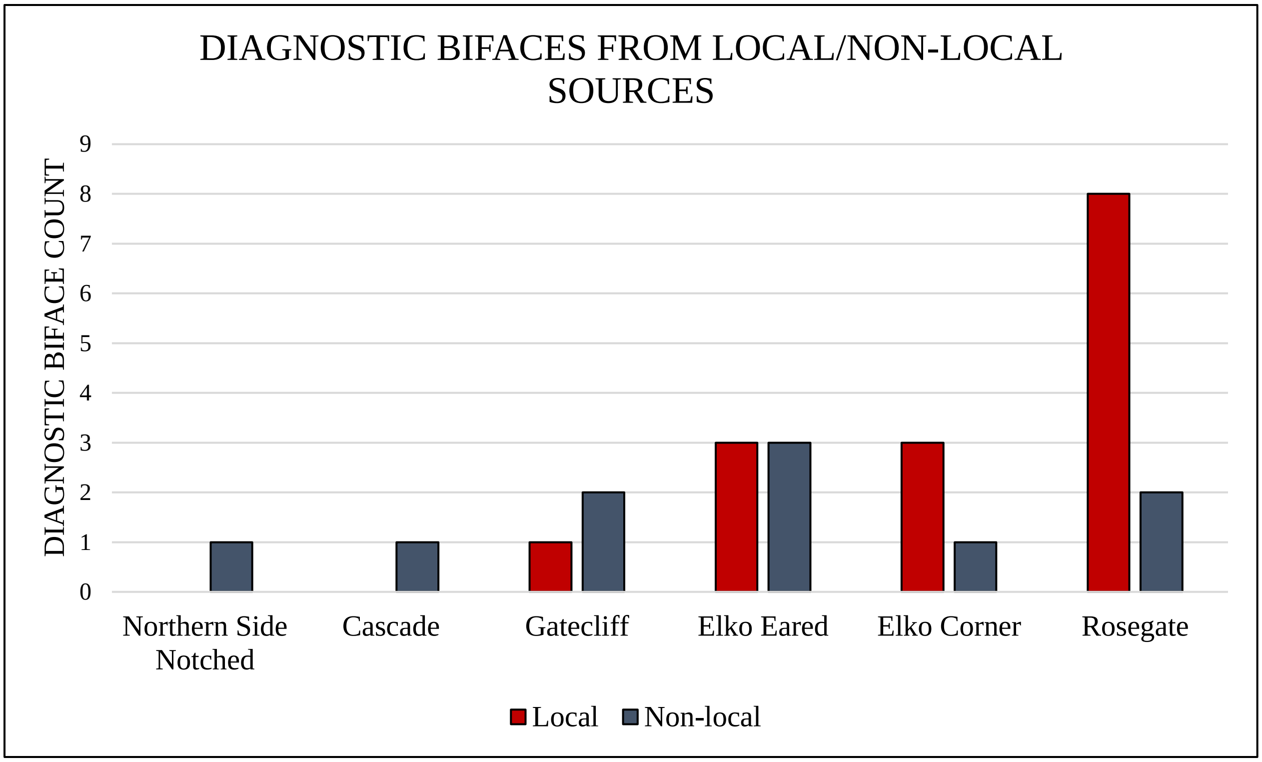

Figure 6-5. Bar graph depicting frequency of diagnostic bifaces from local and non-local sources.

However, when only using the diagnostic bifaces as temporal markers as was done by Hughes (2015), the pattern is evident and due to stratigraphic issues at the site, in this case be more reliable. Furthermore, while the pattern is not present in the overall obsidian stratigraphic distribution and the diagnostic biface sample from Rock Creek Shelter small, this information could contribute to the building of a hypothesis that could be tested in this part of the northern Great Basin. This could be particularly significant at the understudied Refuge where the potential of future research is high and could allow a more complete understanding of prehistoric land use and adaptive patterns in this area.

Nevertheless, based on this pattern it seems that Rock Creek Shelter inhabitants began to focus more on the local area during the Middle Archaic and began to do so even more during the

Late Archaic. Also, in contrast to the pattern highlighted by Hughes (2015), instead of bow-and-arrow technology increasing the foraging radius and material conveyance opportunities for people in the Great Basin, it seems to have caused a decrease on the Refuge with people becoming more focused on the local landscape during, or soon after, the introduction of bow-and-arrow technology. Other researchers working in near the Refuge have found a pattern that is more like that found by Hughes (2015). For example, researchers working in the Warner Valley have found that Paleoindian bifaces sources are usually considerable distances away, Early and Middle Archaic sources less distant, and Late Archaic bifaces again from sources a considerable distance away (McGuire 2002; King 2016; Smith 2010; Smith, Pattee, and Van Der Voort 2016). Although, the distance sources during the Late Archaic times were not as distant as they were during Paleoindian times (Smith, Pattee, and Van Der Voort 2016). Rock Creek Shelter does not possess any Paleoindian points (i.e. Western Stemmed and Clovis), so this part of their pattern cannot be examined. However, if a larger sample size of diagnostic bifaces was available in the assemblage for the other cultural periods it could be possible that the pattern they found could hold true here as well since the diagnostic bifaces that farthest from the site include Rosegate series points. For example, as seen in Table 6-3, there is one Rosegate point from Buck Mountain and one Rosegate point from Survey Spring which are 118.9 km (73.93 mi) and 75.8 km (47.1 mi) from the site, respectively. However, as also shown in Table 6-3, the majority of Rosegate points from Rock Creek Shelter are still from Beatys Butte which is considered local to the site. What is interesting about the pattern if it held true, is not only would it show a different conveyance pattern occurred on the Refuge than has been proposed elsewhere in the northern Great Basin, but also that the settlement pattern described by Weide (1968) may have not always been in place. For example, Weide (1968) noted that the specialized lakeside adaptation pattern occurred from 3450 B.P. to 1450 B.P., and since this type of adaptation is specific to the local landscape and began in the Middle Archaic, this sourcing data could indicate that her earlier date is when a more focused use of the local area began. For example, this sourcing pattern along with her interpretation, may highlight that this pattern only extends back until the

Table 6-3. Rock Creek Shelter diagnostic bifaces by obsidian source.

	Geochemical Source							
Point Type	Buck Mountain	Beatys Butte	Buck Spring	Double O	Indian Creek Buttes	Massacre Lake/Guano Valley	Surveyor Spring	**Total**
Northern Side Notched	1	-	-	-	-	-	-	**1**
Cascade/Foliate	1	-	-	-	-	-	-	**1**
Gatecliff	2	1	-	-	-	-	-	**3**
Elko Eared	1	3	-	-	2	-	-	**6**
Elko Corner Notched	-	3	-	1	-	-	-	**4**
Rosegate	1	5	1	-	-	2	1	**10**
Total	**6**	**12**	**1**	**1**	**2**	**2**	**1**	**25**

Middle Archaic, a finding which may be associated with the productivity of the lakes and wetlands or a more local phenomenon. Furthermore, this pattern indicates that patterns found elsewhere in the Great Basin should be only attributed on a local level since the sourcing data obtained in this study indicated there could be local variability which could be attributed to several factors unique to an area.

Another interesting point that could be made from this pattern, is that it could indicate that bow-and-arrow technology had a different effect on the inhabitants at Rock Creek Shelter and on the Refuge. For example, although Bettinger (2013:22) argues the more efficient bow-and-arrow technology that replaced dart technology led to a reduced family band size causing an increase in mobility, he also points out that bow-and-arrow technology encouraged other opportunities like plant intensification and the more efficient exploitation of ungulates and small mammals. Therefore, it could be that this technological change led people on the Refuge to develop a more flexible adaptive strategy. One example, being the adaptive strategy discussed by

Tipps (1998), that he argued was flexible enough to account for any ecological changes including the productivity levels of the lakes and wetlands.

Lastly, although most of the data obtained for this thesis indicate continuity in almost every respect, the increased use of the local landscape beginning in the Middle Archaic, if tested further, could indicate a change occurred beginning in the Middle Archaic that is more specific to the Refuge. An increased use of the local landscape beginning in the Middle Archaic could also explain why the Middle Archaic and Late Archaic are the most manifested cultural periods at Rock Creek Shelter and are also the most represented components at other sites in the area. For example, Smith, Pattee, and Van Der Voort (2016:9) found after sourcing diagnostic bifaces from the northern Warner Valley that groups utilized the northern Warner Valley more frequently during the Late Holocene (the last 4500 years). They also found that Early Archaic points were underrepresented in the northern Warner Valley (Smith, Pattee, and Van Der Voort (2016:9). This is also the case at Rock Creek Shelter where there are only two Early Archaic points. It is possible that if the Warner Valley and Refuge inhabitants had a larger foraging radius in the Early Archaic, points from this cultural period may have been discarded away from these two areas. There is much more that could be interpreted from this pattern, but it does not seem necessary to elaborate on in this study given that a larger sample of sourced diagnostic bifaces could show otherwise. For the time being, this pattern is interesting to speculate upon and is one way of speaking to change through time based on the sourcing data that is not affected by the site's stratigraphic issues. If tested further, it could provide important information about settlement and land use patterns on the Refuge that may relate to new technologies including the bow-and-arrow.

Summary

The results from the obsidian source analysis clearly indicate that Beatys Butte was an important source of raw material for the inhabitants of Rock Creek Shelter. Although this could be due to its proximity to Rock Creek Shelter (32.8 km [20.4 mi]), it could also be the case that the obsidian from this source was of higher quality than other source locations. This interpretation seems particularly likely since the Hart Mountain (22.2 km [13.8 mi]) and Buck Spring (13.6 km [8.49 mi]) sources are closer to the site but are less represented in the sourced assemblage. The distribution of raw material sources indicates that people on the Refuge were connected to a large geographic area in the northern Great Basin, but movement over space and decisions about which sources to use may have been influenced by connection to rich wetland resources such as those present on the Refuge and in the adjacent Warner Valley. Therefore, this reaffirms the tethered concept discussed by Weide (1968) but also suggests that the resource-rich environment in the Warner Valley was not the only one the site's occupants exploited since the obsidian sourcing data shows they traveled substantial distances for resources.

Lastly, that there seems to be an increase in use of more local obsidian sources beginning in the Middle Archaic, a trend that increases in the Late Archaic. While this interpretation is given with caution due to the paucity of temporally diagnostic bifaces, this pattern could be investigated in the future with an increased sample size. If this pattern holds true, it could have important implications for the settlement and land use pattern posited by Weide (1968) and further refined by Young (1998). For example, it could indicate that during the Middle Archaic is when the settlement pattern centered around wetland resources began which, in turn, may have led to a more efficient adaptive strategy that could account for any future fluctuations. Additionally, it could highlight the effects that bow-and-arrow technology had upon the inhabitants in this part of the northern Great Basin since this technology is usually thought to increase, not decrease, the foraging radius and mobility of hunter-gatherers. However, until more sourcing is conducted on diagnostic bifaces from the Refuge, it appears that during the Middle Archaic occupation of Rock Creek Shelter an increased use of the local landscape emerged like that put forth by Weide (1968) and persisted until the abandonment of the site.

CHAPTER SEVEN

PERISHABLE MATERIAL

This chapter provides a summary of the perishable assemblage recovered from Rock Creek Shelter. The objective is to provide an overall description of these materials, as well as a comparative analysis of major perishable artifact classes which can help to address whether there is any evidence of the Numic expansion at Rock Creek Shelter, one of the major research questions of this thesis. While most other artifact classes in the assemblage provide information relating to site function and land use patterns, consideration of diagnostic perishable materials can provide insight into the Numic expansion into this part of the northern Great Basin.

Perishable Artifacts

The Rock Creek Shelter collection includes 390 perishable artifacts, though for this thesis, only major perishable artifact classes will be discussed in any detail. Perishable items not described in this thesis include small plant fragments, and small/ fragmentary ethnobotanical remains. Major perishable artifact classes are defined here as artifacts that fall into one of three categories: (1) textiles including basketry and matting, (2) cordage, (3) and modified wood. Additionally, a few miscellaneous perishable artifacts (i.e., feathers, coprolites, hide/fur) are briefly discussed.

Dry caves and rockshelters in the Great Basin are famous for their well-preserved basketry materials (Cowles 1959). The most well-known example of "basketry" being the sandals, matting, basketry, and cordage recovered by Luther Cressman in the Fort Rock vicinity (Cressman 1940).

Basketry

In the Great Basin literature, the term *basketry* includes baskets as well as a variety of perishable items with similar weaving and construction techniques (Connolly 1994:63). In general, *matting* includes woven items that are two dimensional or flat, while basketry includes three dimensional items that can be a variety of shapes (Adovasio 1986:194). Construction techniques utilized in the making of basketry artifacts varies regionally and consists of three different technologies in the Great Basin: plaited, coiled, and twined (Adovasio 1986; Cressman 1940). These three different technological classes are found throughout the Great Basin, but in the northern Great Basin, twined construction is the most commonly reported technique. Basketry material of twined construction is present in the Rock Creek Shelter artifact assemblage and is significant in that most researchers would agree that this tradition appears to have continued without interruption for nearly 10,000 years (Connolly 1994:63).

Twined basketry construction is defined as a technique that involves twisting or twining a pair of horizontal weft elements around vertical warp elements (Adovasio 1977; Andrews et al. 1986; Connolly 1994:63). Twined basketry specimens also vary in the construction method utilized and in the type of plant material which they are constructed. For example, Adovasio (1986) defines three different twining methods in the northern Great Basin: close simple twining, close diagonal twining, and open simple twining. The twisted wefts and warps in the twining method can either be z-twisted (counter-clockwise) or s-twisted (clockwise) although the z-twisted method appears much more frequently (Advasio 1986). The close simple twining method paired with z-twist wefts and constructed from tule reeds is what Cressman defined as "Catlow Twine" (Advasio 1986; Connolly 1994; Cressman 1942; Smith, Ollivier, Barker, et al. 2016).

The basketry material in the Rock Creek Shelter assemblage consists of 18 basketry specimens of which 12 (67%) have a known stratigraphic provenience. All basketry specimens except two have z-twist wefts (Figure 7-1). Unfortunately, these two specimens do not have a known provenience and were both recorded in the 1967 field notes as being surface finds, and therefore were not dated for this study. Other specimens that were either surface finds or were not documented as being recovered from a particular stratum, consist of open simple twine basketry fragments with a z-twist weft (n=3) and a close simple twine basketry fragment with a z-twist weft (n=1). All open simple twine basketry fragments are constructed from tule (*Scirpus acutis*) and all close simple twine basketry fragments are constructed from what appears to be sagebrush bark (*Artemisia tridentata*).

The earliest basketry fragment at Rock Creek Shelter was dated to 2960 ± 30 B.P. and the latest to 780 ± 30 B.P. As shown in Table 7-1, all open simple twine basketry fragments fall within the Middle Archaic component at Rock Creek Shelter while all the close simple twine

Figure 7-1. Open simple-twine basketry fragment with s-twist weft (Inv. # 1857). Specimen recovered from surface.

basketry fragments fall within the Late Archaic component. This finding indicates that open simple twine basketry construction may have not been practiced at the site during the Late Archaic and may have been replaced with the close simple twining method. Although the overall sample size is small, this could hold true since fortunately, given that basketry material is organic, stratigraphic mixing at the site can slightly be ignored since many of these specimens were directly dated (Figure 7-2 – Figure 7-6).

Table 7-1. Basketry types from Rock Creek Shelter by cultural component.

	Component			
Artifact Type	Early Archaic	Middle Archaic	Late Archaic	**Total**
Open simple twine with z-twist weft	-	10	-	**10**
Close simple twine with z-twist weft	-	-	2	**2**
Total	-	**10**	**2**	**12**

Figure 7-2. Open simple twine basketry fragment (Inv. # 1942) dated to 2310 ± 30 (2355-2310 cal B.P.)

Figure 7-3. Open simple twine basketry fragment (Inv. #1880) dated to 2960 ± 30 B.P. (3210-3005 cal B.P.).

Figure 7-4. Open simple twine basketry fragment with z-twist weft (Inv. #1793) dated to 2270 ± 30 B.P. (2345-2160 cal B.P.)

Figure 7-5. Open simple twine basketry fragment with z-twist weft (Inv. # 1858).

Figure 7-6. Close simple twine basketry fragment with a z-twist weft (Inv. #1917). Dated to 780 ± 30 B.P. (735-670 cal B.P.).

Cordage

Another perishable item often found in dry caves and usually associated with basketry material is cordage. Cordage can either be z-twisted (Figure 7-7) or s-twisted (Figure 7-8) and is also made from a variety of plant materials. There are 119 cordage fragments in the Rock Creek Shelter assemblage, of which 104 (87%) have a known stratigraphic provenience. Of the 119 cordage fragments, 97 (82%) are classified as z-twist and 23 (19%) are classified as s-twist. All the s-twist cordage fragments have a known stratigraphic provenience while 81 (84%) of the z-twist cordage fragments have a documented provenience in the 1967 field notes. Almost all cordage fragments are 2-ply cordage with a ply being defined as single strand or bunch of fibers that are twisted together (Marchesini 1994:184). However, there are also cordage fragments that are one-ply (n=9) and one that is three-ply. Some the z-twist cordage fragments are tied with an overhand knot (n=6), a few are wrapped (n=3), and one is braided. One of the wrapped z-twist cordage fragments (Figure 7-9) is the sample that was submitted for radiocarbon dating and

Figure 7-7. Z-twist cordage fragment (Inv. #1471) dated to 1560 ± 30 B.P. (1530-1380 cal B.P.).

Figure 7-8. S-twist cordage fragments (Inv. # 604) dated to 2240 ± 30 B.P. (2340-2290 cal B.P.).

Figure 7-9. Wrapped z-twist cordage fragment (Inv. #1820) dated to 7490 ± 40 B.P. (8385-8200 cal B.P.).

returned the earliest date acquired for Rock Creek Shelter of 7490 ± 40 B.P. (8385 – 8200 cal B.P.). There is also one wrapped s-twist cordage fragment and several s-twist cordage fragments that are tied with an overhand knot (n=8). A few of the s-twist cordage fragments (n=3) are tightly wound and are much finer than the z-twist cordage, a finding that aligns with other s-twist cordage specimens found in the region (Connolly et al. 2014). All specimens appear to be constructed from sagebrush bark except for the tightly wound s-twist cordage fragments just mentioned. Currently, the plant material type used in the construction of these specimens is unknown.

As shown in Table 7-2, z-twist cordage is present in all cultural components at Rock Creek Shelter with the majority falling into the Middle Archaic. S-twist cordage is absent from the Early Archaic component and is also the most represented in the Middle Archaic. It is hard to say whether this was a type of cordage construction technique not utilized in the Early Archaic since in relation to z-twist cordage, there are significantly fewer s-twist specimens.

Table 7-2. Frequency of cordage artifacts by cultural component.

	Component			
Artifact Type	Early Archaic	Middle Archaic	Late Archaic	**Total**
Z-twist Cordage	7	52	22	**81**
S-twist Cordage	-	16	7	**23**
Total	**7**	**68**	**29**	**104**

In addition to the cordage artifacts, a related artifact type in the Rock Creek Shelter assemblage are sagebrush bark bundles (Figure 7-10 and Figure 7-11) which are likely a source raw material for cordage making (Smith, Ollivier, Barker et al. 2016). For this study, bark bundles are defined as loose bark fragments that are wrapped together purposely and closely

Figure 7-10. Wrapped bark bundle (Inv. #1934).

Figure 7-11. Wrapped z-twist cordage (Inv. #1429) dated to 1360 ± 30 B.P. (1310-1270 cal B.P.).

resemble what other researchers in the Great Basin have referred to as such (Aikens 1970; Andrews et al. 1986; Loud and Harrington 1929; Smith, Ollivier, Barker et al. 2016). In the assemblage, there are 17 bark bundles with only 10 that have a known provenience. None of these specimens fall into the Early Archaic component, eight specimens fall into the Middle Archaic component, and two specimens fall into the Late Archaic component.

Modified Wood

Modified wood artifacts are also present in dry caves or rockshelters due to their high levels of preservation. Although modified wood fragments are not as significant to the interpretation of a site as are basketry and cordage, their presence at archaeological sites is rare and therefore must be discussed. There is not a considerable amount of modified wood (n=17) in the Rock Creek Shelter assemblage, especially in comparison to other sites with levels of preservation (Aikens 1970; Heizer and Krieger 1956; Loud and Harrington 1929). There are 15 (88%) modified wood artifacts that have a known provenience and most of these are small (less than about 1 cm in diameter). As is the case with many of the perishables from Rock Creek Shelter other than the textiles and cordage, the modified wood artifacts were not analyzed thoroughly for this study. Nevertheless, during the classification of the site assemblage, it was noted that a few of the modified wood artifacts resemble identified items from similar sites. For example, a few of the modified wood pieces appear to resemble the items that were classified as bow drill implements at Hogup Cave (Aikens 1970). There is also one modified wood artifact with cordage wrapped tightly around one end and another with an indention around one end that suggests it also had cordage wrapped around it at one time. The modified wood fragment with the "cordage scarring" (Figure 7-12) and when compared to similar artifacts most closely

Figure 7-12. Modified wood fragment with cordage scarring (Inv. #1739).

resembles a type of gaming piece documented at Hogup Cave (Aikens 1970). Another modified wood artifact in the assemblage is almost certainly an awl based on a comparative assessment of wood artifacts at other sites (Aikens 1970; Heizer and Krieger 1956; Loud and Harrington 1929). Wooden awls are defined as having a tapered end and were likely used for textile weaving (Aikens 1970:85), which was likely their function at Rock Creek Shelter given the presence of woven items. Other modified wood items include small tapered end fragments that have a burned end. These items likely could be fire drills based on similar rockshelter assemblages (Aikens 1970; Heizer and Krieger 1956; Loud and Harrington 1929). These modified wood artifacts further highlight the diverse number of activities that occurred at Rock Creek Shelter. This is particularly true of the modified wood artifact that resembles a gaming piece which could suggest leisure activities occurred at the site.

Given the small sample size of modified wood in the assemblage, there is not much that can be interpreted as it relates to its distribution across the cultural components at Rock Creek Shelter. As shown in Table 7-3, most of the modified wood fragments were recovered from strata dated to the Middle Archaic with no fragments within strata dated to the Early Archaic. Given such a small sample size, the only inference that can be made from this table is that like the stratigraphic distribution of the other assemblages, suggests a predominantly Middle Archaic occupation at Rock Creek Shelter and that this artifact type is not present at all in Early Archaic times.

Table 7-3. Frequency of modified wood artifacts from by cultural component.

	Component			
Artifact Type	Early Archaic	Middle Archaic	Late Archaic	**Total**
Modified Wood	-	12	3	**15**

Miscellaneous Perishables

Other perishables in the assemblage include artifacts made from hide and fur though none of these specimens have been identified to any diagnostic level of analysis (i.e. species). None of the fur pieces appear to have been utilized, though some of the hide fragments have small fragments of z-twist cordage attached to them which suggests they could have once been an item used by the people who occupied the rockshelter. For example, the excavations at Hogup Cave recovered numerous hide bags (Aikens 1970), but at this point in the analysis the hide fragments from Rock Creek Shelter appear to be either too small or not preserved well enough to draw this conclusion.

Most of the feathers that are in the assemblage are single feathers that are damaged beyond the point of species identification, at least macroscopically. There is one large feather bundle that was recovered and although no positive identification was made, a comparative analysis was conducted at the Washington State University Conner Museum. Based on this comparative analysis which involved examining the feathers from large bird species in the region, it is likely they are feathers belonging to a golden eagle (*Aquila chrysaeto*). There are also 11 coprolites in the assemblage nine of which have a known stratigraphic provenience: six in a Middle Archaic component and three in a Late Archaic component. Although, these specimens have yet to be analyzed too thoroughly, it is believed that they are from a type of canine which in this area, means they are likely coyote (*Canis latrans*) coprolites. As will be discussed in the next chapter, there are also canine remains present in the faunal assemblage and due to their low numbers, they are likely later disturbances at the site.

Lastly, there are two sinew strips in the Rock Creek Shelter assemblage and one Olivella shell. Based on similar assemblages from Great Basin rockshelters, the sinew strips could have functioned as bowstring used in the construction of bow-and-arrows during the time of this technology (Aikens 1970). However, this is only based off comparing these specimens to others recovered in dry caves and it is not unlikely that these sinew strips had another function at the site. Although, they were both recovered from the Middle Archaic component which could be interesting if their function could be related to bow-and-arrow technology.

The single Olivella shell at the site was recovered from Trench 3 Stratum III, which dated to 2270 ± 30 B.P. (2245 – 2160 cal B.P.) and is thus a Middle Archaic component. These shell beads are often found at Great Basin sites and have been found to often originate from the Pacific Coast (Heizer 1951; Jennings 1957; Loud and Harrington 1929; Smith, Cherkinsky, Hadden et al. 2016). These types of shells were found to be strung on necklaces and used for ear or hair decorations by the Northern Paiute in ethnographic times (Fowler 1992). The Klamath and Modoc also used Olivella shells for decorative items. Although, instead of placing them on necklaces they were noted as being an item that they would use to decorate clothing (Stern

1998). While there is only one, the presence of this shell along with the sourcing data discussed in Chapter Six, does highlight that the Rock Creek Shelter inhabitants were likely socially connected to other groups in northern California and since these shells are from the coast, possibly along the Oregon and California coast as well. Although this Olivella shell was not directly dated and only indirectly dated to the Middle Archaic, it is believed that people in the Great Basin first acquired these beads during the Early Holocene (Smith, Cherkinsky, Hadden et al. 2016:550).

Summary

Based on the work by Cressman (1942) in the Fort Rock vicinity and subsequent basketry analyses (Eiselt 1997; Adovasio 1986; Fowler and Dawson 1986; Connnolly; Smith, Barker, Ollivier et al. 2016), the basketry fragments recovered from Rock Creek shelter are ethnographically associated with Klamath peoples who contemporarily reside to the west of the Warner Valley. These basketry types were first attributed to Klamath people more than seventy years ago by Cressman (1942) after finding that the basketry items he recovered from southeastern Oregon, between Warner Valley and Steens Mountain, did not resemble those constructed by the modern Numic peoples. Instead, these baskets he believed, were more like those made by the Klamath and the Modoc (Grayson 2011:327), which also holds true for the basketry assemblage from Rock Creek Shelter. Furthermore, although the twining method is exclusive to the northern Great Basin Cressman (1942) noted the not only were the basketry items he recovered not ethnographically associated with Northern Paiute, they were evidence that Klamath and Modoc once occupied southern Oregon as far east as Steens Mountain (Connolly and Barker 2004:241; Connolly et al. 2016).

Although definitive archaeological evidence for the Numic expansion is rare and even when Numic markers are present can be difficult to attribute to Numic peoples, research has primarily focused on perishable material and a few other diagnostic artifacts to assess a presence of this expansion. Cordage is not diagnostic between the two groups because Klamath cordage used in the production of basketry contain both z-twist and s-twist cords, and Northern Paiute cordage is variable with both z-twist and s-twist being used as well (Eiselt 1997:69).

Basketry assemblages associated with Numic peoples in the Great Basin are believed to consist of coiled basketry, twined seed beaters, twined triangular winnowing trays, conical carrying baskets, and predominately but not exclusively, s-twisted wefts are present in Numic assemblages (Adovasio 1986:204). The presence of s-twist wefts on basketry materials has been said to indicate Numic construction (Smith, Ollivier, Barker, et al. 2016). Although as previous mentioned, the s-twist pattern has also been said to imply possible gender traditions in the production of fine cordage (Fowler 1992; Connolly et al. 2016). This is a possibility that exceeds the scope of this study.

There are two basketry fragments that have s-twist wefts in the assemblage, but neither of these artifacts were radiocarbon dated since their provenience is unknown and the objective of the radiocarbon dating was to acquire an overall site chronology by dating as many cultural strata as possible. It would be interesting to know a date for this basketry type at Rock Creek Shelter given their morphological difference to the other types identified, but without a date, it must be assumed they date to a similar point in time as the other open simple twine basketry fragments. Therefore, at Rock Creek Shelter, there are no basketry or perishable materials that indicate or suggest the presence of Numic peoples in this region and this can be said to be the case at least until 780 B.P. This does not necessarily mean that basketry material that is ethnographically associated with Numic peoples is not to be found elsewhere on the Refuge or surrounding area. Even though the basketry from Rock Creek Shelter does not indicate a presence of Numic peoples in the region, it does lend more credibility to an ongoing argument that the Klamath and Modoc once occupied areas east towards the Steens Mountains prior to the arrival of the Northern Paiute since the basketry types are believed to be associated with Klamath peoples (Connolly et al. 2016; Spier 1930; Cressman 1942; Grayson 2011:327).

Although there are only two specimens of close simple twine basketry in the Rock Creek Shelter assemblage, it is interesting to note that this style was only dated to the Late Archaic and that the open simple twine basketry was only dated to the Middle Archaic. Other basketry material near the Refuge has been radiocarbon dated from the vandalized South Warner Valley Cave (35LK94). The basketry material from this site consisted of Catlow Twine basketry, "open diagonal twining over rigid warps, close diagonal twining over rigid warps, and close coiling on a mixed rod and bundle foundation" (Connolly et al. 1998:95). Other than the Catlow Twine basketry, the basketry from this site was dated to or less than 150 B.P, while the Catlow Twine ranged between approximately 600 and 700 B.P. (Connolly et al. 1998:95). The dates from this site for the Catlow Twine are close to the dates obtained for the Rock Creek Shelter samples, but unlike these specimens, the provenience of the artifacts from South Warner Valley Cave is unknown.

In terms of the function of the basketry/matting materials there are likely many different functions this material served. For example, even though the term basketry is often used when referring to these types of artifacts, much of the Rock Creek "basketry" is likely matting since most specimens are two dimensional and flat. Matting at Rock Creek Shelter could have possibly functioned as what some archaeologists call "bedding" which served as the living floor within a rockshelter and was a place where people could sleep or work on an occupational surface (Goldberg et al. 2009; Wadley et al. 2011). As the stratigraphic sketches from Chapter Four indicate (Figures 4-2 and Figure 4-4), the matting often occurred at the base of a stratum. Therefore, given this stratigraphic position of the matting at Rock Creek Shelter, it seems that most of the matting at the site was an occupational surface where people could sit and conduct a range of activities. This seems especially likely since the Klamath are known to have used matting in ethnographic times as bedding, floor covering, tabletops, and house covering (Eiselt 1997:36). Although there is also evidence that tule matting was used for activity mats to be utilized during cooking, dining, fish drying, and other past-times (Eiselt 1997:36). Baskets were often used by the Klamath as sifters which would function as graters to peel skins from roots and tubers or sift wokas *(Nuphar polysepala)* seeds (Eiselt 1997:54; Spier 1930).

In the northern Great Basin, cordage artifacts are thought to possibly be fragments of netting given that Klamath groups were known to use nets and snares to capture rabbits and waterfowl (Spier 1930), but it is also thought that cordage was a multifunctional item. For example, Jenkins et al. (2006) suggest that cordage likely had many uses and therefore should not be considered a specialized tool related to the procurement of a particular taxa. Others have suggested that z-twist cordage could be warp trimmings from basket construction while s-twist cordage, which is often finer and more tightly wound, would have been used for netting construction (Connolly 1994; Connolly et al. 2016). As will be discussed in the next chapter, there are numerous rabbit remains in the faunal assemblage which could lend credibility to the suggestion that cordage artifacts could be netting for capturing this taxon, but given its multifunctional nature, it would be hard to argue that this is the primary function of the cordage in the assemblage.

Other than the suggestion that the bark bundles are a source of raw material (Smith, Barker, Ollivier et al. 2016), the exact function of these artifacts is unknown, and it is likely, that like the more formally constructed z-twist and s-twist cordage fragments, they were multifunctional artifacts that served a variety of purposes. Although, it is not unimaginable that the bark bundles served as a source of raw material cordage construction at Rock Creek Shelter since the bark bundles appear to be an ideal way for raw materials for cordage to be transported to the site or a way to store these material at the site when it was not occupied.

The modified wood fragments in the Rock Creek Shelter assemblage likely reflect a variety of activities at the site. However, other than the awl specimens, possible game pieces, and fire drill implements, assigning a function to these items with confidence is difficult given that only a comparative analysis of these artifacts was conducted for this study. Lastly, the artifacts classified as miscellaneous perishables in this study are primarily mentioned for documentation purposes and to illustrate the diversity of the artifact assemblage recovered. None of these artifacts were analyzed in any detail and it is likely much more could be learned about Rock Creek Shelter and its inhabitants by a future researcher with a different approach.

CHAPTER EIGHT

FAUNAL REMAINS

The faunal assemblage from Rock Creek Shelter was analyzed during the spring of 2017 as part of a terrestrial mammal analysis project at Washington State University in the Department of Anthropology Zooarchaeology Laboratory. The faunal sample (n=994) was divided among three groups of graduate students by excavation trench with the objective of the analysis being to: (1) identify and quantify the taxa represented at the site and determine how it reflects the diet and subsistence strategies of the past occupants; (2) record cultural (cut marks, burning) and taphonomic bone modifications (rodent gnawing, weathering), to infer the organization of activities both within and immediately outside of the rockshelter; (3) address the degree to which any of these behaviors changed through time. This chapter will report on the findings from this analysis and the interpretations that were made following its completion.

Analysis and Methods

The coding system utilized for this analysis was adapted from Shaffer and Baker (1992). The codes in this system are predominantly numerical which allowed for simple quantification and data analysis upon completion. In addition to stratigraphic positions and specimen numbers, taxa codes were generated following Shaffer and Baker's (1992) coding system along with element codes, a completeness scale, portion codes, side designations, taxa age identification, burning classifications, a binary scale indicating the presence or absence of weathering, cut marks, gnawing, and pathology. Most taxa and element identifications were made utilizing the comparative collection in the Zooarchaeology Laboratory at Washington State University. For example, the faunal material in the reference collection for identifying Leporidae and large mammal elements was sufficient to make many confident taxa identifications. Although, in terms of analyzing rodent remains, which are numerous in the assemblage, the reference collection is currently lacking. Supplemental lab manuals (Gilbert 1990; Gilbert et al. 1981) were utilized to make up for the absence of comparative material needed for the identification of rodent and avian remains. As will be discussed in detail below, though the reference collection for large mammal and medium mammal identification is sufficient, many of these elements were too fragmented or too small of portions to make many identifications beyond large mammal or artiodactyl.

NISP and Subsistence

The number of identified specimens (NISP) quantification method was utilized to determine the overall faunal representation at the site. Although, it is argued that the NISP method is best supplemented by a calculated minimum number of individuals (MNI) and meat weight in most osteological analyses (Hopt and Grier 2016:8), it was decided to only utilize the NISP method given that the primary focus of the analysis was only to infer the general patterns represented at the site. The total NISP and weight for the faunal assemblage from all three trenches is shown in Table 8-1. In some cases, a few of the large mammals, medium mammals, and avian remains were identified to more specific categories (i.e., family, genus, class), though they are not differentiated in the table given that it would not influence the overall interpretation of the assemblage. Additionally, some of the more specific classifications, particularly the rodential and avian identifications, were made with less confidence due to the lack of reference material available during the time of the analysis. It is worth briefly stating what some of the more specific taxa identifications were and what likely makes up each category given that future faunal studies at this site could benefit from these data. It is likely that many of the large mammal elements are artiodactyl mammals such as deer and pronghorn. Although, this

Table 8-1. NISP frequency from each cultural component.

	Component				
Taxon	Early Archaic	Middle Archaic	Late Archaic	Weight (g)	**Total**
Large mammal	30	140	98	610.98	**268**
Leporidae	32	155	70	135.98	**257**
Rodentia	14	110	67	44.33	**191**
Small/medium mammal	8	130	28	81.09	**166**
Marmota spp.	2	38	20	58.85	**60**
Aves	1	30	8	25.56	**39**
Reptilia	-	1	12	0.5	**13**
Total NISP	**87**	**604**	**303**	**-**	**994**
Total Weight (g)	**127.5**	**551.79**	**278**	**957.29**	**-**

cannot be said with complete certainty given that many of these elements are fragmented and distal and proximal ends which could be diagnostic, are often missing. Leporidae specimens could not be identified to species, but it is worth pointing out that their size varies considerably. Rodentia was one of the most difficult to identify more specifically, given the few reference specimens available in the laboratory, but the specimens in the collection are believed to be squirrel and gopher elements based on their morphology. The category small/medium mammals includes three Canis elements which are thought to be coyote (*Canis latrans*) elements based on their size and morphology, while the majority of the other specimens belong to small/medium size unidentifiable mammals. The category Marmota consists of elements able to be confidently differentiated from Rodentia and identifiable as a type of marmot (species unknown). The category Aves (birds) includes five Anatidae (ducks, geese, swans) elements, one Corvidae (crow family) element, and ten Phasianidae elements which could be Greater Sage-Grouse

(*Centrocercus urophasianus*) given that they have been reported from faunal analyses from several other nearby Great Basin sites (Grayson 1988:77) and are known to be a species of bird commonly taken as food by many native peoples in this area (Fowler 1986:86). The last category, Reptilia, could not be identified more specifically in any case.

As indicated in Table 8-1, large mammals represent the single most common taxa followed closely by Leporidae. The taxa Leporidae and large mammals also have the highest weights in the assemblage though, as expected, patterns slightly differ when looking at NISP versus weight due to the differential sizes of the taxa included in these categories. The category Rodentia also has a high NISP, but many of these specimens almost certainly represent later disturbances given that many rodent disturbances cut through the excavated trenches. However, as mentioned previously, this category does include what are thought to be squirrel and gopher specimens both of which are known food sources for many peoples such as the Northern Paiute (Fowler 1986:80). Therefore, at least to some extent, the taxa in this category could reflect subsistence. Marmota is also recognized as an ethnographic food source (Fowler 1986:81), and based on its total NISP, could also be significant to the diet of the rockshelter's occupants. Reptilia, which are likely later disturbances, and Aves are relatively deemphasized in the total NISP and therefore were not considered at any further point in the analysis given that it cannot be said with confidence that these taxa represent animals that were targeted for subsistence.

Cultural Modifications and Intrasite Variation

The intrasite analysis focused on site activities both within and just outside of the rockshelter by assessing taxa representation and behavioral patterns evidenced on faunal remains including burning, cut marks, and other cultural factors that would influence taxa and element representation at the site. Cut marks do not frequently occur on faunal elements represented at the site, though there is one medial portion of a large mammal long bone from Trench 2 possesses clear butchering marks (Figure 8-1). The marks do not resemble the cut marks that are often characterized on faunal remains (Domínguez-Rodrigo et al. 2009), but instead appear to be

Figure 8-1. Large mammal long bone fragment with cut marks.

marks from hacking or chopping given that they are much larger and wider than typical cut marks. Of all the specimens analyzed, this is the only element where "cut marks" can be confidently attributed to human behavior. Other specimens that were noted to possess cut marks were classified as such with less confidence, and it is possible they could be marks caused from excavation tools (i.e., trowels, shovels).

Spatial patterning of taxa representation is shown in Figure 8-2. Overall, the taxa representation varies little between inside and outside contexts apart from the small/medium

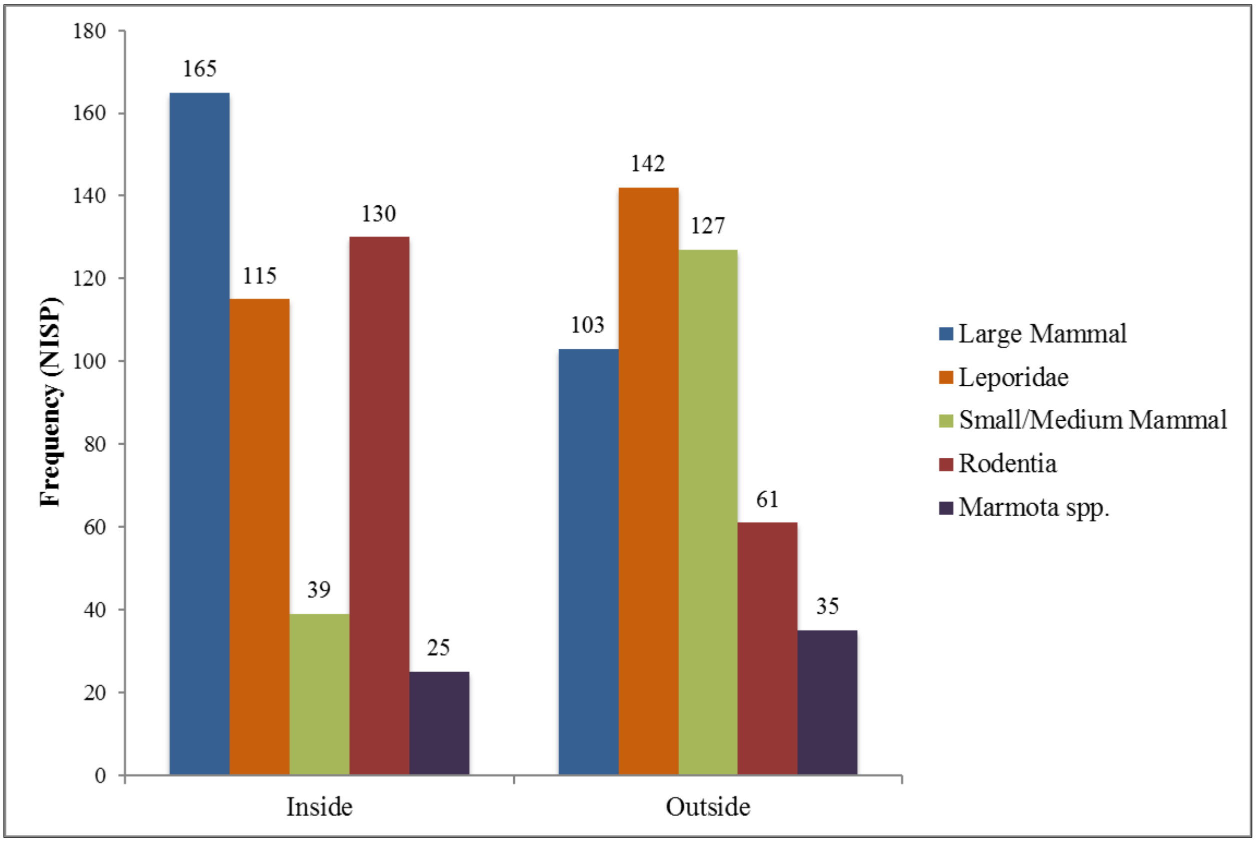

Figure 8-2. Comparison of NISP frequencies from inside and outside contexts.

mammals and the mammals in the Rodentia category. Why the small/medium mammals are mostly in the outside context will be discussed in the next section, but the high NISP frequency of Rodentia in interior contexts can be attributed mostly to non-anthropogenic intrusions within the shelter itself which were documented frequently in the field notes from the 1967 excavation. What is the most important to point out here is that large mammals dominate the assemblage recovered from the interior trenches while predominantly Leporidae and small mammals dominate the exterior trench.

Many of the specimens in the faunal assemblage showed varying degrees of burning. For this part of the analysis, the spatial patterning of this cultural modification was examined in relation to inside and outside contexts and in relation taxa categories. The burning differentiation from inside and outside contexts is shown in Figure 8-3. What is surprising about the results from this part of the analysis is that Trench 2 contains the hearth feature mentioned in Chapter Three. Most of Trench 2 lies just beyond the dripline and outside of the rockshelter, but as shown in Figure 8-3, more burned elements were identified from inside the rockshelter than outside and most elements outside are unburned. As will be discussed, it is possible that this pattern can be attributed to different ways of processing large and small animals.

Figure 8-4 shows the frequency of the top five faunal categories that were either burned, unburned, or calcined. Of all the top five categories, no individual category was found to have more burned than unburned specimens and very few were calcined from each category. Also, less than 50% of the total NISP was found to be burned with most specimens being unburned. However, large mammals exhibited the highest frequency of burned specimens, and in all cases were burned the most extensively.

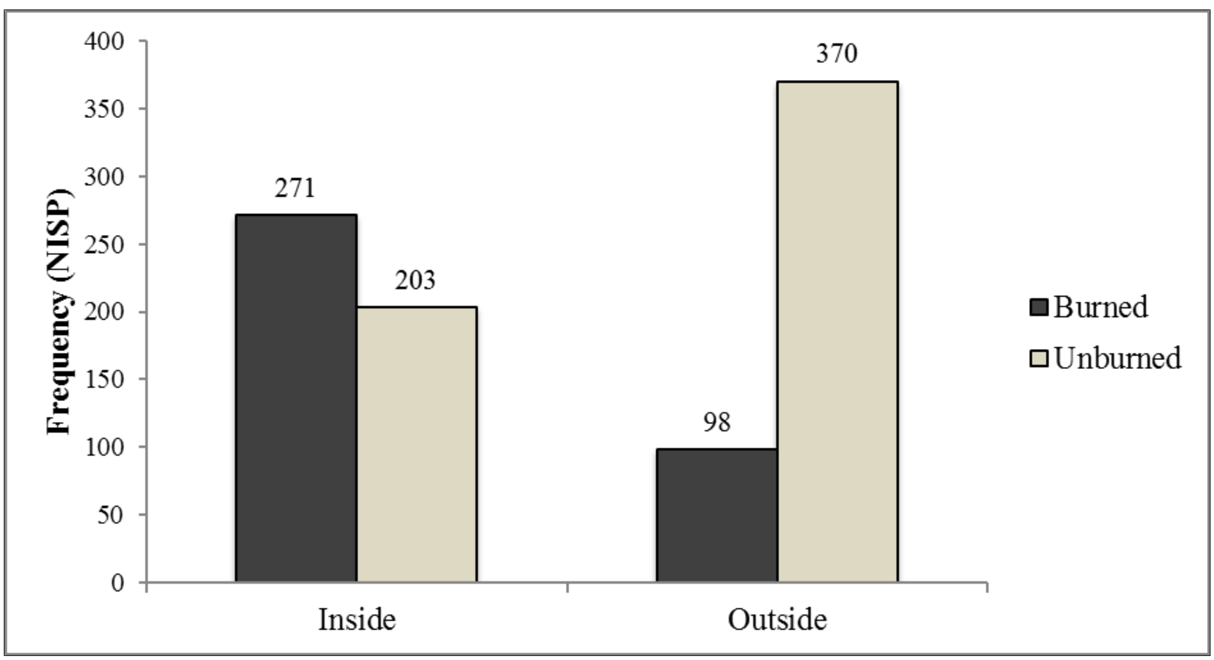

Figure 8-3. Comparison of burned and unburned NISP frequencies from inside and outside contexts.

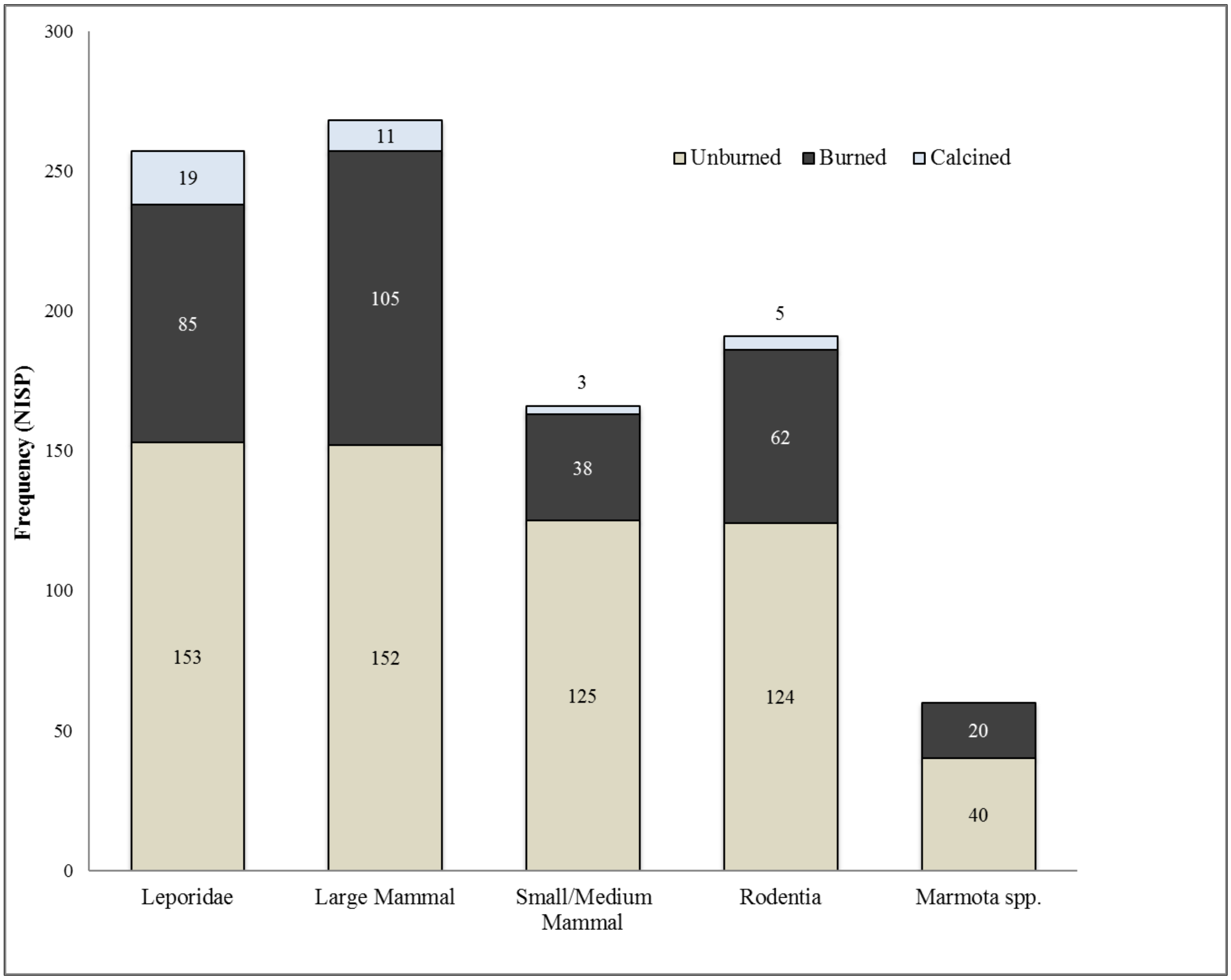

Figure 8-4. Frequency of unburned, burned, and calcined specimens by taxa categories.

Non-Cultural Taphonomic Factors

Preservation at the site is very high and many elements, particularly smaller specimens, are complete and in some cases, are still fully articulated. Many rodent specimens and all lizard specimens are thought to be intrusive but given that there is no evidence of carnivore gnawing on any elements in the assemblage, there is no reason to suggest that larger animals entered the rockshelter after it was abandoned and further disturbed the site.

Weathering was not identified on many elements from any trench and is often only found on burned elements when it is present. Therefore, due to the low presence of weathering and high preservation of faunal elements at the site overall, weathering was not deemed a significant taphonomic factor in this analysis.

Summary

The overall faunal representation indicates that both large mammals and rabbits were a highly targeted species for the site's inhabitants. Hunting large mammals was suggested to be a significant activity practiced in the uplands adjacent to the Warner Valley by Weide (1968), and although this pattern is also evident at this upland site, the faunal analysis further indicates that past occupants targeted other type of taxa as well. For example, based on the data generated in this analysis, it is evident that the past occupants procured rabbits extensively while occupying the shelter and likely brought them back for mass harvesting based on their abundance in the total NISP compiled for the assemblage. The high abundance of rabbit remains is a finding which is not surprising given findings from other faunal analyses in the northern Great Basin (Grayson 1988) and that rabbit drives are attested by ethnographic data from this area (Fowler 1986). Furthermore, Jenkins et al. (2004:15) point out that the procurement of rabbits is one of the most consistently pursued hunting activities conducted throughout the northern Great Basin over thousands of years and is well attested at many sites in this region. The high abundance of rabbit remains in the faunal assemblage could explain the high frequency of cordage found at Rock Creek Shelter since as mentioned, northern Great Basin groups (Fowler and Liljeblad 1986) and Klamath basin groups (Voegelin 1942) are known ethnographically to have used nets to capture rabbits, but as Jenkins et al. (2004:16) point out cordage should be thought of as a multifunctional tool and there is no evidence that it is a specialized tool for this type of activity.

Given that faunal assemblages in the Great Basin usually vary in relation to where a site is located and the season in which it was occupied (Jenkins et al. 2004:15), the rabbit remains do suggest a spring, summer, and early fall occupation a Rock Creek Shelter based on similar data from sites in the Fort Rock vicinity, (Jenkins et al. 2004:15), and that large communal drives of rabbits were often conducted in preparation for the winter months (Fowler 1986:82; Jenkins et al. 2004:12).

Of all the cultural modifications present on the faunal elements from Rock Creek Shelter, the most significant factor was burning. All taxon categories were found to be more than 40% burned when burning was present, but the large mammal elements were burned the most extensively (i.e. burning covered entire element). This could suggest differential cooking practices between the two taxa as has been noted at other sites in the Great Basin (Grayson1988:26). For example, small mammals such as rabbits are believed to have been roasted whole over fire (Grayson 1988:26), and thus their faunal elements would be burned less than those of larger mammals. Furthermore, it was noted in the analysis that many of the large mammal elements in the assemblage consist of broken shaft fragments with missing proximal and distal ends and conchoidal fractures near each end. This indicates that past occupants were likely extracting the marrow from the bones of the larger mammals at the site given that concentrated burned areas on shaft fragments often indicate the use of fire to assist with cracking elements to get at marrow (Orton 2012:325) and that conchoidal fractures suggest blunt force was used to crack the element to get at the marrow inside (Binford 1978:153). This pattern of marrow extraction also matches what was found at the LSP-1 rockshelter in the northern Warner Valley where there was also a focus on rabbit remains and long bones were found to have been broken for the intention of extracting marrow (Smith et al. 2012:29). This cooking practice could also explain why most of the burned elements are inside of the shelter instead of outside near the hearth feature if smaller elements that do not yield much marrow were discarded away from the hearth feature while larger elements that do possess a significant amount of marrow were left in the hearth after extraction.

In terms of change through time, it was determined during the duration of this analysis and subsequently upon closer inspection, that there is little reason to suggest a significant change through time as it relates to subsistence. The primary reason for this interpretation is that when assessing the NISP in each category, there is not a sudden appearance of a new taxa in later components not represented in earlier components or a disappearance of taxa in later components and that each taxon increases and decreases together across components relatively similarly. Instead the only pattern that can be inferred is that the NISP for each taxon is the highest during the Middle Archaic, which confirms, along with the other artifact distributions presented in this thesis, that this cultural period is when the site was most intensively occupied. There are many more patterns that would likely arise if the data generated from this analysis is revisited, but the interpretations put forth in this chapter seek to only explain the primary cultural behaviors centered around diet and subsistence gathered from this brief analysis.

CHAPTER NINE

SUMMARY AND CONCLUSION

In this chapter I summarize (1) the results of the analyses conducted, (2) the interpretations of these data, and (3) the answers to the three research questions posed in this study. This chapter will conclude with suggestions for future work not only at Rock Creek Shelter, but on the larger Refuge area. It is hoped that the results from this study, along with the discussion of potential research directions, will inspire future researchers to conduct additional work at the site and guide future research questions about the Hart Mountain National Antelope Refuge and surrounding area.

Site Function

The first question addressed in this thesis was to determine site function of Rock Creek Shelter. Specifically, I was concerned with determining the primary function of Rock Creek Shelter, how this varied through time, and when was the site was most intensely occupied? Based on radiocarbon dating results obtained from 14 organic samples and the diagnostic biface assemblage, the site was occupied from at least 7490 ± 40 (8385 – 8200 cal B.P.) to 780 ± 30 B.P. (735 – 670 cal B.P.), or a period of roughly 8,000 years. Although there are site chronology issues due to mixed cultural strata, multiple lines of evidence suggest that the site was most intensively occupied during the Middle Archaic, followed by the Late Archaic when the occupation appears to begin to taper off then cease before the Historic period.

It is evident from the overall artifact assemblage recovered in 1967 and classified for this study that Rock Creek Shelter was utilized for a diverse number of activities. Debitage frequency and obsidian sourcing data indicate that site activities included the manufacturing and sharpening of lithic tools, the processing of game, and preparation of plant material used in basket construction. Rock Creek Shelter seems to have served as a logistical location where nearby quality raw material obsidian sources like Beatys Butte were heavily used. The damage on 16 of the hafted bifaces that resembles the type of damage produced by impact (Flenniken and Raymond 1986) suggests that many of them may have been utilized as projectiles. This provides evidence that the site likely also served as a base camp for hunting parties pursuing large game with a projectile throwing implement such as a bow-and-arrow or atlatl. The presence of matting material may be related to the preparation of a task related occupational surface; it may also be associated with bedding material for site occupants. The cordage, though likely a multifunctional item, suggests that much of the matting was constructed within the rockshelter since most fragments could be trimmings. The cordage could also relate to the procurement of small game like rabbits if the fragments represent pieces used in the manufacturing of netting. If this were the case, this suggests that the site also served as a place where groups could prepare items needed for activities like rabbit drives. There are not many modified wood artifacts, but the one that was the most confidently classified appears to be a gaming piece which is interesting in that it suggests that leisure activities occurred at the site.

There are only a few ground stone artifacts in the Rock Creek Shelter, but that does not necessarily mean that plant processing or other activities conducted with these artifacts did not frequently occur at the site. For example, numerous ground stone artifacts were observed on the surface at the site during the 2015 field visit—as many as there are in the recovered artifact assemblage—and it is likely there are even more along the bank of Rock Creek. Therefore, since ground stone was recovered from all cultural components, and more was observed during the field visit, the site probably served as a place to process plant material and grind gathered root crops. This activity likely occurred in the late spring when a variety of *Lomatium* species would have been in full bloom on the Refuge and near the site. The faunal data suggests that the site's occupants pursued large game and targeted a variety of small game. Based on the abundance of rabbit remains in the faunal assemblage and that rabbit drives were often conducted in preparation for winter (Fowler 1986:82), the site was also utilized as a place where captured rabbits could be processed. The abundance of burned faunal specimens in the assemblage further indicates that extensive cooking and animal processing were conducted at the site. These cooking and food preparation activities likely occurred just outside of the rockshelter within the hearth feature that was identified during the 1967 excavations.

Finally, items such as bark bundles, mats, and useable raw lithic material may have been cached during times when Rock Creek Shelter was not occupied during the winter months when people were at residential sites in the Warner Valley (Weide 1968). Evidence that the site served as a caching location aligns with what has been reported for other rockshelters in the Great Basin (Jenkins et al. 2004:20), and since utilizing these sites in this way often involved burying items, could explain the mixed cultural deposits at Rock Creek Shelter.

The overall diversity of the artifact assemblage at Rock Creek Shelter is consistent with the inferences drawn by Cannon et al. (1990), who suggested that upland sites were used to a greater extent than initially proposed by Weide (1968). In contrast to her interpretation that upland sites activities were restricted mostly to tool procurement and large game hunting (Weide 1968), Rock Creek Shelter was a multifunctional site for the region's inhabitants and it is not unreasonable to think that the variety of activities practiced there may be more numerous than even the diverse artifact assemblage indicates.

Land Use

The second question addressed in this study was what interpretations about prehistoric land use on the Refuge can be made based on the artifact assemblage and analyses conducted? Results from the obsidian sourcing analysis indicate that the Rock Creek Shelter inhabitants not only exploited the local landscape, but also exchanged materials and/or traveled great distances to exploit additional resources and procure raw materials elsewhere in the Great Basin. This finding is highlighted by the range of obsidian sources that were utilized by the site's occupants which range in distance from 13.6 km (8.5 mi) to 118.9 km (73.9 mi) in a mostly north-south conveyance pattern. This large conveyance range not only allowed them to exploit wetland resources all the way to present-day northern California, but also caused them to be socially and economically connected to other groups in areas outside of the Warner Valley and Refuge. This is also highlighted by the single Olivella shell which was likely obtained from either the Oregon or northern Californian coast. Furthermore, although Weide (1968) argued a "tethered" subsistence strategy focused on local wetlands and lakes, based on the obsidian source analysis, there is also evidence that the site's inhabitants traveled great distance for resource exploitation and likely practiced this same strategy near other wetland areas in the northern Great Basin.

The diverse artifact assemblage from Rock Creek Shelter revealed that the local upland landscape on the Refuge was utilized with a flexible of pattern of use throughout the site's occupation, which was a pattern also found by Weide (1968:223). However, the sourcing data also highlights that this pattern may not have always been in place, and the local landscape may have become more heavily utilized beginning in the Middle Archaic and increasingly so in the Late Archaic. While this interpretation is given with caution due to the small number of temporally diagnostic bifaces in the assemblage and stratigraphic mixing, the sourcing pattern indicates that, beginning the Middle Archaic, the obsidian conveyance range or distance decreased, which may be associated with a more localized model of land use. It is likely this change could be associated with the productivity of the wetlands and lakes in the Warner Valley, especially since the Middle Archaic is when the regional climate began to become cooler and moister. This finding also has possible implications for the effects that bow-and-arrow technology may have had on the groups in this region. For example, since this technology is usually believed to increase conveyance ranges and group mobility patterns (Hughes 2015), it is likely that the effects this technology had on people varied in different parts of the northern Great Basin. Therefore, highlighting the importance of not attributing specific patterns of behavior to an entire culture area, particularly one as environmentally-variable as the Great Basin.

Aside from this pattern, the artifact assemblage, artifact stratigraphic distribution, and raw material source use provide meager evidence suggestive of significant adaptive or land use strategical changes. Instead, the study data primarily reveal long term continuity as initially proposed by Weide (1968) and built upon by other researchers since that time (Cannon et al. 1990; Middleton et al. 2014; Smith, Pattee, and Van Der Voort 2016; Young 1998).

Numic Expansion

Finally, in this study it was asked if there is any evidence for the Numic expansion at Rock Creek Shelter? In addition to little evidence of a change in adaptive behaviors practiced by the site's occupants, there is also no evidence to suggest that Numic speakers occupied the site given that the comparative analysis of basketry showed a stylistic association with techniques practiced by the Klamath and Modoc. However, it is important to note that assigning artifacts ethnicity can be problematic (Eiselt 1997), and artifacts in the Rock Creek Shelter assemblage that could be said to be Numic markers were recovered from the surface during the 1967 excavations (i.e. s-twist basketry). Given that these artifacts were not dated and lack provenience, there is currently no way of knowing whether they are temporally associated with the arrival of Numic speakers into this region.

The occupation of the site appears to cease around the time of the Numic expansion into this part of the northern Great Basin, which has been argued to have occurred in the last thousand years or sooner (Morgan and Bettinger 2012:195). This could indicate two possibilities that require further investigation. First, it is possible that Numic speakers never utilized the site simply because it did not fit into their adaptive strategy since their practices would have been vastly different than their predecessors (Bettinger and Baumhoff 1982). Another interesting possibility is that occupation at Rock Creek Shelter ceased because of the arrival of Numic speakers who may have driven former occupants out of the region. The former occupants may have been the Klamath and Modoc who are ethnographically associated with areas to the west of the Refuge at the base of the Cascade Mountains. Although, it has been argued quite convincingly from ethnographic data and basketry artifact analysis from nearby sites, that the Klamath and Modoc could have once inhabited regions east of their ethnographic territory to Steens Mountain (Aikens 1994; Kelly 1932; Connolly et al. 2016). Future research on the Refuge may shed more light on the Numic expansion into this part of the northern Great Basin, but in this study, it can be said rather confidently that Numic speakers did not occupy Rock Creek Shelter; at least when assuming that there are artifacts that are ethnically Numic. It can also confidently be asserted that there is not a significant change in adaptive behaviors visible in the archaeological record at Rock Creek Shelter which could also mark the arrival of Numic speakers into this part of the northern Great Basin.

Future Directions

There are a number of different directions these studies may be expanded in the future. A primary need is for more sites on the Refuge to be analyzed and documented to better understand overall land use of the region. As shown in this study, important questions can be addressed even with a 50-year-old orphaned artifact assemblage. As for Rock Creek Shelter specifically, one avenue of future research would be to consider the importance of plant use by the site's occupants. For example, although the ground stone assemblage recovered in 1967 is a small sample, many more ground stone implements were observed at the rockshelter during the field visit in 2015. It is likely that many more ground stone implements lie in the thick brush along the bank of Rock Creek, not only near the site, but in the surrounding area. Research directed at this artifact type has the potential to shed light on the importance of plants, particularly *Lomatium* species to the region's inhabitants. Another potential avenue of research would be to conduct obsidian hydration on a sample of the diagnostic bifaces recovered from Rock Creek Shelter, or from a sample collected elsewhere on the Refuge. Hydration was not performed on any artifacts for this study due to its destructive nature, but this type of study could assist in calibrating the radiocarbon dates obtained for the cultural strata at Rock Creek Shelter and provide baseline dates for the obsidian sources discussed in this thesis. Regardless of the direction future research will take, the work conducted for this thesis will hopefully ensure that Rock Creek Shelter will always remain an important place in the archaeological record of the Hart Mountain National Antelope Refuge, just as the site itself has been an important place to the people in this region for the past 8,000 years.

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APPPENDIX A

TEPHRA ANALYSIS RESULTS

WASHINGTON STATE UNIVERSITY | School of the Environment

July 18, 2016

Andrew Frierson
Department of Anthropology
Washington State University

Dear Andrew,

I ran the sediment sample you provided our lab and I wish I had better news for you. Unfortunately, it contained very little glass. I was able to collect data on a total of 9 glass fragments, the composition of which was bimodal. I searched my database for the bulk composition and the two compositional subgroups groups (glass 1 & glass 2) all of which were unusually high in K_2O for a tephra glass. Unfortunately I was not able to match these compositions to tephras in my database of western U.S. tephras. Note the similarity coefficients (Table 1) are all less than 0.83 and similarity coefficients less than 0.88 (Borchhardt et al. (1972) J. Sed. Petrol., 42, 301-306) are not permissive of a match.

Since I took the chance of a doing a full analysis, in part satisfy my and the microprobe techs curiosity, you'll only be billed for an examination fee of $55.

Good luck in your research.

Sincerely,
Nick
F. Nick Foit
Professor Emeritus

PO Box 642812, Pullman, WA 99164-2812
509-335-3009 | Fax: 509-335-3700 | soe@wsu.edu | http://soe.wsu.edu

Table 1. Glass Compositions of Glasses in Rock Creek Shelter Tephra

Oxide	**RC Shelter Tephra** bulk composition	glass 1	glass 2
SiO_2	72.25(2.54)[1]	70.62(0.70)	75.55(0.32
Al_2O_3	13.44(0.89)	14.04(0.20)	12.28(0.24)
Fe_2O_3	1.69(0.55)	2.05(0.13)	0.97(0.08)
TiO_2	0.27(0.12)	0.32(0.08)	0.15(0.08)
Na_2O	0.26(0.20)	0.21(0.12)	0.38(0.31)
K_2O	10.84(0.67)	11.24(0.33)	10.18(0.72)
MgO	0.25(0.19)	0.34(0.14)	0.04(0.04)
CaO	0.87(0.48)	1.04(0.19)	0.34(0.24)
Cl	0.13(0.03)	0.14(0.02)	0.10(0.03)
Total[2]	100	100	100
Number of shards analyzed	9	5	3
Probable Source/Age	????	????	????
Similarity Coefficient[3]	< 0.83	< 0.81	< 0.77

[1] Standard deviations in parentheses
[2] Analyses normalized to 100 weight percent
[3] Borchardt et al. (1972) J. Sed. Petrol., 42, 301-306

Sample: Fierson RC shelter, glass bulk composition

number of records searched: 1716

Glass composition of sample:

SiO2	TiO2	Al2O3	MgO	CaO	BaO	MnO	Fe2O3	Na2O	K2O	Cl	Total
72.25	0.27	13.44	0.25	0.87	0.00	0.00	1.69	0.26	10.84	0.13	100.00

weighting factor (only for oxides in bold type)

SiO2	TiO2	Al2O3	MgO	CaO	Fe2O3	Na2O	K2O
1	0.25	1	0.25	1	1	1	1

Similiarity Coefficients for 15 closet matches

SiO2	TiO2	Al2O3	MgO	CaO	Fe2O3	Na2O	K2O	sim coef weighted avg	rec#	Std	Date	State	Source/Age	Notes
0.976	1.000	0.940	0.640	0.879	0.693	0.634	0.830	0.825	352			OR	????	35JE51B-2, Glass B , Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.960	0.630	0.895	0.120	0.816	0.698	0.591	0.819	0.764	348			OR	????	TR-201, Glass B, Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.959	0.630	0.904	0.120	0.908	0.768	0.385	0.849	0.763	465			OR		Sample 35JE51B, 2520-2, Glass D; Infotec, Willowdale Quad.
0.956	0.593	0.892	0.080	0.874	0.684	0.394	0.768	0.729	345			OR	????	TR-101, Glass B, Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.961	1.000	0.989	0.840	0.879	0.983	0.066	0.394	0.728	864			OR		Sample 54-1; Four Bulls Site; near Keno ,OR; 400m from Klamath River on shore of what used to be South Klamath Lake; Doug Wilson, Archaeological Invest
0.965	0.844	0.984	0.720	0.977	0.894	0.067	0.423	0.723	648			OR		Tephra WL-A-37-1, Glass 3, Wetland Levee Core, Summer Lake, OR, P. Wigand, Desert Research Institute, Univ. of Nevada
0.959	0.926	0.993	0.840	0.906	0.988	0.061	0.328	0.719	25			OR	????	Sample from level 25, 120-125 cm depth, Fort Rock Valley, B. Cannon, BLM Lakeview
0.978	0.675	0.958	0.595	0.554	0.744	0.250	0.875	0.719	330			OR	????	35JE49, TEU-1-276-1, Ash #2, Central OR, 5 mi SE of Madras
0.958	0.741	0.993	0.680	1.000	0.911	0.062	0.387	0.718	701			OR		Sample 35KL972-742-1 from site 35KL972, Block "E", depth 45-53 cm in Klamath County near Bonanza, OR, next to Lost River near Horton Rim, Archaeologi
0.958	0.778	0.986	0.760	0.966	0.935	0.060	0.376	0.718	702			OR		Sample 35KL972-747-1 from site 35KL972, Block "E", depth 100-131 cm in Klamath County near Bonanza, OR, next to Lost River near Horton Rim, Archaeolc
0.955	0.778	0.974	0.720	0.989	0.944	0.063	0.363	0.717	102			OR		35KL972-795-31-1 (bulk composition), Klamath Basin, 20 mi E of Klamath Falls, Jo Reese of Archaeological Invest. NW
0.960	0.852	0.997	0.840	0.897	0.949	0.062	0.344	0.713	112			OR		35KL978-795-42-2 (bulk composition), Klamath Basin, 20 mi E of Klamath Falls, Jo Reese of Archaeological Invest. NW
0.958	0.926	0.985	0.880	0.879	0.994	0.059	0.305	0.713	1058 s			NV	Trego Hot Springs 23,200 +/-300 C14 BP	Sample LD-82; THS from Agency Bridge, NV; Benson et al., (1997) Radiocarbon Ages & Environments of Deposition of the Wono and Trego Hot Springs Teph
0.976	0.807	0.965	0.787	0.984	0.868	0.057	0.382	0.712	1623			OR	Newberry - Obsidian in Central Pumice Cone	Unit average (floor, ring, & attached to pumice)
0.960	0.844	0.979	0.960	0.879	0.929	0.064	0.366	0.712	865			OR		Sample 55-1; Four Bulls Site; near Keno ,OR; 400m from Klamath River on shore of what used to be South Klamath Lake; Doug Wilson, Archaeological Invest

Print Date: 7/18/16

Sample: Fierson RC shelter glass 1

number of records searched: 1716

Glass composition of sample:

SiO2	TiO2	Al2O3	MgO	CaO	BaO	MnO	Fe2O3	Na2O	K2O	Cl	Total
70.62	0.32	14.04	0.34	1.04	0.00	0.00	2.05	0.21	11.24	0.14	100.00

weighting factor (only for oxides in bold type)

SiO2	TiO2	Al2O3	MgO	CaO	BaO	MnO	Fe2O3	Na2O	K2O
1	0.25	1	0.25	1			1	1	1

Similiarity Coefficients for 15 closet matches

SiO2	TiO2	Al2O3	MgO	CaO	Fe2O3	Na2O	K2O	sim coef weighted avg	rec#	Std	Date	State	Source/Age	Notes
0.954	0.844	0.900	0.471	0.952	0.840	0.512	0.801	0.813	352			OR	????	35JE51B-2, Glass B , Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
1.000	0.800	0.999	0.810	0.662	0.903	0.202	0.843	0.771	330			OR	????	35JE49, TEU-1-276-1, Ash #2, Central OR, 5 mi SE of Madras
0.938	0.531	0.865	0.088	0.760	0.932	0.476	0.819	0.761	465			OR		Sample 35JE51B, 2520-2, Glass D; Infotec, Willowdale Quad.
0.939	0.531	0.857	0.088	0.683	0.847	0.477	0.790	0.730	348			OR	????	TR-201, Glass B, Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.951	0.844	0.976	0.735	0.937	0.990	0.052	0.383	0.721	506			OR		Lower Ash (bulk composition), Summer Lake Area, Ana River Exposure Locality, P. Wigand, Desert Research Inst.
0.956	0.970	0.978	0.824	0.954	0.851	0.061	0.418	0.718	521			OR		WL-A-9-3, Summer Lake Area, Wetland Levee Core Locality, P. Wigand, Desert Research Inst.
0.961	0.938	0.996	0.735	0.971	0.932	0.042	0.327	0.715	1564			OR	Newberry volcano - Ice Quarry tephra	Sample SK-97-33 T398-3 --- Newberry volcano, SCK site 97-33 (Ice Quarry tephra) --- A. Sarna-Wojicki, written comm. with SCK
0.956	0.702	0.999	0.701	0.968	0.962	0.047	0.361	0.715	1624			OR	Newberry - East Draw tephra (tephra 9714D)	Unit average
0.961	0.906	0.991	0.706	0.963	0.895	0.047	0.369	0.712	565			OR	Newberry 115-1350 BP ???	Sample TU2 Soil Sample 13, Glass 2, depth = 45 cm, Sandy River Delta (confluence of Sandy & Columbia) near Troutdale OR, J. Reese, Arch. Invest. NW
0.958	1.000	0.999	0.941	0.759	0.986	0.053	0.369	0.709	1347			CA	Medicine Lake ~1200 BP	Sample CA-MOD-3911 from a depth of 20-38 cm b.s. at Site #05-09-56-3059 along PGT-PG&E pipline expansion project corridor just southwest of Tionesta &
0.956	0.688	0.993	0.647	0.923	0.990	0.047	0.364	0.709	16			OR	Newberry ?	Lost Lake, Blue Mtns, Or, 3.435m, Mehringer
0.958	0.946	0.982	0.833	0.949	0.886	0.049	0.319	0.706	1628			OR	Newberry - Ice Quarry Tephra (tephra 973B)	Unit average
0.958	0.969	0.999	0.912	0.748	0.990	0.053	0.368	0.706	1346			CA	Medicine Lake ~1200 BP	Sample CA-MOD-3989 from a depth of 24-31 cm b.s. at Site #05-09-56-3065 along PGT-PG&E pipline expansion project corridor just southwest of Tionesta &
0.958	0.875	0.994	0.853	0.832	0.945	0.051	0.371	0.705	507			OR		Lower Ash (glass 1), Summer Lake Area, Ana River Exposure Locality, P. Wigand, Desert Research Inst.
0.957	0.719	0.994	0.618	0.923	0.956	0.045	0.372	0.705	1066			OR	Newberry Crater 1300 BP ??	Sample Skull Creek Dunes, tephra from between big red layer and Mazama, Skull Creek Dunes, Catlow Valley, OR sampled by Peter Mehringer, Department c

Print Date: 7/18/16

Sample: **Fierson RC shelter glass 2**

number of records searched: 1716

Glass composition of sample:

SiO2	TiO2	Al2O3	MgO	CaO	BaO	MnO	Fe2O3	Na2O	K2O	Cl	Total
75.56	0.15	12.28	0.04	0.34	0.00	0.00	0.97	0.38	10.18	0.10	100.00

weighting factor (only for oxides in bold type)

SiO2	TiO2	Al2O3	MgO	CaO	BaO	MnO	Fe2O3	Na2O	K2O	Cl	Total
1	0.25	1	0.25	1			1	1	1		

Similiarity Coefficients for 15 closet matches

SiO2	TiO2	Al2O3	MgO	CaO	Fe2O3	Na2O	K2O	sim coef weighted avg	rec#	Std	Date	State	Source/Age	Notes
0.996	0.882	0.980	0.750	0.479	0.401	0.864	0.872	0.769	348			OR	????	TR-201, Glass B, Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.977	0.333	0.974	1.000	1.000	0.732	0.142	0.607	0.733	1021			CA	Bishop Ash 0.73 Ma ???	REK 3895-35, sample from 50cm thick bed, 10's of meters up section from REK 3895-1 in Death Valley National Monument, 117 degrees and 28' by 37 degrec
0.980	0.556	0.972	0.250	0.343	0.398	0.927	0.884	0.724	352			OR	????	35JE51B-2, Glass B , Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.990	0.617	0.863	0.860	0.962	0.952	0.078	0.432	0.715	1648			OR	Newberry - 98-69 welded tuff - Part 2 (Tepee Draw tuff?)	multiple welded shards
0.980	0.467	0.970	1.000	0.791	0.887	0.107	0.507	0.709	161 s			CA	Glass Mtn-G/1.0-1.1Ma	Glass Mountain-G Ash near Ventura, CA, A. Sarna-Wojcicki et al. (1984) USGS PP 1293
0.977	0.533	0.990	0.800	0.756	0.814	0.129	0.581	0.705	737			CA	Bishop Ash 0.73 Ma ?	Sample RK-3, Mormon Point, Death Valley, Bennetts Well 15' Quad, 116 deg. 46' by 36 deg. 3', Daniel Levish, D-3611, Bur. of Reclamation, Denver, CO 8022
0.969	0.533	0.968	1.000	0.791	0.814	0.139	0.512	0.704	847			UT	Glass Mountain D Ash 1.06 Ma	Average of Glass Mountain ash from 2 cores from Bonneville Basin, Utah, S.K. Williams (1994) Late Cenozoic tephrostratigraphy of deep sediment cores from
1.000	0.938	0.976	0.500	0.447	0.393	0.576	0.817	0.703	345			OR	????	TR-101, Glass B, Site 35JE51B, INFOTEC, Willowdale Quad., OR just north of Willowdale
0.989	0.400	0.959	1.000	0.941	0.732	0.100	0.474	0.699	1449 s			CA	Glass Mtn lower tuffs, ~1.78~1.96 Ma	Sample FLV-48-WW, lower tuffs of Glass Mtn, Fish Lake Valley,CA; Knott, J.R., Sarna-Wojcicki, A.M., Meyer, C.E., Tinsley III, J.C., Wells, S.G., and Wan, E.(1
0.984	0.333	0.954	0.750	0.912	0.814	0.096	0.505	0.698	163			CA	????/	Bailey Ash near Ventura, CA, A. Sarna-Wojcicki et al. (1984) USGS PP 1293
0.981	0.933	0.993	0.800	0.680	0.634	0.182	0.631	0.697	895			WY	Late Pleistocene Yellowstone Tephras	Sample CCP-C (all shards), Cub Creek Pond, core 86C2, 4.88-4.92m, sample from P. Carrara, see Sarna-Wojcicki Memo of 9-May-89
0.978	0.333	0.978	0.750	0.810	0.814	0.120	0.560	0.697	738			CA	Bishop Ash 0.73 Ma ?	Sample RK-4, Mormon Point, Death Valley, Bennetts Well 15' Quad, 116 deg. 46' by 36 deg. 3', Daniel Levish, D-3611, Bur. of Reclamation, Denver, CO 8022
0.975	0.467	0.975	1.000	1.000	0.608	0.103	0.491	0.695	733 s			CA	Tuff of Taylor Canyon ~2.1-2.2Ma	Average of 7 samples of distal and proximal samples of the middle part of the Tuff of Taylor Canyon erupted fom Glass Mountain; Reheis et al. (1993) GSA Bul
0.980	0.533	0.959	1.000	0.773	0.794	0.109	0.519	0.695	1442 s			CA	Glass Mtn upper ash beds, ~0.8~1.2 Ma	Sample JRK-DV-8, 2 cm thick bed at Mormon Point, Death Valley, CA, Knott, J.R., Sarna-Wojcicki, A.M., Meyer, C.E., Tinsley III, J.C., Wells, S.G., and Wan, E
0.976	0.882	0.990	0.571	0.500	0.882	0.196	0.608	0.695	474			OR		Stringy clear pumice, Ash flow tuff from near site 35-JE-51B, Jefferson Co., OR, C. Skinner, Infotec Res.

Page 1 of 1

APPENDIX B

BETA ANALYTIC INC. RADIOCARBON DATING RESULTS

BETA
Consistent accuracy delivered on time

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Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

February 13, 2017

Mr. Andrew Frierson
Washington State University
Pullman, WA 99163
United States

RE: Radiocarbon Dating Results.

Dear Mr. Frierson:

Enclosed are the radiocarbon dating results for 14 samples recently sent to us. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable. The Conventional Radiocarbon Ages have all been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratory and counted in our own accelerators here. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analyses.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C values were measured separately in an IRMS (isotope ratio mass spectrometer). They are NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the results, please consider any communications you may have had with us regarding the samples. As always, your inquiries are most welcome. If you have any questions or would like further details of the analyses, please do not hesitate to contact us.

Our invoice has been sent separately. Thank you for your prior efforts in arranging payment. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD
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beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Andrew Frierson — Report Date: 2/13/2017

Washington State University — Material Received: 1/30/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457051 1793 AMS-Standard delivery	2260 +/- 30 BP	d13C= -24.1	2270 +/- 30 BP
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal BC 395 to 350 (Cal BP 2345 to 2300) and Cal BC 295 to 230 (Cal BP 2245 to 2180) Cal BC 220 to 210 (Cal BP 2170 to 2160)			
Beta - 457052 1429 AMS-Standard delivery	1370 +/- 30 BP	d13C= -25.4	1360 +/- 30 BP
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 640 to 680 (Cal BP 1310 to 1270)			
Beta - 457053 1917 AMS-Standard delivery	740 +/- 30 BP	d13C= -22.5	780 +/- 30 BP
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 1215 to 1280 (Cal BP 735 to 670)			
Beta - 457054 1880 AMS-Standard delivery	2970 +/- 30 BP	d13C= -25.5	2960 +/- 30 BP
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal BC 1260 to 1075 (Cal BP 3210 to 3025) and Cal BC 1065 to 1055 (Cal BP 3015 to 3005)			
Beta - 457055 1942 AMS-Standard delivery	2300 +/- 30 BP	d13C= -24.5	2310 +/- 30 BP
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal BC 405 to 360 (Cal BP 2355 to 2310)			
Beta - 457057 1471 AMS-Standard delivery	1560 +/- 30 BP	d13C= -25.0	1560 +/- 30 BP
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 420 to 570 (Cal BP 1530 to 1380)			

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD

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MIAMI, FLORIDA, USA 33155
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beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Andrew Frierson — Report Date: 2/13/2017

Washington State University — Material Received: 1/30/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457058 1739 AMS-Standard delivery	2890 +/- 30 BP	d13C= -25.5	2880 +/- 30 BP

MATERIAL/PRETREATMENT: (wood): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 1155 to 1145 (Cal BP 3105 to 3095) and Cal BC 1125 to 975 (Cal BP 3075 to 2925)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457059 1727 AMS-Standard delivery	4570 +/- 50 BP	d13C= -24.5	4580 +/- 50 BP

MATERIAL/PRETREATMENT: (burned bone organics): collagen extration: with alkali
2 SIGMA CALIBRATION : Cal BC 3500 to 3430 (Cal BP 5450 to 5380) and Cal BC 3380 to 3265 (Cal BP 5330 to 5215)
Cal BC 3240 to 3105 (Cal BP 5190 to 5055)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457060 1871 AMS-Standard delivery	1560 +/- 30 BP	d13C= -24.2	1570 +/- 30 BP

MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 415 to 560 (Cal BP 1535 to 1390)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457061 604 AMS-Standard delivery	2180 +/- 30 BP	d13C= -21.3	2240 +/- 30 BP

MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 390 to 340 (Cal BP 2340 to 2290) and Cal BC 325 to 205 (Cal BP 2275 to 2155)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457062 1820 AMS-Standard delivery	7500 +/- 40 BP	d13C= -25.4	7490 +/- 40 BP

MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 6435 to 6250 (Cal BP 8385 to 8200)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457063 1674 AMS-Standard delivery	4870 +/- 30 BP	d13C= -20.9 d15N= +7.7	4940 +/- 30 BP

MATERIAL/PRETREATMENT: (bone collagen): collagen extration: with alkali
2 SIGMA CALIBRATION : Cal BC 3780 to 3650 (Cal BP 5730 to 5600)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

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REPORT OF RADIOCARBON DATING ANALYSES

Mr. Andrew Frierson — Report Date: 2/13/2017

Washington State University — Material Received: 1/30/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457064 1408 AMS-Standard delivery	3200 +/- 30 BP	d13C= -23.2	3230 +/- 30 BP

MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : cal BC 1605 - 1585 (cal BP 3555 - 3535) and cal BC 1545 - 1435 (cal BP 3495 - 3385)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457065 1409 AMS-Standard delivery	1930 +/- 30 BP	d13C= -22.4	1970 +/- 30 BP

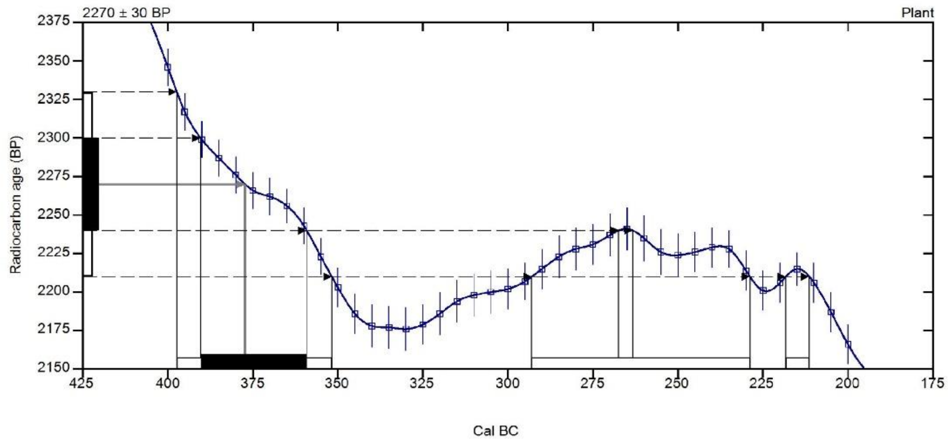
MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : cal BC 40 - cal AD 40 (cal BP 1990 - 1870)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.1 o/oo : lab. mult = 1)

Laboratory number	**Beta-457051 : 1793**
Conventional radiocarbon age	**2270 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 395 to 350 (Cal BP 2345 to 2300)** **Cal BC 295 to 230 (Cal BP 2245 to 2180)** **Cal BC 220 to 210 (Cal BP 2170 to 2160)**
Intercept of radiocarbon age with calibration curve	Cal BC 375 (Cal BP 2325)
Calibrated Result (68% Probability)	Cal BC 390 to 360 (Cal BP 2340 to 2310)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -25.4 o/oo : lab. mult = 1)

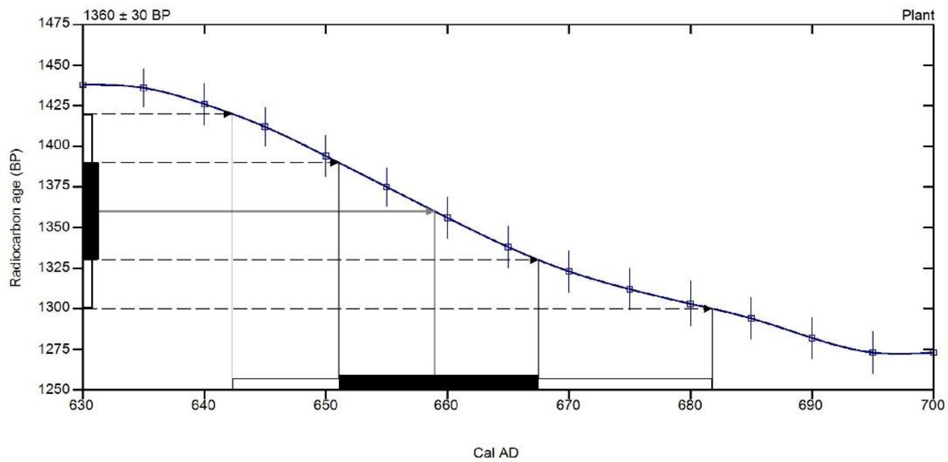
Laboratory number **Beta-457052 : 1429**

Conventional radiocarbon age **1360 ± 30 BP**

Calibrated Result (95% Probability) **Cal AD 640 to 680 (Cal BP 1310 to 1270)**

Intercept of radiocarbon age with calibration curve Cal AD 660 (Cal BP 1290)

Calibrated Result (68% Probability) Cal AD 650 to 670 (Cal BP 1300 to 1280)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
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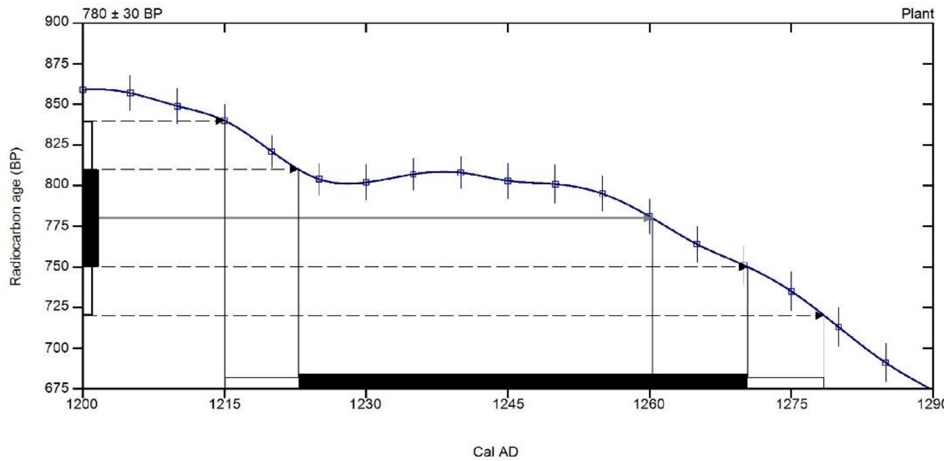
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-457053 : 1917**
Conventional radiocarbon age	**780 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1215 to 1280 (Cal BP 735 to 670)**
Intercept of radiocarbon age with calibration curve	Cal AD 1260 (Cal BP 690)
Calibrated Result (68% Probability)	Cal AD 1225 to 1270 (Cal BP 725 to 680)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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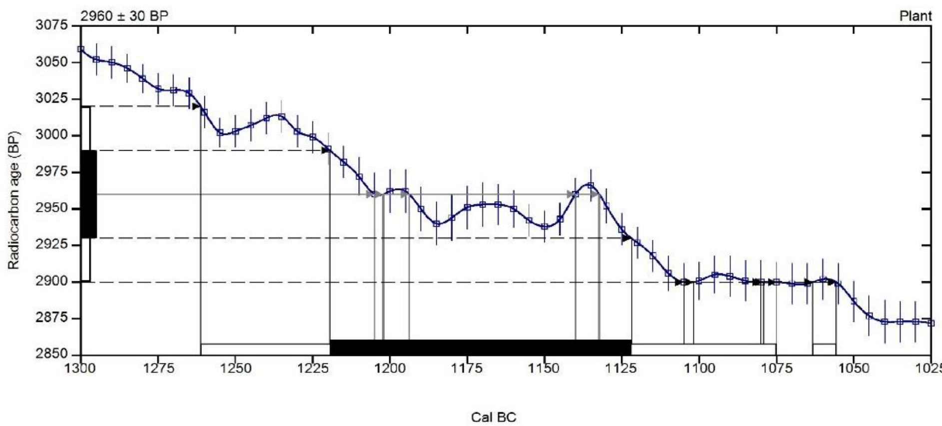
(Variables: C13/C12 = -25.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-457054 : 1880**
Conventional radiocarbon age	**2960 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 1260 to 1075 (Cal BP 3210 to 3025)** **Cal BC 1065 to 1055 (Cal BP 3015 to 3005)**
Intercept of radiocarbon age with calibration curve	Cal BC 1205 (Cal BP 3155) Cal BC 1200 (Cal BP 3150) Cal BC 1195 (Cal BP 3145) Cal BC 1140 (Cal BP 3090) Cal BC 1130 (Cal BP 3080)
Calibrated Result (68% Probability)	Cal BC 1220 to 1120 (Cal BP 3170 to 3070)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
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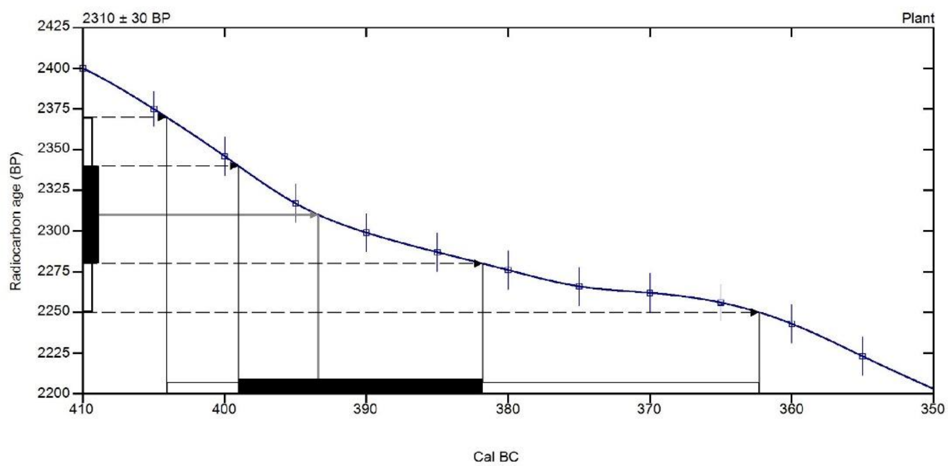
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-457055 : 1942**
Conventional radiocarbon age	**2310 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 405 to 360 (Cal BP 2355 to 2310)**
Intercept of radiocarbon age with calibration curve	Cal BC 395 (Cal BP 2345)
Calibrated Result (68% Probability)	Cal BC 400 to 380 (Cal BP 2350 to 2330)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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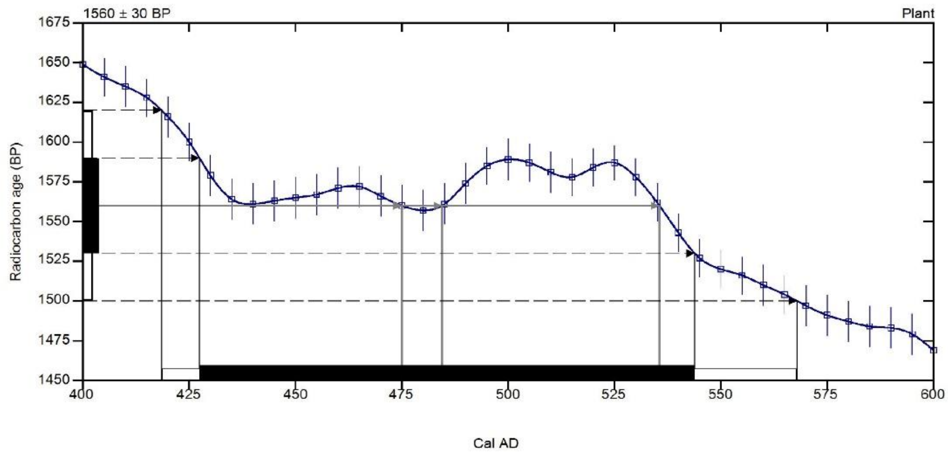
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -25 o/oo : lab. mult = 1)

Laboratory number	**Beta-457057 : 1471**
Conventional radiocarbon age	**1560 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 420 to 570 (Cal BP 1530 to 1380)**
Intercept of radiocarbon age with calibration curve	Cal AD 475 (Cal BP 1475) Cal AD 485 (Cal BP 1465) Cal AD 535 (Cal BP 1415)
Calibrated Result (68% Probability)	Cal AD 425 to 545 (Cal BP 1525 to 1405)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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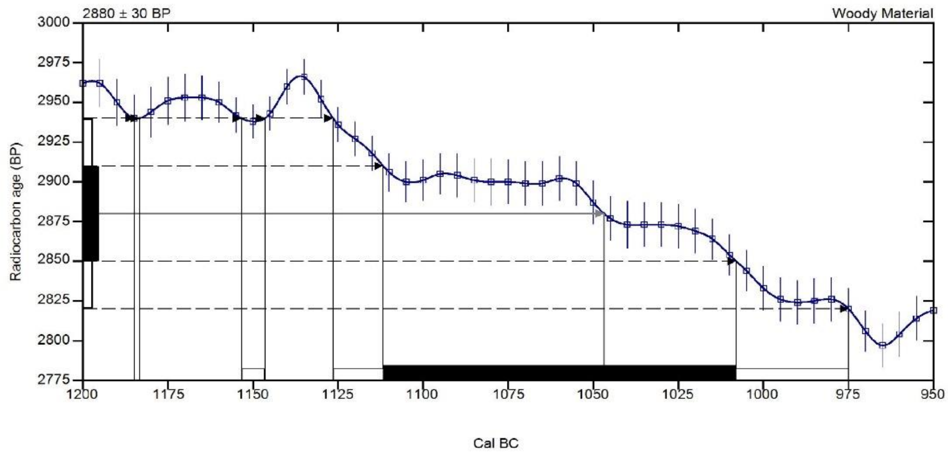
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -25.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-457058 : 1739**
Conventional radiocarbon age	**2880 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 1155 to 1145 (Cal BP 3105 to 3095)** **Cal BC 1125 to 975 (Cal BP 3075 to 2925)**
Intercept of radiocarbon age with calibration curve	Cal BC 1045 (Cal BP 2995)
Calibrated Result (68% Probability)	Cal BC 1110 to 1010 (Cal BP 3060 to 2960)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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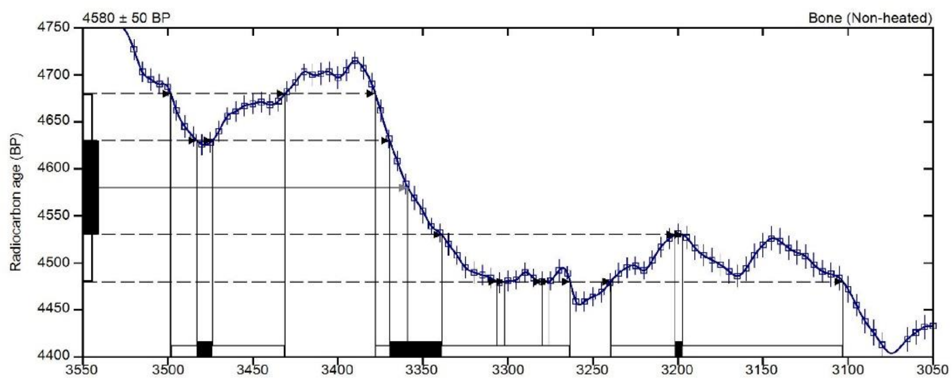
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-457059 : 1727**
Conventional radiocarbon age	**4580 ± 50 BP**
Calibrated Result (95% Probability)	**Cal BC 3500 to 3430 (Cal BP 5450 to 5380)** **Cal BC 3380 to 3265 (Cal BP 5330 to 5215)** **Cal BC 3240 to 3105 (Cal BP 5190 to 5055)**
Intercept of radiocarbon age with calibration curve	Cal BC 3360 (Cal BP 5310)
Calibrated Result (68% Probability)	Cal BC 3485 to 3475 (Cal BP 5435 to 5425) Cal BC 3370 to 3340 (Cal BP 5320 to 5290) Cal BC 3200 to 3195 (Cal BP 5150 to 5145)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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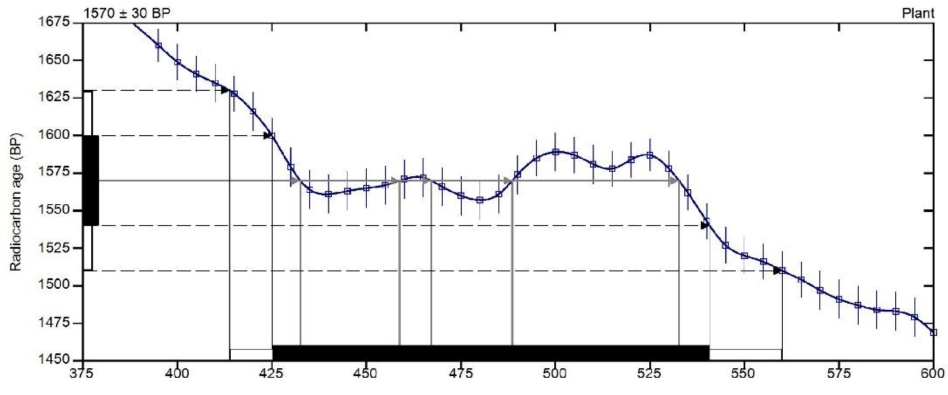
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.2 o/oo : lab. mult = 1)

Laboratory number	**Beta-457060 : 1871**
Conventional radiocarbon age	**1570 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 415 to 560 (Cal BP 1535 to 1390)**
Intercept of radiocarbon age with calibration curve	Cal AD 435 (Cal BP 1515) Cal AD 460 (Cal BP 1490) Cal AD 465 (Cal BP 1485) Cal AD 490 (Cal BP 1460) Cal AD 535 (Cal BP 1415)
Calibrated Result (68% Probability)	Cal AD 425 to 540 (Cal BP 1525 to 1410)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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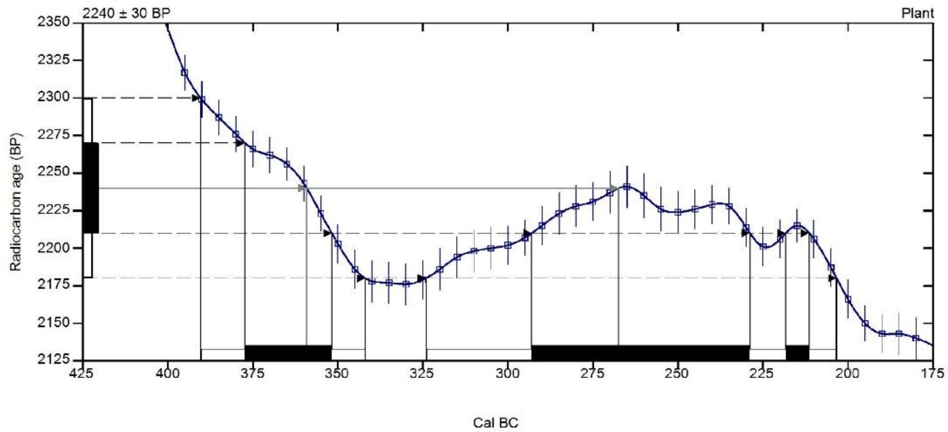
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -21.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-457061 : 604**
Conventional radiocarbon age	**2240 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 390 to 340 (Cal BP 2340 to 2290)** **Cal BC 325 to 205 (Cal BP 2275 to 2155)**
Intercept of radiocarbon age with calibration curve	Cal BC 360 (Cal BP 2310) Cal BC 265 (Cal BP 2215)
Calibrated Result (68% Probability)	Cal BC 375 to 350 (Cal BP 2325 to 2300) Cal BC 295 to 230 (Cal BP 2245 to 2180) Cal BC 220 to 210 (Cal BP 2170 to 2160)



Database used
INTCAL13

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Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -25.4 o/oo : lab. mult = 1)

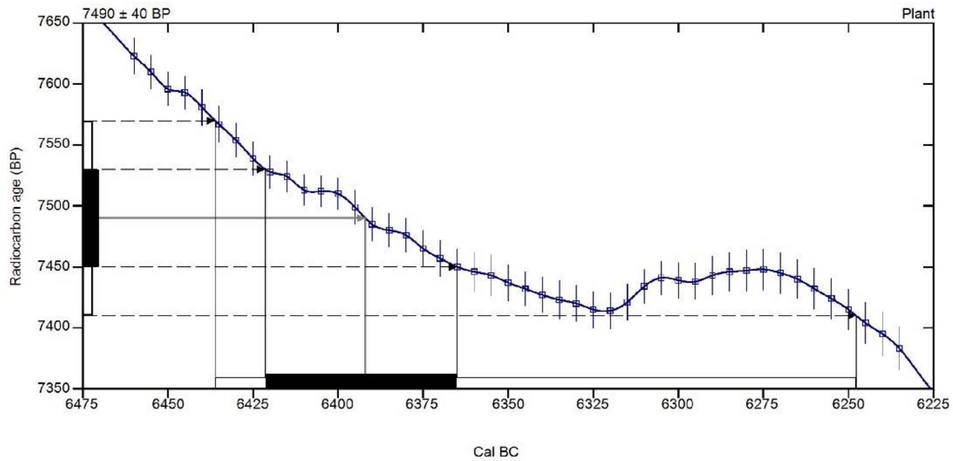
Laboratory number **Beta-457062 : 1820**

Conventional radiocarbon age **7490 ± 40 BP**

Calibrated Result (95% Probability) **Cal BC 6435 to 6250 (Cal BP 8385 to 8200)**

Intercept of radiocarbon age with calibration curve Cal BC 6390 (Cal BP 8340)

Calibrated Result (68% Probability) Cal BC 6420 to 6365 (Cal BP 8370 to 8315)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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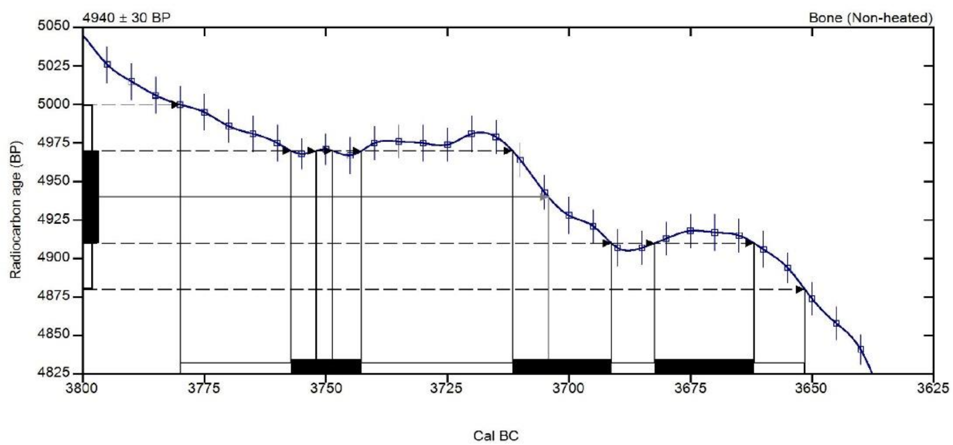
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -20.9 o/oo : lab. mult = 1)

Laboratory number	**Beta-457063 : 1674**
Conventional radiocarbon age	**4940 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 3780 to 3650 (Cal BP 5730 to 5600)**
Intercept of radiocarbon age with calibration curve	Cal BC 3705 (Cal BP 5655)
Calibrated Result (68% Probability)	Cal BC 3755 to 3745 (Cal BP 5705 to 5695) Cal BC 3710 to 3690 (Cal BP 5660 to 5640) Cal BC 3680 to 3660 (Cal BP 5630 to 5610)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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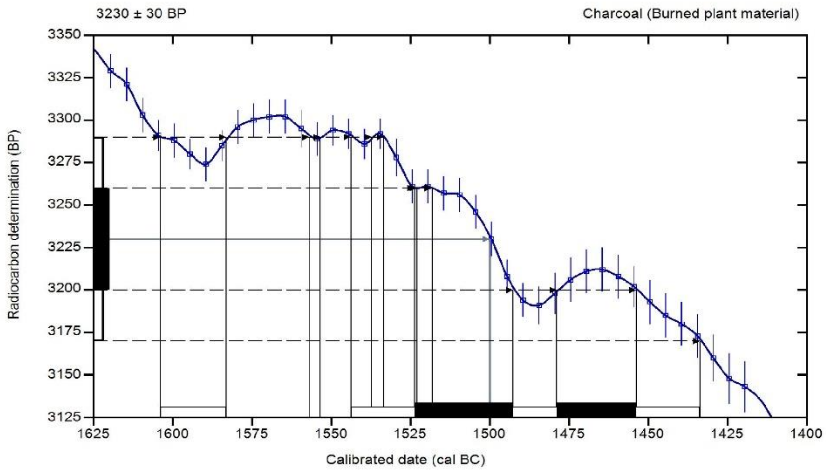
Calibration of Radiocarbon Age to Calendar Years

(Variables: d13C = -23.2 o/oo)

Laboratory number	**Beta-457064 1408**	
Conventional radiocarbon age	**3230 ± 30 BP**	
2 Sigma calibrated result	**cal BC 1605 - 1585**	**(cal BP 3555 - 3535)**
95% probability	**cal BC 1545 - 1435**	**(cal BP 3495 - 3385)**
Intercept of radiocarbon age with calibration curve	cal BC 1500 (cal BP 3450)	
1 Sigma calibrated results	**cal BC 1525 - 1495**	**(cal BP 3475 - 3445)**
68% probability	**cal BC 1480 - 1455**	**(cal BP 3430 - 3405)**



Database used

INTCAL13

References

References to Intercept Method

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2) : 317-322

References to Database INTCAL13

Reimer, et.al., 2013, Radiocarbon55(4).

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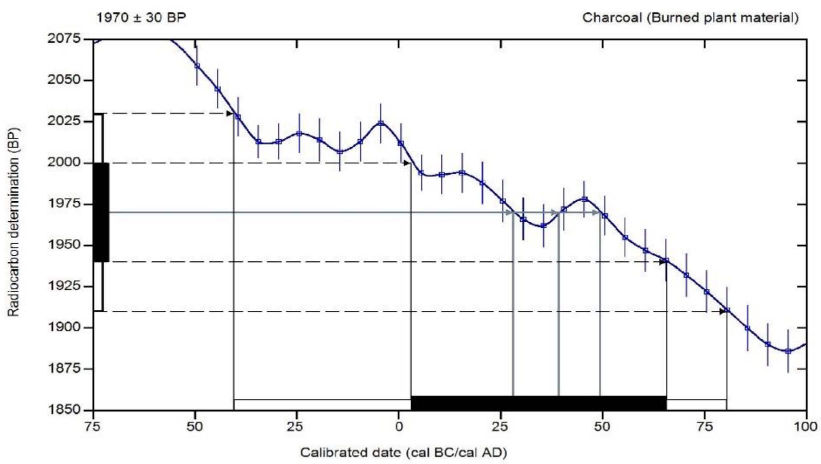
Calibration of Radiocarbon Age to Calendar Years

(Variables: d13C = -22.4 o/oo)

Laboratory number	**Beta-457065 1409**	
Conventional radiocarbon age	**1970 ± 30 BP**	
2 Sigma calibrated result 95% probability	**cal BC 40 - cal AD 40**	**(cal BP 1990 - 1870)**
Intercept of radiocarbon age with calibration curve	cal AD 30 (cal BP 1920) cal AD 40 (cal BP 1910) cal AD 50 (cal BP 1900)	
1 Sigma calibrated results 68% probability	**cal AD 5 - 65**	**(cal BP 1945 - 1885)**



Database used

INTCAL13

References

References to Intercept Method

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2) : 317-322

References to Database INTCAL13

Reimer, et.al., 2013, Radiocarbon55(4).

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APPENDIX C

1967 STRATIGRAPHY NOTES AND DATES

1967 Field Notes for Trench 1 and AMS dates.

Stratum	Matrix	Color	Thickness	Inclusions/Remarks	Artifacts	^{14}C BP Date 2σ cal BP Range
I	No Data	Brown	8 cm	Many plant fragments	No Data	1560 ± 30 1530-1380
II	Ashy	Gray	8 cm	Few plant debris	No Data	1570 ± 30 1535-1390
III	No Data	No Data	12 cm	Plant fragments and pebbles	No Data	No Data
IV	No Data	No Data	10 cm	Plant fragments and pebbles	No Data	No Data
V	No Data	No Data	22 cm	Plant fragments and pebbles	No Data	2960 ± 30 3210-3005
VI	No Data	No Data	20 cm	Plant fragments and pebbles	No Data	No Data
VII	No Data	No Data	20 cm	Plant fragments and pebbles	No Data	4940 ± 30 5730-5600
VIII	No Data	No Data	40 cm	Plant fragments and pebbles	No Data	4580 ± 50 5450-5055
IX	Sandy loam; sticky;	Light Brown	30 cm	Pebbles; occasional compacted areas	No Data	2880 ± 30 3105-2925
X	No Data	No Data	No Data	No Data	No Data	No Data

1967 Field Notes for Trench 2 and AMS dates.

Stratum	Matrix	Color	Thickness	Inclusions/Remarks	Artifacts	^{14}C BP Date 2σ cal BP Range
I	Very fine silt; loose; non-sticky; non-plastic; rodent-churned	10 YR 5/2; Grayish brown	8-14 cm	Many plant remains; scatological remains; rodent nests; bird shells; few pebbles; some heavy roof-fall	Cordage; flakes	2240 ± 30 2340-2155
II	Very fine silt; compact; less rodent mixing	10 YR 5/2; Grayish brown	5-10 cm	Heavy mat of plant fragments and cordage at bottom; some scatological remains; few pebbles	No Data	1360 ± 30 1310-1270
III	Very fine silt; compact; little evidence of rodents	No Data	4-8 cm	Some mat of plant fragments at bottom	Many flakes at bottom; hearth area at bottom in NW corner of trench	No Data
IV	Fine silt; compact	No Data	10-12 cm	Mat of plant fiber and rodent nest at bottom; since Level IV does not extend into south margin of trench, we extended it north about ½ meter into a slightly disturbed area		1970 ± 30 3230 ± 30 1990-1870 3555-3385
V	Very fine silt; loose	10 YR 5/2; Grayish brown	10-12 cm	Plant remains; scatological remains; bird feathers; nest fragments; egg shell fragments; several krotovinas filled with plant remains	3 hand stones (manos) associated with hearth areas but in different levels	No Data
VI	No Data	No Data	Indeterminable	First arbitrary level; arbitrary levels were begun because of little differentiation in natural stratigraphy and sharp decrease in cultural materials	Metate found in sparse cultural deposit 15-18 cm below hearth in Level III	7490 ± 40 8385-8200

1967 Field Notes for Trench 3 and AMS dates.

Stratum	Matrix	Color	Thickness	Inclusions/Remarks	Artifacts	^{14}C BP Date 2σ cal BP Range
I	Very fine silt; loose	10YR5/2; Grayish brown	12-24 cm	Plant fragments and scatological remains mixed throughout	Mano; flakes; cordage	780 ± 30 735-670
II	Ashy (from hearth area)	10YR7/2; Light gray (dry)	20-24 cm	Small pebbles; small bits of calcined bone; rodent holes; much plant material at top and little within ash	Many small flakes; specks of charcoal; expanding stemmed point at base of level	No Data
III	Very fine silt	10 YR 4/1 Dark gray	22-24 cm	Much matting and plant fibers; some ash; rat nest in central portion of level	Olivella shell bead close to bottom at north wall of pit	2270 ± 30 2245-2160
IV	No Data	10 YR 5/2; Grayish brown	Indeterminable	Pumice material at 95 cm below surface located at south end of pit	Mat/basket from rat nest; leaf shaped knife ca. 75 cm below surface at south end of pit; basketry and cordage 140 cm below surface at north end from rodent nest in bottom of central part of pit	2310 ± 30 2355-2310

APPENDIX D

NORTHWEST OBSIDIAN X-RAY FLUORESCENCE RESULTS

Northwest Research Obsidian Studies Laboratory Report 2017-04

X-Ray Fluorescence Analysis of Obsidian Artifacts from 35-LK-22, Lake County, Oregon

Alex J. Nyers
Northwest Research Obsidian Studies Laboratory

One hundred artifacts from site 35-LK-22, (N = 100), Lake County, Oregon were submitted for energy dispersive X-ray fluorescence trace element provenance analysis. The samples were prepared and analyzed at the Northwest Research Obsidian Studies Laboratory under the accession number 2017-4.

Analytical Methods

X-Ray Fluorescence Analysis. Nondestructive trace element analysis of the samples were completed using a Thermo NORAN QuanX-EC energy dispersive X-ray fluorescence (EDXRF) spectrometer. The analyzer uses an X-ray tube excitation source and a solid-state detector to provide spectroscopic analysis of elements ranging from sodium to uranium (atomic numbers 11 to 92) and in concentrations ranging from a few parts per million to 100 percent. The system is equipped with a Peltier-cooled Si(Li) detector and an air-cooled X-ray tube with a rhodium target and a 76 micron Be window. The tube is driven by a 50 kV 2mA high voltage power supply, providing a voltage range of 4 to 50 kV. During operation, the tube current is automatically adjusted to an optimal 50% dead time, a variable that is significantly influenced by the varying physical sizes of the different analyzed samples. Small specimens are mounted in 32 mm-diameter sample cups with mylar windows on a 20-position sample tray while larger samples are fastened directly to the surface of the tray.

For the elements that are reported in Table A-1, we analyzed the collection with a 3.5 mm as well as an 8.8mm beam collimator installed with tube voltage and count times adjusted for optimum results. Instrument control and data analysis are performed using WinTrace software (version 7) running under the Windows 7 operating system.

The diagnostic trace element values used to characterize the samples are compared directly to those for known obsidian and fine-grained volcanic (FGV) sources reported in the literature and with unpublished trace element data collected through analysis of geologic source samples (Northwest Research 2017a). Artifacts are correlated to a parent obsidian, FGV, or basalt source (or geochemical source group) if diagnostic trace element values fall within about two standard deviations of the analytical uncertainty of the known upper and lower limits of chemical variability recorded for the source. Occasionally, visual attributes are used to corroborate the source assignments although sources are never assigned solely on the basis of megascopic characteristics.

Results of Analysis

X-Ray Fluorescence Analysis. The obsidian artifacts analyzed by X-ray fluorescence methods were correlated with thirteen known obsidian sources. The locations of the sites and the identified sources are shown in Figure 1. Analytical results are presented in Table A-1 in the Appendix and are summarized in Table 1 and Figure 2.

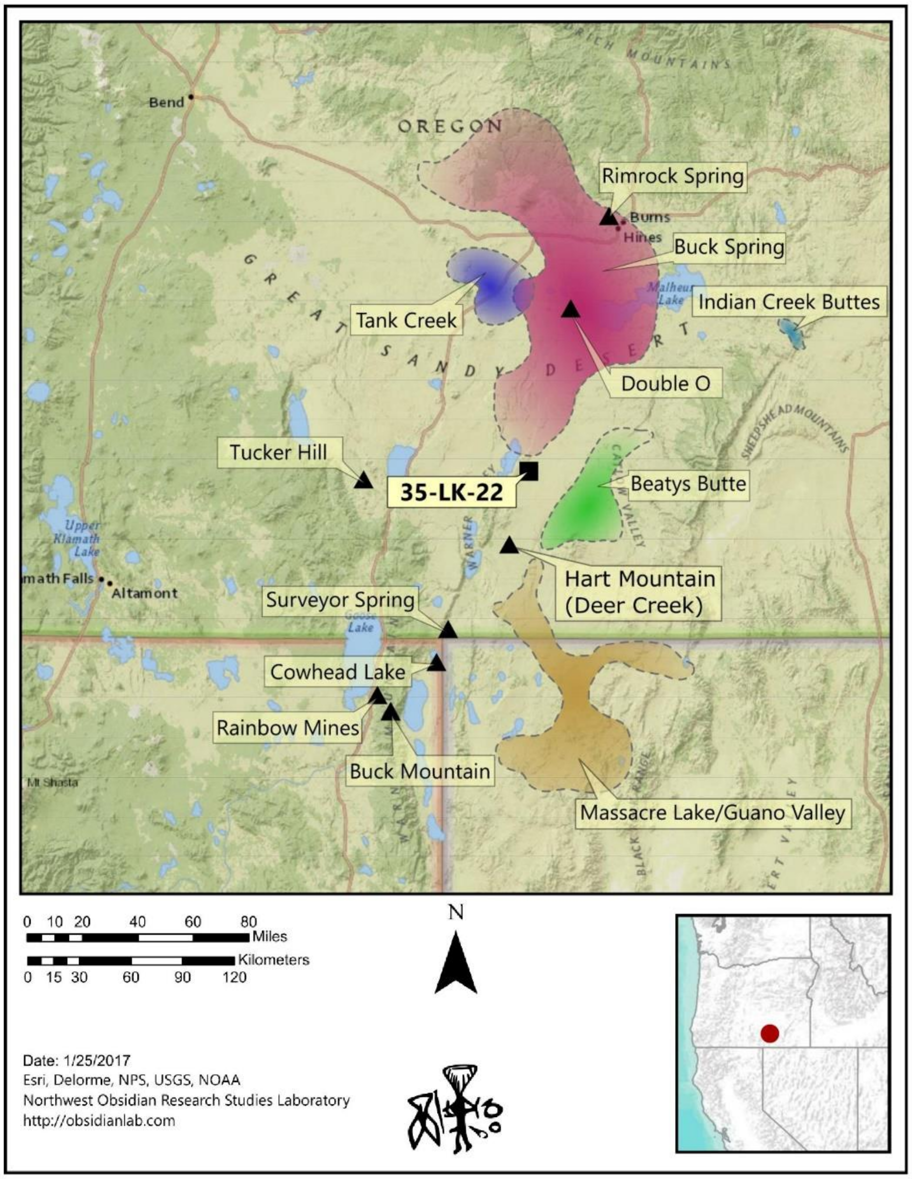

Figure 1. Locations of the project site and sources of the obsidian artifacts. Black triangles in the map above designate the location of the identified sources. Shaded polygons represent boundaries of geologic sources of obsidian that are distributed over a large geographic area.

Table 1. Summary of results of trace element analysis of the project specimens.

GEOCHEMICAL SOURCE	N=	PERCENTAGE
Beatys Butte	75	75%
Buck Mountain	9	9%
Buck Spring	3	3%
Cowhead Lake	1	1%
Double O	2	2%
Hart Mountain (Deer Creek)	1	1%
Indian Creek Buttes	2	2%
Massacre Lake/Guano Valley	2	2%
Rainbow Mines	1	1%
Rimrock Spring	1	1%
Surveyor Spring	1	1%
Tank Creek	1	1%
Tucker Hill	1	1%
TOTAL	**100**	**100%**

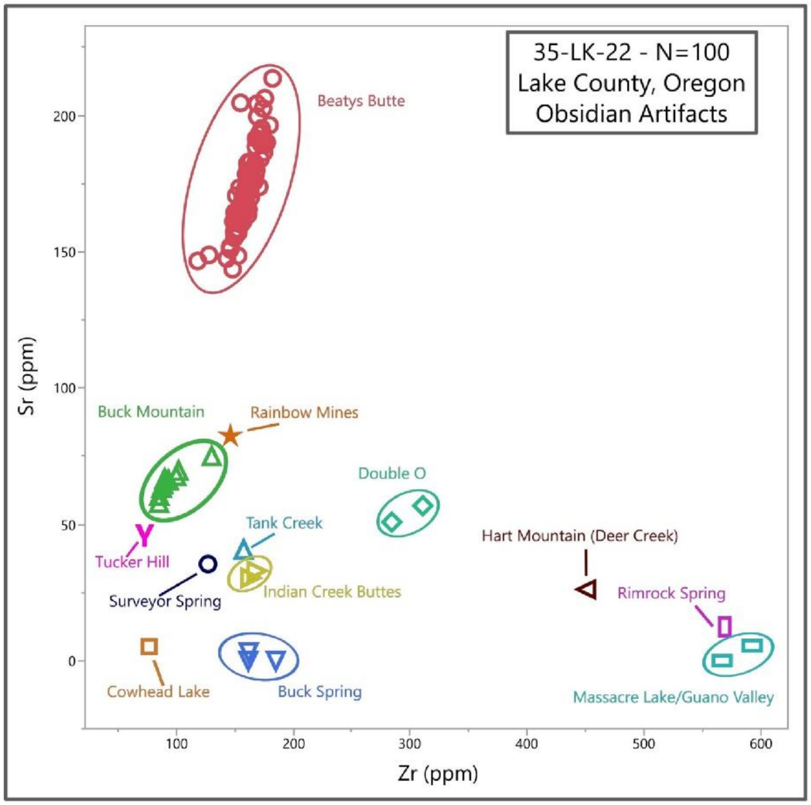

Figure 2 - Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for analyzed artifacts.

Information concerning the location, geologic setting, and prehistoric use of obsidian sources identified in the current investigation may be found at www.sourcecatalog.com (Northwest Research 2017b).

References Cited

Northwest Research Obsidian Studies Laboratory

2017a Northwest Research Obsidian Studies Laboratory World Wide Web Site (www.obsidianlab.com).

2017b Northwest Research U. S. Obsidian Source Catalog (www.sourcecatalog.com).

Appendix

Results of X-Ray Fluorescence Analysis

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Ratios Fe:Mn	Fe:Ti	Geochemical Source
35-LK-22	1	1037	126	157	16	153	8	NM	NM	768	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	29	NM			
35-LK-22	2	1076	135	191	14	171	11	NM	NM	740	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	35	NM			
35-LK-22	3	1013	66	26	44	451	47	NM	NM	841	NM	NM	NM	Hart Mountain (Deer Creek)
			± 3	2	2	4	3	NM	NM	28	NM			
35-LK-22	4	1	106	205	16	155	9	NM	NM	871	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	5	1070	130	168	17	158	10	NM	NM	717	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	31	NM			
35-LK-22	6	612	111	70	18	102	12	NM	NM	394	NM	NM	NM	Buck Mountain
			± 3	2	2	2	2	NM	NM	31	NM			
35-LK-22	7	615	123	163	13	157	10	NM	NM	814	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	28	NM			
35-LK-22	8	611	116	152	14	146	8	NM	NM	735	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	9	20	147	184	16	172	10	NM	NM	796	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	29	NM			
35-LK-22	10	621	156	190	18	177	13	NM	NM	798	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	27	NM			
35-LK-22	11	913	145	189	14	175	10	NM	NM	692	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	28	NM			
35-LK-22	12	28	126	149	16	153	10	NM	NM	782	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	26	NM			
35-LK-22	13	914	149	214	17	182	8	NM	NM	843	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	29	NM			
35-LK-22	14	880	122	171	15	157	9	NM	NM	856	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	26	NM			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.		Trace Element Concentrations Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Ratios Fe:Mn	Fe:Ti	Geochemical Source
35-LK-22	15	34		132	174	12	162	11	NM	NM	834	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	25	NM			
35-LK-22	16	220		125	170	15	159	12	NM	NM	728	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	32	NM			
35-LK-22	17	427		144	203	14	174	11	NM	NM	864	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	31	NM			
35-LK-22	18	428		152	191	16	173	9	NM	NM	780	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	33	NM			
35-LK-22	19	1276		143	182	17	168	10	NM	NM	871	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	25	NM			
35-LK-22	20	466		119	0	98	185	41	NM	NM	0	NM	NM	NM	Buck Spring
			±	3	1	2	3	2	NM	NM	19	NM			
35-LK-22	21	472		130	164	14	156	11	NM	NM	814	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	31	NM			
35-LK-22	22	1118		131	166	14	162	10	NM	NM	845	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	26	NM			
35-LK-22	23	277		127	179	15	162	7	NM	NM	930	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	29	NM			
35-LK-22	24	50		135	178	15	168	8	NM	NM	843	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	24	NM			
35-LK-22	25	278		152	196	18	180	15	NM	NM	902	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	30	NM			
35-LK-22	26	282		134	164	14	162	10	NM	NM	884	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	27	NM			
35-LK-22	27	53		112	144	14	148	9	NM	NM	858	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	26	NM			
35-LK-22	28	1114		127	83	21	146	8	NM	NM	863	NM	NM	NM	Rainbow Mines
			±	3	2	2	3	2	NM	NM	24	NM			

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NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations: Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Ratios: Fe:Mn	Fe:Ti	Geochemical Source
35-LK-22	29	231	134	174	18	171	11	NM	NM	898	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	22	NM			
35-LK-22	30	306	122	167	16	158	8	NM	NM	912	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	25	NM			
35-LK-22	31	316	149	192	17	168	8	NM	NM	803	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	41	NM			
35-LK-22	32	65	131	172	17	162	9	NM	NM	908	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	25	NM			
35-LK-22	33	340	151	190	17	176	11	NM	NM	773	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	37	NM			
35-LK-22	34	175	113	161	13	151	4	NM	NM	858	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	33	NM			
35-LK-22	35	96	120	169	14	159	9	NM	NM	936	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	28	NM			
35-LK-22	36	176	125	164	16	155	8	NM	NM	824	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	32	NM			
35-LK-22	37	97	122	5	30	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
			± 3	1	2	2	2	NM	NM	18	NM			
35-LK-22	38	95	129	189	11	168	9	NM	NM	946	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	26	NM			
35-LK-22	39	143	112	151	12	146	11	NM	NM	788	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	32	NM			
35-LK-22	40	168	137	180	15	169	9	NM	NM	814	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	33	NM			
35-LK-22	41	148	142	204	16	169	10	NM	NM	847	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	33	NM			
35-LK-22	42	99	101	41	40	158	18	NM	NM	1509	NM	NM	NM	Tank Creek
			± 3	3	2	3	2	NM	NM	25	NM			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations: Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Ratios: Fe:Mn	Fe:Ti	Geochemical Source
35-LK-22	43	140	127	169	18	160	10	NM	NM	835	NM	NM	NM	Beatys Butte
			± 3	2	2	3	2	NM	NM	26	NM			
35-LK-22	44	102	126	176	15	167	10	NM	NM	915	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	23	NM			
35-LK-22	45	416	132	172	13	163	10	NM	NM	566	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	31	NM			
35-LK-22	46	112	130	194	16	174	12	NM	NM	1024	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	47	105	130	170	15	164	10	NM	NM	951	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	23	NM			
35-LK-22	48	104	138	182	12	161	7	NM	NM	863	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	31	NM			
35-LK-22	49	1948	145	194	16	172	12	NM	NM	788	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	34	NM			
35-LK-22	50	1947	138	179	15	160	10	NM	NM	756	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	36	NM			
35-LK-22	51	1951	122	161	15	157	9	NM	NM	955	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	23	NM			
35-LK-22	52	744	133	174	14	160	10	NM	NM	747	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	53	741	137	183	16	164	11	NM	NM	732	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	29	NM			
35-LK-22	54	743	120	165	15	158	9	NM	NM	792	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	28	NM			
35-LK-22	55	742	144	206	14	176	10	NM	NM	845	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	56	746	115	157	11	150	9	NM	NM	785	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	25	NM			

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NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
			Trace Element Concentrations									Ratios		
35-LK-22	57	745	114	171	14	151	10	NM	NM	900	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	27	NM			
35-LK-22	58	71	112	165	14	150	7	NM	NM	730	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	31	NM			
35-LK-22	59	73	101	67	17	90	9	NM	NM	592	NM	NM	NM	Buck Mountain
			± 3	3	2	3	2	NM	NM	24	NM			
35-LK-22	60	37	104	46	24	73	13	NM	NM	255	NM	NM	NM	Tucker Hill
			± 3	2	2	2	2	NM	NM	22	NM			
35-LK-22	61	42	130	200	14	169	11	NM	NM	906	NM	NM	NM	Beatys Butte
			± 3	2	2	2	2	NM	NM	28	NM			
35-LK-22	62	43	141	176	13	165	9	NM	NM	841	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	29	NM			
35-LK-22	63	82	108	147	10	118	5	NM	NM	649	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	32	NM			
35-LK-22	64	80	161	35	25	127	11	NM	NM	251	NM	NM	NM	Surveyor Spring
			± 3	3	2	3	3	NM	NM	26	NM			
35-LK-22	65	25	209	6	88	592	38	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
			± 3	2	2	2	2	NM	NM	22	NM			
35-LK-22	66	61	105	149	11	128	6	NM	NM	539	NM	NM	NM	Beatys Butte
			± 3	2	2	4	2	NM	NM	32	NM			
35-LK-22	67	301	211	0	87	567	33	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
			± 3	3	2	2	2	NM	NM	22	NM			
35-LK-22	68	46	123	168	14	156	8	NM	NM	832	NM	NM	NM	Beatys Butte
			± 4	2	3	4	2	NM	NM	28	NM			
35-LK-22	69	38	122	164	13	154	8	NM	NM	835	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	27	NM			
35-LK-22	70	120	121	163	17	151	10	NM	NM	808	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	25	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^{2}O^{3T}$	Fe:Mn	Fe:Ti	Geochemical Source
			Trace Element Concentrations									Ratios		
35-LK-22	71	44	119	158	16	153	7	NM	NM	787	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	28	NM			
35-LK-22	72	122	145	187	16	175	11	NM	NM	697	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	73	751	142	177	15	163	12	NM	NM	749	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	30	NM			
35-LK-22	74	110	122	75	20	130	11	NM	NM	692	NM	NM	NM	Buck Mountain
			± 3	2	2	2	2	NM	NM	32	NM			
35-LK-22	75	882	121	171	13	160	11	NM	NM	893	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	27	NM			
35-LK-22	76	500	146	190	17	172	10	NM	NM	819	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	28	NM			
35-LK-22	77	94	151	51	38	284	17	NM	NM	659	NM	NM	NM	Double O
			± 3	2	2	3	2	NM	NM	30	NM			
35-LK-22	78	14	138	195	16	173	11	NM	NM	938	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	32	NM			
35-LK-22	79	13	139	189	16	173	12	NM	NM	977	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	32	NM			
35-LK-22	80	494	132	12	86	569	55	NM	NM	0	NM	NM	NM	Rimrock Spring
			± 3	2	2	4	3	NM	NM	22	NM			
35-LK-22	81	804	136	0	94	162	42	NM	NM	0	NM	NM	NM	Buck Spring
			± 3	1	2	3	2	NM	NM	26	NM			
35-LK-22	82	24	181	30	48	163	29	NM	NM	140	NM	NM	NM	Indian Creek Buttes
			± 3	2	2	3	2	NM	NM	22	NM			
35-LK-22	83	1956	94	60	22	86	12	NM	NM	627	NM	NM	NM	Buck Mountain
			± 3	2	2	2	2	NM	NM	24	NM			
35-LK-22	84	8	104	66	15	94	10	NM	NM	612	NM	NM	NM	Buck Mountain
			± 3	2	2	2	2	NM	NM	26	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.		Trace Element Concentrations Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe^2 O^{3T}$	Ratios Fe:Mn	Fe:Ti	Geochemical Source
35-LK-22	85	109		176	57	43	311	15	NM	NM	860	NM	NM	NM	Double O
			±	3	2	2	3	2	NM	NM	27	NM			
35-LK-22	86	1953		98	63	23	88	9	NM	NM	667	NM	NM	NM	Buck Mountain
			±	3	2	2	2	2	NM	NM	28	NM			
35-LK-22	87	108		104	65	15	89	13	NM	NM	629	NM	NM	NM	Buck Mountain
			±	3	2	2	2	2	NM	NM	23	NM			
35-LK-22	88	92		127	3	95	162	39	NM	NM	0	NM	NM	NM	Buck Spring
			±	3	1	2	3	2	NM	NM	22	NM			
35-LK-22	89	1113		125	148	16	143	8	NM	NM	659	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	30	NM			
35-LK-22	90	750		95	58	20	85	15	NM	NM	605	NM	NM	NM	Buck Mountain
			±	3	2	2	2	2	NM	NM	27	NM			
35-LK-22	91	1954		123	158	15	153	9	NM	NM	818	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	28	NM			
35-LK-22	92	124		113	155	16	150	10	NM	NM	787	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	26	NM			
35-LK-22	93	9		124	172	13	163	11	NM	NM	900	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	26	NM			
35-LK-22	94	1955		143	173	11	154	9	NM	NM	840	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	32	NM			
35-LK-22	95	26		124	183	15	162	9	NM	NM	904	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	25	NM			
35-LK-22	96	60		199	33	51	169	33	NM	NM	166	NM	NM	NM	Indian Creek Buttes
			±	3	2	2	3	2	NM	NM	24	NM			
35-LK-22	97	79		119	161	15	149	10	NM	NM	759	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	27	NM			
35-LK-22	98	300		139	181	17	165	8	NM	NM	673	NM	NM	NM	Beatys Butte
			±	3	3	2	3	2	NM	NM	32	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-22, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	
35-LK-22	99	123	119	164	13	156	6	NM	NM	806	NM	NM	NM	Beatys Butte
			± 3	3	2	3	2	NM	NM	33	NM			
35-LK-22	100	40	102	68	14	100	12	NM	NM	632	NM	NM	NM	Buck Mountain
			± 3	2	2	2	2	NM	NM	30	NM			
NA	RGM-1	RGM-1	151	109	26	227	11	NM	NM	775	NM	NM	NM	RGM-1 Reference Standard
			± 3	2	2	3	2	NM	NM	22	NM			

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