Analysis of Paleoindian Site Structure and Toolstone Procurement at the Overlook Site (26CH3413), Churchill County, Nevada

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Based on lithic studies, it appears that the early inhabitants of the Great Basin were mobile, far-ranging, and possessed a flexible lithic toolkit. They left behind traces of ephemeral, often redundant, occupations across the landscape. While investigators have studied Paleoindian mobility patterns at large scales across the Great Basin, fine-grained analyses are rarely applied to individual open-air sites. This study evaluates the hypothesis that the archaeological record at a single Paleoindian site located in Churchill County, western Nevada the Overlook Site (26CH3413) represents the remains of a residential base camp; a place from which local toolstone was procured to replace broken and expended tools fashioned on non-local material. To test this hypothesis several methods are employed including the analysis of: (1) site structure vis-à-vis spatial distribution of artifacts; (2) components of the lithic assemblage; and (3) geomorphic processes. These data suggest that cultural and geomorphic processes affect the horizontal distribution of artifacts, eliminating observable internal structure at the site. The assemblage at the site suggests that the manufacture of mid-stage bifaces on local material and discard of broken and expended tools was the dominant activity and that the site was repeatedly visited. To conclude, I consider the Overlook Site within the broader context of Paleoindian sites in the region.
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CHAPTER 1: INTRODUCTION

This thesis proposes to evaluate the Overlook Site (26CH3413/CrNV-03-8569), located in Churchill County, western Nevada (Figure 1.1). The purpose of this evaluation is to contribute to an understanding of Paleoindian mobility in the Carson Desert and discuss it in the context of local and regional settlement patterns. I test the hypothesis that the Overlook Site represents a residential locality occupied during the terminal Pleistocene-early Holocene (TP-EH): a place from which short logistical forays occurred to procure local toolstone to replace exhausted tools made on non-local material.

Archaeological literature focused on the study of lithic technological organization provides a framework in which to test the hypothesis that the Overlook Site represents a residential base camp. Various studies propose ways to relate occupation span length and/or mobility strategies with the composition and character of lithic assemblages (Andrefsky 1983, 1991; Bamforth 1986, 1990; Binford 1979, 1980; Duke 2011; Duke and Young 2007; Ingbar 1992, 1994; Kelly 1983, 1988, 1995; Kuhn 1995; Parry and Kelly 1987; Schlanger 1990; Shott 1986; Smith 2010, 2011; Smith et al. 2013; Surovell 2009; Torrence 1983, 1989; Varien and Mills 1997; Varien and Potter 1997). Together, these studies suggest that toolkits associated with shorter occupations should contain items: (1) made on exotic toolstone; (2) fashioned for multiple purposes; and (3) which have been refined and reworked. In contrast, assemblages reflecting longer occupations should contain: (1) many items fashioned on local toolstone exhibiting little reworking; (2) few items made of exotic toolstone, either acquired during logistical forays or brought to the site during initial occupation that exhibit high degrees of reworking; (3) stockpiled
local toolstone (e.g., blanks or cores) acquired as part of an embedded procurement strategy; (4) expedient tools made for immediate use with little refinement; (5) internal structure or discrete activity areas at the site; and (6) high artifact type diversity.

![Figure 1.1. The Overlook Site location within the western Great Basin.](image)

For this study, I employ the term *Paleoindian* to describe TP-EH hunter-gatherers in the Great Basin, although the word carries some implications. Researchers (e.g., Haynes 2007) have argued that the term suggests a subsistence strategy focused on large game hunting similar to that employed by Clovis and Folsom groups on the Great Plains, a relationship not evidenced in the Great Basin (but see Duke 2015; Grayson 2011). Meanwhile, the leading alternative, *Paleoarchaic* implies a subsistence emphasis on
Great Basin wetland resources and continuity with later Archaic lifeways (Elston and Zeanah 2002; Graf and Schmitt 2007; Smith 2006; Willig 1989). I use the more straightforward term *Paleoindian* without stressing its big-game specialist connotation; I assume that in the Great Basin, early groups were at least partially tethered to wetlands and focused on a wide range of flora and fauna (Hockett 2007; Pinson 2007).

The materials and methods used in this study consist of a comprehensive analysis of lithic artifacts from the Overlook Site and an examination of fine-grained volcanic (FGV), obsidian, and cryptocrystalline silicate (CCS) geologic sources of toolstone from which artifacts at the site are fashioned. Surface mapping of the site suggests that artifacts occur in two discrete concentrations; therefore, supplemental to the flaked stone analysis I explore the spatial relationship of artifacts, both on the surface of the site and from a buried context, to determine whether their distribution is the result of preserved internal structure at the site (e.g., activity loci), an accretionary palimpsest of multiple occupations, or geomorphic processes (e.g., deflation) (Binford 1980; Schiffer 1983; Waters 1992). Internal structure or archaeologically visible activity areas are of significance because the inferences can be made as to length of stay or activity at a site.

The remainder of this chapter provides a general overview of our current understanding of the Great Basin’s TP-EH climatic, environmental, and archaeological records, reviews studies linking mobility to technological organization – the primary means of reconstructing prehistoric lifeways in a region where lithic scatters dominate the archaeological record and details spatial and geological theoretical considerations.
The Terminal Pleistocene-Early Holocene (TP-EH)

Regardless of deterministic or possibilistic theories of cultural change and adaptation, environment and past human culture are inextricably linked (Mehringer 1986). In the Great Basin, the association between the distribution of Paleoindian sites and relict TP-EH pluvial lakes has led many researchers to suggest a relationship between biotic productivity of wetlands, including the attraction of large game to these locations, and TP-EH lifeways (e.g., Adams et al. 2008; Beck and Jones 1997; Bedwell 1973; Campbell et al. 1937; Duke 2011; Duke and King 2014; Jones et al. 2003, 2012; Krieger 1962; Rozaire 1963; Willig 1989). Inferred Paleoindian adaptive strategies focused on TP-EH lakes have been variously termed the Western Pluvial Lakes Tradition, Pre-Archaic, and most recently Paleoarchaic (Bedwell 1973; Elston and Zeanah 2002; Graf and Schmitt 2007; Smith 2006; Willig 1989).

Prehistoric climate and environmental change in the western Great Basin are expressed in a variety of ways. Measurement of isotopes and lamination in glacial ice cores has provided high-resolution insight into TP-EH global climatic events, whereas variations in Great Basin pluvial lakes, which had no outlet to the sea, afford proxy measures of regional climate change indicating amount of precipitation, runoff, and evaporation rates (Houghton et al. 1975). Local and regional vegetation history is recorded in pollen and small and large mammal remains preserved in stratified sediments, packrat middens, and coprolites from lakes, marshes, meadows, and dry caves. Volcanic tephra beds are also important time markers and environmental indicators along with
sediment and soil sequences created during intervals of erosion and deposition (Davis 1982; Morrison 1964).

Although the paleoenvironmental record in the Great Basin is rich and diverse, it is also complex and difficult to piece together into a cohesive illustration (Davis 1982). The term *pluvial* implies a time of increased rainfall; however, the nature of TP-EH climate is not so straightforward (Mehringer 1986). Furthermore, the use of multiple proxy types and time scales to reconstruct prehistoric environments limits accuracy and precision in our estimations. It is important to know these issues prior to any attempt at piecing together the proxy data to characterize the environmental conditions that early Great Basin inhabitants encountered. The summary below is largely based on studies by Clark et al. (2009), Davis (1982), Grayson (2011), Mehringer (1986), Wigand and Nowak (1992), Wigand and Rhode (2002), and Wigand (2001), among others. When a radiocarbon age and error are provided in the cited reference, the age was calibrated using Calib 7.0 (Stuiver and Reimer 2014). When an age is given but it is unknown if the author was using calibrated or radiocarbon ages, a “best guess” approach was taken. When dates are provided in-text that are clearly or interpreted as radiocarbon dates without sample numbers or error ranges, Grayson’s Appendix 1 (2011) was used to provide a general calibrated age.

The TP-EH is defined herein as the period between the beginning of the Younger Dryas climatic event ~12,900 calendar years ago (cal BP) and the onset of the middle Holocene ~8,200 cal BP (Walker et al. 2012). The following sections are subdivided by established climatic periods (Clark et al. 2009; Walker et al. 2012).
Climate and Environment

Younger Dryas 12,900-11,600 cal BP. The Younger Dryas was an abrupt return to glacial conditions following the Bølling-Allerød interstadial (Dansgaard et al. 1989). Proxy data indicate lower temperatures and higher average annual precipitation; however, absence of moraines and outwash indicate no significant glacial advances in the Sierra Nevada (Gillespie and Clark 2011). In the eastern and western Great Basin, respectively, Lake Bonneville and Lake Lahontan rose perhaps as much as 100 m (Benson et al. 1992; Morrison 1991). In southern Nevada, spring-fed channels and organic black mats appear with synchronous filling of valley aquifers (Quade et al. 1998) and a persistent Clovis-age drought (13,300-12,900 cal BP) ended at this time (Haynes 2002). Many small mammals flourished during the Younger Dryas, settling in ecozones outside of their current normal range (Grayson 2011). Bushy-tailed woodrats (Neotoma cinerea) were found throughout New Mexico and into western Texas (Grayson 2011). Yellow-bellied marmots (Marmotus flaviventris), currently restricted to cool and moist higher-elevation sites in the Great Basin, resided at Homestead Cave and Camels Back Cave in western Utah (Grayson 2006; Schmitt and Lupo 2005).

Early Holocene 11,600-8,200 cal BP. Following the Younger Dryas, temperatures climbed at least 18°F within ~60 years (Grayson 2011). In some cases, lake basins dried completely (Duke and King 2014; Goebel et al. 2011) while elsewhere the vertical relief of basins and high water tables allowed for low elevation lakes, substantial marshlands, springs, and sloughs (Holmes and Huckleberry 2009; Wigand and Rhode 2002; Young 1995, 2000, 2008). Bonneville Basin lakes Gunnison and Gilbert receded
and the Old River Bed dried up between ~11,000 and ~10,200 cal BP (Louderback and Rhode 2009). By ~10,800 cal BP, archaeological evidence from caves along the margin of the Carson Sink suggests that Lake Lahontan had recessed to elevations below 1,220 m amsl (Adams et al. 2008; Goebel et al. 2011).

During the shift in climate ~11,600 cal BP, conifers retreated northward and to higher elevations and were replaced by xeric lowland communities (Wigand and Rhode 2002). Utah juniper disappeared in the Smoke Creek Desert by ~12,000 cal BP and their persistence in lower elevations in the western Great Basin ended at ~10,700 cal BP (Wigand and Rhode 2002). Semiarid woodlands were replaced by shadscale and greasewood desert shrub communities common in valley bottoms today (Wigand and Mehringer 1985; Wigand and Rhode 2002).

Yellow-bellied marmots disappeared from Homestead Cave ~9,000 cal BP (Grayson 2000, 2006). Similarly, the abundance of bushy-tailed woodrats dropped sharply between ~9,800 and ~9,300 cal BP (Schmitt and Lupo 2005). Large mammals including bison (*Bison bison*), deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), mountain sheep (*Ovis canadensis*), and pronghorn (*Antilocapra americana*) persisted into the Holocene (Broughton et al. 2008; Grayson 2011).

These data suggest a changing climate and a synchronous, though perhaps lagged, change in the plants and animals available to humans during the TP-EH. The early Holocene was a time of transition from the cool and wet Younger Dryas to warmer and drier conditions. Although the climate was shifting, the archaeological record suggests climatic amelioration. The early Holocene was conceivably a good time, perhaps the optimal time, to occupy the Great Basin (Elston 1982).
Dry caves and rockshelters have figured markedly in our understanding of Paleoindian lifeways in the Great Basin (Bryan 1979; Cressman 1977; Drooker and Webster 2000; Goebel 2005; Heizer 1951; Heizer and Krieger 1956; Jenkins 2007; Jennings 1957; Loud and Harrington 1929; Orr 1956, 1974; Steward 1937; Thomas 1985; Tuohy and Dansie 1997; Wheeler and Wheeler 1969). The archaeological record from cave sites provides not only stratigraphic and chronological control for diagnostic Paleoindian artifacts such as Western Stemmed Tradition (WST) projectile points and related lithic tools, but it but also adds a rich record of preserved perishable artifacts and bone tools, subsistence residues, and human remains (Connolly and Barker 2004; Cressman 1977; Hockett 2007; Jenkins 2007; Pinson 2007; Smith et al. 2014). While cave sites are special in this regard, most Paleoindian sites in the Great Basin are near-surface flaked stone assemblages located on relict landforms associated with terminal Pleistocene lakes with little potential for intact features or preserved organic remains.

Projectile points associated with early occupations in the Great Basin, assigned to the WST (Bryan 1980; Willig and Aikens 1988) and/or Great Basin Stemmed Series (Layton and Tuohy 1977), are used as index fossils for typologically cross-dating open-air sites. WST points, which are large contracting stemmed bifaces, are morphologically variable. WST point varieties include Windust (Rice 1972), Haskett (Butler 1965), Cougar Mountain (Layton 1970, 1972), Parman (Layton 1970), Lind Coulee (Daugherty 1956), Lake Mohave (Amsden 1937), and Silver Lake (Amsden 1937) types. Large unfluted concave base lanceolate points such as Black Rock Concave Base (Clewlow
Western Fluted points and large fluted concave base points referred to as Western Fluted points (Beck and Jones 2009) also mark this time period. WST points occur in a variety of contexts (e.g., dry caves, alluvial fans, upland areas, tributaries) but are most commonly found on the margins of extinct shallow early Holocene lakes and sloughs (Beck and Jones 2009; Campbell et al. 1937; Duke 2011; Duke and Young 2007; Elston et al. 1977; Goebel et al. 2011; Jenkins et al. 2012; Rusco et al. 1982; Smith 2006, 2007). Artifacts often associated with or found in similar geomorphic contexts as WST projectile points include beaked gravers, drills, steep-edge end and side scrapers, spokeshaves, choppers, formed and expedient flake tools, crescents, combination/multifunctional tools, and Western Fluted points (Beck and Jones 2009, 2010; Bedwell 1973; Bryan 1979; Duke 2011; Graf 2001; Lafayette and Smith 2012; Layton 1970, 1979; Pendleton 1979; Smith 2006, 2007; Tuohy 1968, 1969; Warren and Ranere 1968). The relationship between Western Fluted and WST technology is currently debated (Beck and Jones 2010, 2012; Fiedel and Morrow 2012). Some researchers contend that the two technologies represent distinct cultural traditions carried by separate groups and that WST points predate Western Fluted points in the Great Basin (Aikens et al. 2013; Beck and Jones 2007, 2010; Estes 2009), while others disagree with this assertion (Fiedel and Morrow 2012; Goebel and Keene 2014).

Although subsistence residues are limited and direct evidence for Paleoindian diet is even more uncommon, faunal assemblages suggest that early foragers had a broad palate (Graf and Schmitt 2007; Haynes 2002; Hockett 2007; Madsen 2007; Pinson 2007). Below, I provide a review of the sites that have yielded data with which to construct
generalizations regarding Paleoindian toolkits, diet, and lifeways in the Great Basin. As above, these sections are subdivided by established climatic periods.

**Younger Dryas (12,900 to 11,600 cal BP).** The Younger Dryas-age archaeological record is limited and few archaeological sites of this period have been reported in the western Great Basin (Goebel et al. 2011); therefore, I present a broader view with a focus on sites from the eastern (Bonneville Estates Rockshelter, Danger Cave, the Sunshine Locality), western (Pyramid Lake, Fishbone Cave), and northeastern (Buhl Woman) portions of the region.

Bonneville Estates Rockshelter, Danger Cave, and the Sunshine Locality are located in the eastern Great Basin. Bonneville Estates is in eastern Nevada south of Wendover and overlooks the Bonneville basin. Excavation there revealed Paleoindian occupations spanning from ~13,000 to ~9,600 cal BP (Goebel et al. 2011). Along with numerous WST points, excavation recovered more than 2,000 fragments of burned, cut, and butchered pronghorn, mountain sheep, mule deer, black bear (*Ursus americanus*), hare (*Lepus* sp.), and sage grouse (*Centrocerus urophasianus*) bone, along with katydids (*Tettigoniidae*) (Goebel et al. 2011; Hockett 2007). Plant foods enjoyed by Bonneville Estates’ early occupants include cactus (*Opuntia* sp.), ricegrass (*Oryzopsis hymenoides*), dropseed sandgrass (*Sporobolus* sp.), Great Basin wild rye (*Leymus cinereus*), goosefoot (Chenopodiaceae), sunflower (Asteraceae), mustard (Brassicaceae), bulrush (*Scirpus* sp.), and cattail (*Typha* sp.) (Rhode and Louderback 2007).

Danger Cave (42TO13) is located in western Utah on the margin of the Bonneville Basin. The cave was first excavated in the 1940s and 1950s and revealed a long record of occupation spanning from the Younger Dryas through the late Holocene
The earliest Paleoindian component at the site dates to ~12,200 cal BP (Rhode et al. 2006). Sage grouse remains are clearly associated with hearth features in the Paleoindian occupation and plant remains include fruits and seeds from greasewood and sagebrush (Rhode et al. 2006). Artifacts include chert and obsidian debitage, a lanceolate point (perhaps a Haskett), knotted fibers, and ground stone (Goebel et al. 2011; Jennings 1957; Rhode et al. 2006).

The Sunshine Locality is located at the southern end of Long Valley in eastern Nevada. Excavations and surface collections occurred in the 1970s, 1980s, and most recently in the 1990s by George T. Jones and Charlotte Beck (Beck and Jones 2009). The Younger Dryas Paleoindian record is both from surface and subsurface contexts dating to ~12,100 cal BP, although it is important to note that many subsurface artifacts were likely redeposited from other nearby locations (Goebel et al. 2011). The assemblage from this early period includes WST point fragments, crescents, a Western Fluted point base, flake tools, and debitage (Beck and Jones 2009).

The remains of an individual known as the Buhl Woman (10TF1019) were discovered in 1989 in central Idaho on the northern margin of the Great Basin (Green et al. 1998). Radiocarbon dating of the skeleton returned a date of ~12,600 cal BP (10,675±95 14C B.P.) (Green et al. 1998). A large obsidian Windust (WST) projectile point was found beneath her right cheek. In addition to the Windust point, the woman was found with an unmodified badger bone, a portion of a bone needle, and two incised fragments of a bone awl or pin (Green et al. 1998). Isotopic analysis of Buhl Woman’s skeleton suggests a heavy reliance on meat and anadromous fish (Green et al. 1998). Furthermore, her teeth showed wear patterns consistent with the incorporation of fine
sand or grit into her food, possibly the result of food processing/preparation (Green et al. 1998).

Excavation of the lowest levels of Fishbone Cave (26PE3e) in western Nevada produced horse mandibles with purported cut marks dated to ~12,830 cal BP, although it is not clear whether the alterations were human derived (Adams et al. 2008; Dansie and Jerrems 2005). A cedar bark mat associated with a burial from Fishbone Cave was radiocarbon dated to ~13,100 cal BP (11,250±250 $^{14}$C BP) (Orr 1974). Two bone artifacts recovered from a surface site near Pyramid Lake date to ~12,200 cal BP; however, the artifacts could have been fashioned from older quarried large mammal bone (Dansie and Jerrems 2005).

In sum, the archaeological record during the Younger Dryas in the Great Basin exhibits the ephemeral (e.g., lacking residential features) redundant, overlapping residues from short-term occupations made by non-sedentary groups (Goebel et al. 2011). Floral and faunal remains reflect a variety of food choices including insects, large and small game, fish, fruits, and seeds. Overwhelmingly, people inhabiting the sites employed WST technology for food procurement, processing, and perhaps other tasks (Lafayette and Smith 2012). This suggests that human settlement initially occurred during the latest terminal Pleistocene (Goebel et al. 2011), with populations not increasing to any substantial level until the early Holocene (Louderback et al. 2010).

*Early Holocene (11,600-8,200 cal BP).* The archaeological sites mentioned above also contain occupations dating to the early Holocene; however, I have chosen to focus on TP-EH archaeological sites closer to my study area. Post-Pleistocene evidence for occupation of the Great Basin is more abundant, especially in the western Great Basin
where the Overlook Site is located. These include surface sites and cave sites carved out by oscillations of Lake Lahontan, the Wizard Beach site at Pyramid Lake, artifacts from Winnemucca Dry Lake, the Grimes Point Burials, and Spirit Cave.

Wizards Beach Man was found in 1976 along with another skeleton of middle Holocene age on Pyramid Lake’s western shore (Jackson 2012). It appears that the skeleton was a surface discovery, possibly in secondary context, and it was dated to 10,660 cal BP (~9200 \(^{14}\)C BP) (Edgar 1997). Sagebrush cordage interpreted to be a seining net, also found at Wizards Beach but not clearly associated with the burial, was dated to ~11,000 cal BP (Adams et al. 2008).

Textile from Shinners Site A and Crypt Cave (26PE3a) near Winnemucca Dry Lake were dated to ~10,600 cal BP (~9400 \(^{14}\)C BP) (Adams et al. 2008; Dansie 1997). Plainweave textiles associated with the burial of a child from Grimes Burial Shelter (26CH1C) and a small fragment from Hidden Cave date to ~10,500 cal BP (9329±50 \(^{14}\)C BP) (Fowler et al. 2000).

Excavations at Spirit Cave (26CH1F) in the Carson Desert took place in 1940 and uncovered four interments (Wheeler and Wheeler 1969). The burials consisted of two individuals buried in stratigraphic succession (Burial No. 1 above and Burial No. 2 below) and two plainweave textile bags containing cremated human remains. Burial No. 1 consists of a plainweave mat and a few disarticulated human bones found about 1 ft below the surface, reportedly reburied by the Wheelers in the cave (Dansie 1997). The scattered bones of a young man and an adult female were also collected from the deposit. The female bones date to ~10,500 cal BP (9300±70 \(^{14}\)C BP) and the male bones are younger and date to ~5,390 cal BP (4640±50 \(^{14}\)C BP) (Dansie 1997).
Burial No. 2, deemed “Spirit Cave Man” or “Spirit Cave Mummy” due to his excellent preservation, is the remains of a 35 to 55-year-old male wrapped in two pieces of plainweave matting and covered with a large open-twined mat, incorporating both bulrush and cordage into the weave (Fowler et al. 2000). He was wrapped in a rabbit skin blanket and had well-constructed moccasins on his feet (Dansie 1997). The moccasins were made of animal skin and sewn together with woven fiber cordage, and are notably different in construction than the Fort Rock Cave sandals and other sandals dated to the early Holocene elsewhere in the northwestern Great Basin (Connolly and Barker 2004; Cressman 1977; Tuohy and Dansie 1997). Analysis of his bones indicate degenerative spondylosis in his vertebrae, a healed fracture to the skull, indentations in the teeth indicating use for sinew processing, fractures to his right hand, and three abscessed molars that likely led to his demise (Edgar 1997; Jantz and Owsley 1997). Several artifacts were found in the cave, but unfortunately their exact provenience is not well-known and the non-textile perishable items (e.g., greasewood foreshafts, mountain sheep horn pendant, tule fragments) remain undated. Because the cave was used to house later burials, those items may not be associated with Burial No. 2 (Tuohy and Dansie 1997). The weighted mean of seven radiocarbon assays from Spirit Cave Man and his associated burial goods returned a median radiocarbon age of ~10,645 cal BP (9415±25 ¹⁴C BP) making him roughly contemporary with Washington State’s Kennewick Man (Dansie 1997; Powell 2005). Additionally, the textile weave-type (diamond-plaiting or warp-faced-plainweave) matched aforementioned early Holocene discoveries near Winnemucca Lake and a small fragment from Hidden Cave (Fowler et al. 2000; Goodman 1985; Rozaire 1974). Analysis of coprolites recovered from the abdomen of
Spirit Cave Man revealed that he had recently eaten a meal of small fish (Cyprinidae [*Gila* and *Richardsonius* sp.] and sucker [Catostomidae]) endemic to the Carson Desert marshes today (Eiselt 1997). Pine, juniper, sagebrush, mountain mahogany (*Cercocarpus* sp.), greasewood, saltbush (Chenopodioideae), and lomatium (Apiaceae) pollen were found inside the coprolites (Wigand 1997). Cattail and sedge (Cyperaceae) pollen were also found in the coprolites, indicating the presence of a nearby marsh (Wigand 1997). It is unclear whether this pollen represents ingested or background pollen; however, these types of plants were present locally at the time of Spirit Cave Man’s death.

The cremations were found about 10 ft from the burials in the form of one plainweave bag with one set of remains inside yet another bag (Cremation No. 1) and a second bag sitting atop this bag with a second set of remains (Cremation No. 2). The interior bag holding Cremation No. 1 is close-twined and incorporates American coot duck (*Fulica americana*) feathers. Cremation No. 2 returned a calibrated radiocarbon age of ~10,215 cal BP (9040±50 ¹⁴C BP) (Dansie 1997).

Overall, these data show a focus on lacustrine-rich areas by groups living in the western Great Basin between 10,700 and 10,200 cal BP. Occupations appear to have been short-lived, with caves used primarily as burial crypts. Also, they suggest that flaked stone tools were not commonly interred with human remains and that the lithic record of the period is primarily a surface, open-air manifestation.
Lithic Technological Organization and Mobility

Although limited subsistence data and perishable artifacts are present at some Paleoindian sites, most of what we know about early lifeways in the Great Basin is derived from open-air lithic scatters. Such assemblages are often analyzed with attention to *lithic technological organization*: the way in which groups made, used, transported, and discarded stone tools (Nelson 1991) or “the manner in which human toolmakers and users organize their lives and activities with regard to lithic technology” (Andrefsky 2009:66). Technological organization has been linked to various aspects of hunter-gatherer behavior including time budgeting (Torrence 1983), mobility (Kelly 1988; Shott 1986; Smith 2006), and occupation span (Smith 2011; Surovell 2009).

*Mobility Models*

Binford’s (1980) seminal treatment of hunter-gatherer mobility strategies is often included in studies of technological organization. Binford (1980) distinguished between residential and logistical mobility. The former is characterized by the seasonal movement of an entire hunter-gather group from one resource patch to the next whereas the latter is characterized by sub-groups leaving the residential camp to procure resources which are often processed in the field and brought back to camp. In the foragers’ strategy of “mapping on” to locally available resources, most subsistence-related tasks take place at the residential camp; therefore, small satellite camps are less visible archaeologically. Conversely, collectors, employing alogistically mobile strategy, also maintain residential
base camps, but produce satellite sites (Binford 1980). Groups’ decisions to behave more like collectors or foragers are dependent on the productivity of the seasonal environment or “locational incongruity among critical resources” in which they live (Binford 1980:18; also see Bailey 1960 and Murdock 1967). Furthermore, although such strategies were intended to serve as points at opposite ends of a behavioral continuum, they are not mutually exclusive. Finally, groups may change their mobility strategies based on a variety of factors (Kelly 1992). Graf (2001) noted a similar dichotomy in treatments of Paleoindian mobility, which she deemed “Mobile Forager vs. Tethered Wetland Adaptation” (see also Smith 2006). Mobile foragers utilize a residentially mobile strategy and move as a group to resource patches. Conversely, a tethered wetland adaptation utilizes a semi-sedentary, logistical land use strategy with specific purpose trips to and from base camps. In many ways, these models mirror Binford’s (1977, 1979, 1980) residential and logistical mobility framework.

Because pedestrian travelers are constrained in what they can transport, mobility and lithic technological organization are clearly linked (Andrefsky 1994a, 2005; Beck and Jones 1990; Beck et al. 2002; Bleed 1986; Duke and Young 2007; Dunnell 1978; Gould and Saggers 1985; Hayden 1982; Kelly 1988; Kuhn 1994, 1995; Torrence 1983). Based on evolutionary ecology, lithic technological strategies are viewed as having mediated risk and provided a selective advantage based on energetic returns (Kuhn 1995:19). Depending on the quality and distribution of toolstone, foragers are believed to have relied on technological planning strategies to solve future demand (Kuhn 1995:24). Researchers commonly equate tool design with the degree of mobility (Bamforth 1986; Kelly 1988; Kuhn 1994; Parry and Kelly 1987; Shott 1986). Mobile gear must be
portable, versatile, durable, and reliable to diminish transport cost and be available for immediate use when moving across the landscape (Shott 1986; Torrence 1983). Kuhn’s (1995) concept of provisioning individuals highlights a strategy that supplies individuals with manufactured, transportable, and maintainable toolkits with some future need in mind. According to Kuhn (1995), because toolstone is heavy, the high cost of transporting it should have prompted mobile individuals to provision themselves with portable gear comprised of nearly finished tools rather than cobbles or cores. Where toolstone is not available, tools should exhibit maintenance, reworking, or modification for reuse (Kuhn 1995). Conversely, a strategy of provisioning place anticipates a future need for tools or the materials to make tools at particular localities. This strategy is only useful if there is some regularity to the use of an area and predictability in the availability of a resource (Kuhn 1995). With no transport costs except to carry the needed material to the site, places may have been provisioned more often with tool-making potential or items which may serve a broader range of functions (Kuhn 1995). In contrast to provisioning individuals, where transport costs are of utmost importance, places with stockpiled toolstone may contain a large number of items, a range of artifacts that do not exhibit reworking or situational reuse, and discarded broken tools (Kuhn 1995). People that move residential locations would likely have provisioned individuals, whereas if places were revisited and reoccupied, a strategy of provisioning places would have been favored (Kuhn 1995). Depending on the priority of foraging groups or perhaps time of year, either or both strategies may have been utilized. This suggests a relationship between economizing behavior (i.e., provisioning strategy) and a formal or expedient assemblage. Expediency may be defined as “minimized technological effort under
conditions where time and place of use are highly predictable… expediency anticipates the presence of sufficient materials and times” (Nelson 1991:63). This contrasts with formal or curated tools. Curation may be defined as “a strategy for caring for tools and toolkits that can include advanced manufacture, transport, reshaping, and caching or storage… a critical variable differentiating curation and expediency is preparation of raw materials in anticipation of inadequate conditions (materials, time, or facilities)” (Nelson 1991:62-63), or similarly, as “a tool’s actual use relative to its maximum potential use” (Andrefsky 2009:71).

*Lithic Conveyance*

To interpret the relationship between provisioning strategies and land use we must consider how tools and raw material reached sites (Kuhn 1995). Tracking movement of obsidian and FGV toolstone from source areas using x-ray fluorescence (XRF) analysis has served to establish regional Paleoindian foraging ranges in the Great Basin (Jones et al. 2003, 2011, 2012; Smith 2010). XRF spectrometry uses short-wave radiation to measure the amount of major and minor trace elements present in obsidian and FGV rocks, providing a singular geochemical fingerprint for toolstone sources. While this valuable technique is available for volcanic sources, CCS exhibits within-source variability and therefore is difficult to characterize geochemically (Luedtke 1992).

Jones et al. (2003) analyzed Paleoindian mobility using geological source provenance data for stone tools in the Great Basin. They used obsidian and FGV sourcing as a proxy measure of foraging territory. Based on their work at the Sunshine
Locality in the eastern Great Basin and a compilation of source provenance studies from the central (Beck et al. 2002), western (Graf 2001; Tuohy 1984), northern (Connolly 1999), and southwestern Great Basin (Basgall 1993; Basgall and Hall 1993), Jones et al. (2003) identified five lithic conveyance zones. The conveyance zones are elongated north to south and generally parallel north-south mountain ranges and valleys, which confine movement within specific basins and limit east-west movement. Smith (2010) sought to refine the western and northwestern lithic conveyance zones (and foraging territories) proposed by Jones et al. (2003) and depicted diachronic change in land use, foraging range, and settlement between Paleoindian and Archaic groups. Results based on the sourcing of WST points and documented ethnographic foraging ranges suggest that there were two lithic conveyance zones in the western Great Basin. These data demonstrate that although obsidian was procured at great distances and artifacts were transported hundreds of kilometers, WST points found in the Black Rock Desert/High Rock Country of northwest Nevada are never made on obsidian from southern sources, taken as evidence for a demarcation between two discrete foraging territories (Smith 2010). The Carson Desert, which contains Paleoindian sites with artifacts made on obsidian from both the northwestern and southern Great Basin (Graf 2001), may have represented a boundary land, which groups from both of Smith’s (2010) hypothesized foraging ranges visited.
Spatial Analysis and Occupation Span

Spatial structure has been examined at regional scales utilizing distance measurements of artifacts fashioned on obsidian and other FGV toolstone to consider the mobility ranges of Paleoindian groups; however, for the current study I analyze structure of space on a smaller scale – at the Overlook Site. In addition to geoarchaeological tools, Geographic Information Systems (GIS) are another specialized tool useful for depicting natural and cultural spatial relationships in the archaeological record. Early applications of spatial point data analysis are found in the field of ecology (Orton 2004). Such studies sought to detect differences between random spatial data point distributions and regular or clustered distributions (Orton 2004:301). The quadrat method and nearest-neighbor function were developed to evaluate clustering, random, and regular patterns in the distribution of mapped features (Clark and Evans 1954; Grieg-Smith 1952); however, these methods are scale-dependent and the newest technique for conducting spatial analysis is kernel density analysis, or Ripley’s K (Barceló 2002). Ripley’s K provides a summary of the spatial dependence of plotted features allowing for the assessment of clustering or dispersion at multiple distances and spatial scales (ESRI 2013).

Spatial analysis in archaeology is primarily used for intersite distribution analysis on a regional level (Orton 2004; Orton and Hodder 1977). At both micro- (local) and macro- (regional) scale analysis, GIS allows for visualization and statistical manipulation of spatial (e.g., points, polygons) data (Connolly and Lake 2006). Spatial analysis using digital representation and spatial statistics, along with flaked stone analysis, may support or refute assumed relationships between archaeological sites on the landscape, landforms
and artifacts, intrasite lithic tools and debitage, and distance to resources (Connolly and Lake 2006). Unfortunately, these types of analysis are rarely used to answer questions regarding settlement and site structure at Paleoindian sites (but see Bamforth et al. 2005), although this technique has been used extensively at Archaic and ethnohistoric-period sites (Morgan 2013).

**Geomorphic and Geological Analysis**

When combined with methods based in geology and the earth sciences, spatial analyses provide a powerful tool with which to evaluate Paleoindian sites in basin landscape settings (Cooke et al. 1993; Ferring 1994). Geomorphic processes predominantly affect the vertical and horizontal distribution of lithic assemblages; therefore, studying stratigraphy is critical to understanding site formation processes. Interpretation of the stratigraphic sedimentary sequence at a site is key to understanding the environment at the time of deposition and placing the cultural clasts (i.e., portable artifacts) within their primary or secondary contexts (Balme and Paterson 2006; Schiffer 1996). When combined with data on soils and depositional environments, Quaternary climate, and vegetation, the geospatial distribution of sites and artifacts within sites provide insight into details of past human settlement patterns. Furthermore, it can assist in predicting where archaeological sites are buried, if a singular site may preserve buried contexts, and how post-depositional processes affect open-air lithic assemblages (Schiffer 1995; Schroedl 2011; Seddon et al. 2011). Natural processes can affect the character of a lithic assemblage; for instance, modification of tools by colluvial, mechanical, and
chemical weathering will change debitage type, frequency, and tool breakage characteristics (Prentiss and Romanski 1989; Schick 1987).

As outlined above, late Quaternary environmental change in the Great Basin was significant. A geoarchaeological approach at the Overlook Site may provide an age for the deposits and subsequently a limiting age for the assemblage. A cursory review of aerial photos shows that the Overlook Site is currently being buried by Holocene-age sand traveling from the southwest via eolian processes from the Walker River channel (see Chapter 2). Assessing this vertical and horizontal relationship between the sand sheet and the artifacts at the site is critical in interpreting internal structure and occupation span at the Overlook Site.

**Research Goals**

This study seeks to understand settlement at the Overlook Site utilizing the assessment of presence or absence of activity areas or loci as a proxy measure of site structure and occupation span. Spatial and geomorphological analyses provide additional information with which to address whether the site contains a palimpsest of occupation debris or discrete areas of reduction or activity. Discerning this is important because it may shed light on whether the site is an *in situ* occupation event, suggesting that the density and spatial arrangement of artifacts are the result of a less mobile, residually stable strategy of provisioning place. Conversely, if the artifacts represent a jumble of multiple occupation events, this would suggest a more mobile strategy where people were provisioned. Another outcome of this research may be that the site is a palimpsest
because of natural processes, making the determination of a mobility strategy based
solely on the arrangement of artifacts unresolvable. Using the concepts developed within
the lithic technological organization paradigm, I test the hypothesis that the Overlook Site
represents a residential base camp – a place from which short logistical forays occurred
and where local toolstone was produced to manufacture new tools to replace expended
implements. Because understanding a site’s function and use history is best
accomplished by placing the results of analyses of its assemblage in a broader regional
context, I also consider how the Overlook Site compares to other Paleoindian sites in the
Carson Desert. In the following chapters, I outline the materials and methods used to test
my hypothesis, present my results, discuss their significance to current Paleoindian
research in the region, and point the direction towards future research.
CHAPTER 2: MATERIALS AND METHODS

Data used in this study were collected from analysis of the flaked stone assemblage at the Overlook Site (26CH3413) in the southern Carson Desert of western Nevada. The Overlook Site is a single-component Paleoindian site containing numerous WST points, bifaces, formed and expedient flake tools, cores, and debitage. In this chapter, I present the materials and methods employed to analyze the assemblage and assess mobility, occupation span, and site formation. In addition, I present an overview of the Carson Desert including geology, geography, biotic environment, and climate. I compiled a catalog of known Paleoindian sites and quarries in the Carson Desert region to compare the Overlook Site in terms of size and assemblage composition to other sites in the region. This allowed me to place the site within a greater regional Paleoindian land-use pattern and to understand how it fits within the context of early mobility and provisioning systems. Occupation span at the Overlook Site is modeled using analysis of internal structure (i.e., spatial patterning of mapped artifacts on the surface and subsurface). The sedimentary context at the Overlook Site suggests that eolian processes play a role in site formation processes. These processes are examined in depth to define the geologic context at the location, distinguish between natural and cultural artifact clustering, and assess the potential for buried cultural features.
Southern Carson Desert Overview

Geography. The Carson Desert is situated primarily within Lahontan Valley in Churchill County (Figure 2.1). The valley runs southwest-northeast and is bounded by the Stillwater Mountains to the east, the West Humboldt Range to the north, the Hot Springs Mountains and the eastern end of the Virginia Range to the west, and the Desert and Dead Camel mountains to the south. The intermontane basin contains the Carson Sink the sump of the Carson River. Other waterways and lakes include the Soda Lakes, Stillwater Marsh, and Carson Lake. During particularly wet years, the Carson Sink shares water with the Humboldt Sink; conversely, when the Humboldt River breaches the intervening sill at White Plains playa it flows to and terminates in the Carson Sink. These outflow and inflow events occur until equilibrium is reached below the sill. The Walker River currently flows into the Walker Lake Basin in nearby Lyon County; however, at times it is hypothesized to have flowed into the Carson River and contributed water to Lahontan Valley (Adams 2007).

The lowest valley bottom elevation is 1,176 m amsl and the highest peak in the bounding ranges is Jobs Peak (also known as Fox Peak) in the Stillwater Range, situated at 2,684 m amsl (Morrison 1964; Wheat 1967).

Biogeography and Climate. The altitudinal difference between the valley bottom 1,176 m amsl and the top of the nearest peak 2,678 m amsl creates varied niches for biota. The southern Carson Desert is one of the driest and warmest areas in northern Nevada due in large part to the rainshadow effect of the Sierra Nevada (Morrison 1964). Precipitation occurs primarily in the spring and the region receives a maximum of 123
millimeters per year with a mean maximum temperature of 69.4°F (Western Regional Climate Center 2014). Modern vegetation reflects the aridity of the basin. Vegetation on salt flats and dunes consists of shadscale, greasewood, Indian ricegrass, budsage (*Artemesia spinecens*), winterfat (*Krascheninnikova lanata*), iodinebush (*Allenrolfea occidentalis*), rabbitbrush (*Chrysothamnus nauseosus*), and various herbaceous plants (Billings 1945). The upper slopes of the ranges harbor juniper and a variety of pine, including singleleaf pinyon pine (*Pinus monophylla*), with an understory of big sagebrush, bitterbrush (*Purshia tridentata*), and ephedra (*Ephedra viridis*). Singleleaf pinyon is a relative newcomer to the Stillwater Mountains, only appearing ~1,200 cal BP (Wigand and Nowak 1992). Along the Carson River, various Newlands Project irrigation ditches and sloughs and waterways associated with the Stillwater Marshes foster abundant bulrush, cattail, and cottonwood (*Populus fremontii*) (Billings 1945). Seasonal streams, sloughs, and lakes harbor cutthroat trout (*Oncorhynchus clarki*), Tahoe sucker (*Catostomus tahoensis*), cui-ui (*Chasmistes cujus*), chub (*Cyprinidae*), and dace (*Leuciscus leuciscus*) (BLM 2012; Young 2014).

The valley is situated within the Pacific Flyway, a major north-south route for migrating birds from Alaska to South and Central America (Lahontan Audubon Society 2014). Taxa that stopover include egrets (*Egretta*), herons (*Ardeidae*), pelicans (*Pelecanus*), stilts (*Recurvirostridae*), dowitchers (*Limnodromus*), geese (*Anatidae*) and ducks sp. (*Anatidae*). Ducks that make the valley’s marshes their seasonal home include canvasbacks (*Aythya valisineria*), northern pintails (*Anas acuta*), green-winged teals (*Anas carolinensis*) and cinnamon teals (*Anas cyanoptera*). Golden (*Aquila chrysaetos*) and bald (*Haliaeetus leucocephalus*) eagles, shrikes (*Laniidae*), hawks (*Accipitrinae*),
owls (*Strigiformes*), and prairie falcons (*Falco mexicanus*) are common in the winter and spring (Ryser 1985). Quail (*Calipepla californica*) reside in the sagebrush understory along with Desert kangaroo rats (*Dipodomys deserti*) and a variety of reptiles.

Year-round mammals include the kit fox (*Vulpes microtis*), coyote (*Canis latrans*), Desert cottontail rabbit (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), and the rarely seen mountain lion (*Puma concolor*), with seasonal migrations of mule deer and Pronghorn bringing those taxa to the area.

**Landforms and Geology.** The Carson Desert is a textbook definition of basin-and-range, horst-and-graben topography “visually dominated by isolated mountain ranges rising abruptly from broad, alluvium-filled desert basins” (Peterson 1981:3). The playa floor of the valley bottom is nearly level, mostly barren, and bounded by fault block mountain ranges (Willden and Speed 1974). Along the fringes of the playa are dunes and extensive sandsheets. Due to the prevailing winds originating from the southwest, much of the sediment deposited at the southern end of the valley is derived from the Walker River channel and Adrian Valley paleochannel. This is in contrast to the northern end of the basin where the Carson River entrains sediment conveyed through eolian processes to the northern end of the valley. The floodplain of the Carson River cuts through the playa floor and debouches into the valley near the western margin. Small, young alluvial fans characterize the piedmont slopes of the ranges within the valley. Pluvial Lake Lahontan’s waters and nearshore processes obliterated and reworked many of the older fan alluvium forming beach plains, gravel bars, and well-washed gravel terraces (Adams and Wesnousky 1999).
Figure 2.1. The Overlook Site location within Lahontan Valley, Churchill County, Nevada.

Lake Lahontan is defined here as an area circumscribed by and encompassing all lake cycles below the highest strandline (Morrison 1991). The basin drains internally and has
three outflow sills: (1) the Darwin Pass sill at 1,264 m amsl; (2) the Rawhide sill at ~1,315 m amsl; and (3) the Humboldt Sink sill at 1,250 m amsl.

The geology within Lahontan Valley may be divided into Quaternary and Tertiary-age rocks. The Quaternary Period includes the entire Pleistocene (2.6 million years ago to 11,600 cal BP) and Holocene (11,600 cal BP to the present) epochs (Walker and Geissman 2009). The Tertiary Period spanned 65.5 to 2.6 million years ago. The mountains surrounding the valley are primarily Tertiary-age fine- and coarse-grained volcanics comprising glass, tuff, rhyolite, basalt, dacite, and andesite rock varieties (Willden and Speed 1974). Some of the volcanics occur atop older Tertiary-age sedimentary rocks and petrified wood is noted throughout these deposits (Johnson 1973). Small ranges within the valley include the Lahontan, Bunejug, Cocoon, White Throne, Desert, Dead Camel, and Hot Springs mountains (Morrison 1964). CCS (e.g., cherts, chalcedonies) occurs locally in fan gravels of the highly fractured Bunejug Mountains where silicates have in-filled faults, joints, and vugs (Clay et al. 2011). Wonderstone is a local silicified tuff that comes in a variety of red, brown, and yellow banded varieties. Sedimentary and metasedimentary deposits are present in the Dead Camel Mountains fan deposits (Willden and Speed 1974). Valley margin Lake Lahontan gravel bars and spits consist of reworked alluvial fan deposits. These gravels often contain secondary deposits of FGV toolstone in addition to local CCS nodules of various colors. According to the Nevada Cultural Resource Information System (NVCRIS), to date, 41 CCS quarry sites have been recorded in the valley. Using the Wentworth scale, CCS nodules range in size from pebbles to boulders.
Calcareous tufa, also referred to as sinter and/or travertine, is an accretionary deposit formed in freshwater lakes, cold and hot springs and seeps, waterfalls, and streams (Pedley 1990; Shiraishi et al. 2010). Sinter and travertine differ from calcareous tufa in that they are inorganic calcium carbonate precipitates whereas tufa formation may be influenced by microbial photosynthesis (Shiraishi et al. 2010). Tufa encrustations have been used as proxy indicators of pluvial lake levels and lake stability since lake studies began in the region (Russell 1885). Similar to speleothems in caves, these deposits may accrete annual laminations which preserve high resolution paleoclimatic data (Shiraishi et al. 2010). Tufa covers much of the relict shorelines that circumscribe the Lahontan Valley basin from 1,182 m to 1,321 m amsl (Benson et al. 2013b; Morrison 1964). Tufa morphology ranges from a composite or cementation of gravels to dendritic and lithoid forms (Benson et al. 2013b; Morrison 1964; Russell 1885). Tufa towers are currently forming in the valley on the western margin of Big Soda Lake (Morrison 1964; Rosen et al. 2004).

Clay et al. (2014) recently identified the Dead Camel and Desert Mountains obsidian sources in Lahontan Valley. Sparse small cobbles of obsidian occur in gravel deposits associated with shoreline features on the western and southern margin of the valley. A variety of other non-local obsidian sources are found in the western Great Basin, including Bodie Hills and Mt. Hicks (120-150 km to the south), Sutro Springs (~55 km to the west), the Desatoya Mountains (~110 km to the east), and Mount Majuba (~160 km to the north).

*Local Paleoenvironmental Record.* Lake Lahontan was the second largest lake in the northern hemisphere, covering up to 21,000 km² (Grayson 2011). Its watershed
covered an area from the crest of the Sierra Nevada to the head of the Humboldt River
drainage in northeastern Nevada (Davis 1982). Each of the six major rivers in the region
(Truckee, Carson, Humboldt, Walker, Susan, and Quinn) contributed water to the system
at some point in the past (Grayson 2011). The system is comprised of seven sub-basins
separated by intervening overflow sills: (1) the Smoke Creek/Black Rock Desert; (2)
Carson Desert; (3) Buena Vista Valley; (4) Walker Lake; (5) Pyramid Lake; (6)
Winnemucca Dry Lake; and (7) Honey Lake (Benson and Thompson 1987). At times
when rising waters reached an elevation above 1,308 m amsl – the level of the highest sill
– the subbasins rose and fell as one lake. Conversely, when the water level fell below the
primary sills, lakes settled independently into the sub-basins (Benson and Thompson
1987). Long ago, the late Jonathan Davis (1982:54) pointed out that there is no single
Lake Lahontan chronology, but instead a complex family of chronologies.

A number of studies have contributed to a moderately well-dated lake level
chronology for the Carson Desert (e.g., Adams 2003, 2007; Adams and Wesnousky 1999;
Benson 1978; Benson and Thompson 1987; Benson et al. 1992, 1995, 2013; Currey
1990; Davis 1982, 1985; Mifflin and Wheat 1979; Morrison 1964, 1991; Morrison and
Frye 1965; Reheis 1999; Russell 1885); however, the results of work contributing to the
general chronology is sometimes contradictory, misleading, and difficult to interpret.
Additionally, correlating lake levels in Lahontan Valley with shifts in climate is
problematic due to the lack of clarification in the timing of changes in the course of the
Walker River (Adams 2007; Bradbury et al. 1989; Davis 1982; King 1978). Prior to
~15,500 cal BP, Lake Lahontan reached its terminal Pleistocene highstand of 1,332 m
amsl (Benson et al. 2013b). This vast lake inundated the western Great Basin, creating
prominent wave-cut shoreline scarps, strandlines, caves, and rockshelters (Benson et al. 2013b). Sometime after ~15,500 cal BP, the lake receded ~100 m from its highstand and separated into seven waning lake systems (Benson and Thompson 1987; Benson et al. 1990). The rapid desiccation of the giant lake caused rebound of the landscape which prompted local warping, tilting, and faulting, displacing shorelines and shoreline features (Adams and Wesnousky 1999; Cupp 1998; Mifflin and Wheat 1979; Morrison 1964). Rebound makes correlation between datable landforms and paleolake levels difficult to discern, so correlations must be carefully evaluated (Adams and Wesnousky 1999). The effects of the Younger Dryas are not well-understood in the Lahontan basin. At the beginning of the period, shallow lakes likely occupied valley basins (Adams et al. 2008). The lake level in the Carson Sink has been variously reported as 1,205 m, 1,220 m, 1,228 m and 1,235 m amsl during the Younger Dryas (Adams and Wesnousky 1999; Adams et al. 2008; Benson et al. 1992; Caskey et al. 2004; Currey 1988, 1990). Evidence suggests that following the Younger Dryas, some valleys retained remnant lakes and springs (Duke and King 2014; Young 2008). Pollen recovered from Hidden Cave suggests that a sagebrush-juniper steppe prevailed near 1,250 m amsl until ~7,700 cal BP when vegetation shifted to a more modern vegetation community around the cave (Davis 1985).

*The Paleoindian Record of the Carson Desert.* Archaeological sites are abundant in Lahontan Valley and span not only regional cultural histories but also local temporal phases (Thomas 1985; Young 2014). Paleoindian sites in the Carson Desert, however, are few. This may be due to several factors, including long-term avocational artifact collecting, restricted land access, and insufficient pedestrian surveys of the upper reaches
of the valley outside modern travel corridors. Avocational collecting at archaeological sites in the Great Basin extends back to a time prior to the late 1960s and early 1970s when many historic preservation and environmental laws were legislated (Young 2014). After the enactment of these laws, avocational collectors and amateur archaeologists became informants and donated vast artifact collections to local museums. While a degree of precision in the proveniences of these collections has been lost, it is also important to note the contributions of local avocational collectors. For example, Fallon residents found two of the most important surface Paleoindian sites in the area, the Sadmat and Hathaway Beach sites (Graf 2001).

The Sadmat Site is in the Carson Sink northeast of Hazen and north of Fallon on a Lake Lahontan shoreline between 1,220 m and 1,232 m amsl. The site is a surface lithic scatter approximately two square miles in size consisting of Paleoindian artifacts and a few later-period projectile points (Graf 2001). Tuohy (1967) indicated that this site assemblage is similar to the Lake Mohave Tradition and San Dieguito Complex technologies (Warren 1967). Warren and Ranere (1968) characterized the site as similar to Haskett sites further north, linked to big game hunters from the Plains region, and termed the site “Hascomat”. Avocational collectors Etta-Mae Mateucci and Yvonne Sadler (for whom the site is named) first discovered the site. Peter Ting Sr., also a local collector, visited the site as well. Although all of the artifacts they collected have been donated to the Nevada State Museum, accurate provenience information is lacking. Donald Tuohy examined the artifacts and noted that they appeared to be temporally affiliated with other early sites in the area (Graf 2001). In 2001, Kelly Graf published her Master’s thesis on the site, which includes a detailed artifact analysis and description.
She analyzed 3,140 artifacts and described the assemblage as comprised of Haskett, Parman, and Windust WST points, numerous bifaces of varying size and shape, preforms, crescents, scrapers, retouched flakes, blade-like flakes, gravers, burins, notches, denticulates, multidirectional, bifacial and unidirectional cores, and combination tools. Based on her analysis, she concluded that the assemblage reflects the activities of highly mobile groups provisioned with transportable, formalized tools. She suggests that the assemblage is an accretionary deposit wherein Paleoindian hunter-gatherers made repeat visitations to the site, retooled using local material, and discarded items fashioned on exotic material (Graf 2001).

The Hathaway Beach Site is a large Paleoindian lithic scatter situated on a Sehoo-age (median age of ~22,500 cal BP) gravel spit at 1,250 m amsl near Russell Pass south of Fallon (Morrison 1991). Avocational collector George Hathaway of Carmichael, California first discovered the site in the early 1950s. Local archaeologist and geologist Margaret Wheat visited the site, probably in the 1940s or 1950s, and collected a few items which she later donated to the Nevada State Museum. In the summer of 1951, archaeologists Gordon L. Grosscup and Norman L. Roust, along with geologist Roger B. Morrison, visited the site. They described it as consisting of “crudely flaked andesite blades… obsidian, rhyolite and chert were also used, however, especially for scrapers and crescents” and “crude leaf-shaped points, snub-nosed and concave thinned base-types” (site record for 26CH61; Grosscup 1956:1). Hathaway Beach and two nearby andesite quarry sites contained similar artifacts and they deemed these artifact types “Fallon Phase”, the earliest in a local cultural chronology (Grosscup 1956:62). They proposed similarities between Fallon Phase stemmed points and Lake Mohave and Lind
Coulee/Windust point styles but noted the closest resemblances were to specimens found by Luther Cressman in Guano Valley in southeastern Oregon (Grosscup 1956). Morrison (1964) described the surface of the site as resting on Sehoo-age rhyolite beach gravels and relatively dated the shoreline to the first post-pluvial phase, or the “Anathermal” climatic period (Antevs 1948:168). In 1959, Dr. Richard Shutler visited the site, provided a collection to the Nevada State Museum, and described the artifacts as primarily comprised of highly patinated basaltic debitage. There is some indication on the 1959 site record that artifacts collected from this site ended up at the University of California, Berkeley. Donald Tuohy, then of the Nevada State Museum, visited the site and although he did not dispute its antiquity, he did caution against characterizing the Hathaway localities and related artifacts as representing a “culture” (Tuohy 1968). The most recent record of the site is from a 1984 Nevada Department of Transportation survey for two proposed material pits along Highway 95. The record is cursory and the surveyors did not find any diagnostic artifacts. A field visit to the site in 2013 revealed that a substantial portion of the site to the south is intact and numerous tools, including WST points and debitage occur on the surface.

Accompanying academic and avocational interest in archaeological sites in the Carson Desert, a number of cultural resource management inventories been conducted throughout Lahontan Valley. Survey projects associated with military activities, highway right-of-ways, fiber optic lines, and geothermal testing have occurred across the valley floor. Although most of these projects have focused on areas away from prominent, upper elevation lake terraces, some recent surveys have discovered new Paleoindian sites (Clay and McCabe 2012; Clay et al. 2014). During his work in the Carson Desert, Kelly
(1985) noted that many sites in the valley are devoid of tools, likely due to decades of artifact collecting by local residents. The Overlook Site is situated on Range Bravo-16 lands managed by Naval Air Station (NAS) Fallon and the withdrawal of this property from the Bureau of Land Management (BLM) in the 1940s for military training purposes may have helped preserve the assemblage at the Overlook Site described later in this chapter. Cultural resource management surveys have increased the number of known Paleoindian sites in the Carson Desert, although they are still uncommon relative to later period sites. The sites listed in Table 2.1 are described using Far Western Anthropological Research Group, Inc.’s (Far Western) site typology (Delacorte et al. 1994). This typology defines sites based on the assemblage composition and presence of features. Simple Flaked Stone Assemblages (SFSA) are generally small- to medium-sized accumulations of general utility flaked stone artifacts including projectile points, bifaces, expedient flake tools, and debitage. Complex Flaked Stone Assemblages (CFSA) are also limited to flaked stone artifacts but in higher concentrations and include a variety of maintenance and manufacturing tools such as formed flake tools, drills, awls, abraders, and general utility implements (Duke and Hildebrandt 2012). Simple Ground Stone Assemblages (SGSA) are defined by the occurrence of milling gear and general utility flaked stone artifacts. Complex Ground Stone Assemblages (CGSA) are defined by the occurrence of a wide assortment of flaked and ground stone tools indicative of a high degree of occupational intensity; these are often referred to as base camps or habitation sites (Duke and Hildebrandt 2012). Finally, quarry sites are those that contain debitage and tools associated with early stage reduction of locally available toolstone.
Table 2.1. Paleoindian Sites in the Carson Desert.

<table>
<thead>
<tr>
<th>Trinomial</th>
<th>Name</th>
<th>Description</th>
<th>Trinomial</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26CH1</td>
<td>Grimes Point Shelter</td>
<td>Burial</td>
<td>26CH1993</td>
<td>Julia Beach</td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH1F</td>
<td>Spirit Cave</td>
<td>Burial</td>
<td>26CH2035</td>
<td></td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH22</td>
<td>Hathaway Beach Quarry</td>
<td>Quarry (FGV)</td>
<td>26CH2064</td>
<td></td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH46</td>
<td>Hidden Cave</td>
<td>Textile fragment</td>
<td>26CH2065</td>
<td></td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH61</td>
<td>Hathaway Beach</td>
<td>CFSA</td>
<td>26CH2085</td>
<td></td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH104</td>
<td>Pumice Beach Site</td>
<td>CFSA</td>
<td>26CH2124</td>
<td></td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH163</td>
<td>Sadmat Site</td>
<td>CFSA</td>
<td>26CH3311</td>
<td></td>
<td>SGSA</td>
</tr>
<tr>
<td>26CH189</td>
<td></td>
<td></td>
<td>26CH3326</td>
<td></td>
<td>SFSA</td>
</tr>
<tr>
<td>26CH202</td>
<td>Dansie Site</td>
<td>SFSA</td>
<td>26CH3331</td>
<td></td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH309</td>
<td></td>
<td>CFSA</td>
<td>26CH3415</td>
<td>Quarry (CCS)</td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH317</td>
<td>Harvey Site</td>
<td>SFSA</td>
<td>26CH3543</td>
<td>CFSA</td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH508</td>
<td></td>
<td>CFSA</td>
<td>26CH3605</td>
<td>CGSA</td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH509</td>
<td></td>
<td>CFSA</td>
<td>26CH3616</td>
<td>CFSA</td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH619</td>
<td></td>
<td>SFSA</td>
<td>26CH3788</td>
<td>Quarry (CCS)</td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH645</td>
<td></td>
<td>SFSA</td>
<td>26CH3796</td>
<td>Quarry (CCS)</td>
<td>CFSA</td>
</tr>
<tr>
<td>26CH1765</td>
<td></td>
<td>SFSA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Materials: the Overlook Site (26CH3413)

Site Discovery and Initial Findings

In the winter of 2011, Far Western crews discovered 26CH3413 (The Seal Beach Overlook Site, referred to henceforth as the Overlook Site), while conducting pedestrian survey on NAS Fallon (Clay and McCabe 2012) (Figure 2.2). The Overlook Site is situated at 1,250 m amsl on a silt- and sand-covered volcanic bedrock promontory at the southwestern edge of Lahontan Valley.
The site was described during inventory as a 6,823-m² surface assemblage containing numerous Paleoindian artifacts including formed and expedient flake tools, bifaces in all stages of manufacture, and diagnostic WST projectile points cross-dated to the
Paleoindian period (Figure 2.3; Appendix A). Modern disturbances noted include a coyote trap under a rock outcrop, all-terrain vehicle tracks made by Navy Seals conducting training, and expended ordnance. The Intermountain Antiquities Computer System (IMACS) form for the Overlook Site provided Far Western’s survey-level National Register of Historic Places (NRHP) eligibility recommendation:

“This site is a Paleoindian (Terminal Pleistocene-Early Holocene Period) assemblage on a promontory overlooking Lahontan Valley. It contains an undisturbed and potentially buried cultural assemblage from a temporal period that has relatively few sites and is still poorly understood throughout the Great Basin. The relatively high number of artifacts, presence of obsidian and basalt for analysis, internal spatial patterning, and potential for depth and buried features could provide significant information on Paleoindian Chronology, Subsistence and Settlement, Mobility and Land Use, and Paleoenvironments in Lahontan Valley. The site is recommended eligible to the National Register under Criterion D”.

Figure 2.3. Far Western's original sketch map of 26CH3413.
Research Design Process, Permitting, and Access

Following fieldwork conducted by Far Western in 2011, a request to revisit the Overlook Site to conduct additional research was submitted to the NAS Fallon base archaeologist Mrs. Robin Michel. Upon gaining approval to conduct work at the site, a research design (Rice and Smith 2013) was submitted to the State Historic Preservation Office (SHPO) and the Stillwater Field Office of the Carson City Bureau of Land Management (BLM) in October of 2013 and approved soon thereafter. A Fieldwork Authorization was submitted to the Carson City BLM and a search of their records was conducted. A supplementary search was made of NVCRIS to identify nearby Paleoindian sites and toolstone quarries. In addition, the study required a Cultural Resource Use Permit (N-87283) and a Nevada Antiquities Permit, both obtained by Dr. Geoffrey M. Smith (UNR). Site recording methods were found to comply with the Guidelines and Standards provided by the BLM Nevada State Office (2012). An agreement was reached so that collected artifacts would be analyzed in the Prehistoric Laboratory in the UNR Anthropology Department and ultimately curated at the Nevada State Museum under UNR’s curation agreement. NAS Fallon agreed to supply funds to curate the artifacts and perform source and hydration analysis on a sample of obsidian artifacts. With the necessary permits and approval from the SHPO and Navy to proceed, fieldwork at the Overlook Site was limited to one week, between March 17th and March 23rd, 2014.
To investigate spatial patterning observed at the site during inventory, I piece plotted all new and previously recorded stone tools, all surface collected obsidian debitage, the southwest corners of test units, and surface analysis units using a Trimble® Real Time Kinematic (RTK) Global Positioning System (GPS) unit and Trimble® GeoXT unit with a sub-centimeter accuracy. Geological mapping consisted of a survey of an area surrounding the site large enough to characterize its geologic and geomorphic context. Geological units were identified using excavation units, described below. Crews resurveyed the site area at 1-m intervals to relocate all previously recorded tools, flag new tools, and redefine the site boundary as necessary. Artifact concentrations were flagged and evaluated for potential testing and debitage analysis. In-field debitage analysis recorded flake type (i.e., cortical spall, retouch, shatter, biface thinning flake), raw material type, flake size value, platform type, number of dorsal flake scars, and amount of cortex. In-field analysis of tools included weight, type, dimensions, whether the item was whole or complete, type of break, type of flaking, and type of fragment. These categories are further defined later in this chapter.

The collection strategy sought to obtain a representative sample and preserve a large component of the site for management and future research (Rice and Smith 2013). Therefore, collection was limited to 50% of the tools at the site not fashioned from fine-grained volcanic (FGV) material, all tools fashioned from FGV rock, and all formal tools (e.g., tools that possess clear evidence of being hafted, projectile points classified as WST points, and artifacts that exhibit fine pressure flaking).
Excavation focused on locating buried features within areas of dense lithic artifacts and at contacts between sedimentary units. A maximum of 20 0.5-x-0.5-m² excavation units were proposed to define the cultural and geological deposits while preserving the integrity at the site. One profile within each excavation unit was drawn to illustrate the vertical and horizontal relationships between deposits on the site. Five 0.5-x-0.5-m² excavation units were placed across the site to capture any change or homogeneity in the deposits. Units were dug in arbitrary 5-cm increments with both shovels and trowels. Sediment was sifted through 1/8-in screens.

A 1-m interval pedestrian survey of the area located over 200 tools including numerous WST points, a crescent, bifaces, drills, expedient and formed flake tools, and multifunctional tools (these tool types are defined later in this chapter). Over 1,000 pieces of debitage were analyzed in the field and in the lab from the surface collection of obsidian, in-field analysis, mapping of CCS and FGV flakes, and excavation units. Cores and tested cobbles were recorded and mapped as well.

A sample of in situ tufa was recovered 55 cm below the surface in Excavation Unit 1. The sample was similar in texture and dendritic morphology as tufa covering the volcanic outcrop at the southeastern end of the site. The sample was submitted to Beta Analytic, Inc., who returned an accelerator mass spectrometry radiocarbon date corrected for isotopic fractionation of 10,930±30 ¹⁴C BP (Beta-384273; δ¹³C = -0.7 ‰; Appendix B). This radiocarbon date is based on the 5,568-year Libby half-life. The 2-σ calibrated age range is between 12,810 to 12,730 cal BP with an intercept at 12,755 cal BP. Tufa samples have been dated elsewhere in the valley; however, these studies focused on
defining Lake Lahontan highstands at and above ~1,300 m amsl (Table 2.2; Benson and Thompson 1987).

Table 2.2. Radiocarbon Dates on Tufa in the Carson Desert.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Elevation (m)</th>
<th>Material Dated</th>
<th>Radiocarbon Date (14C BP)</th>
<th>Calibrated Age Range (cal BP)</th>
<th>Calibration Curve Intercept</th>
<th>Source publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD 84-8</td>
<td>1,311</td>
<td>Tufa</td>
<td>12,310 ±150</td>
<td>13,840-15,002</td>
<td>14,200</td>
<td>Benson and Thompson (1987)</td>
</tr>
<tr>
<td>CD 85-2G</td>
<td>1,300</td>
<td>Gastropod</td>
<td>12,500 ±1000</td>
<td>12,516-17,674</td>
<td>15,000</td>
<td>Benson and Thompson (1987)</td>
</tr>
<tr>
<td>CD 84-7</td>
<td>1,303</td>
<td>Tufa</td>
<td>12,650 ±150</td>
<td>14,245-15,483</td>
<td>15,100</td>
<td>Benson and Thompson (1987)</td>
</tr>
<tr>
<td>Beta-384273</td>
<td>1,250</td>
<td>Tufa</td>
<td>10,930 ±30</td>
<td>12,810-12,730</td>
<td>12,755</td>
<td>Current study</td>
</tr>
</tbody>
</table>

Note: All dates were calibrated using Calib 7.0 to 2-σ (Stuiver and Reimer 2014).

Tufa may be subject to a reservoir effect, where the occurrence of older carbon in bodies of water can shift the radiocarbon age to values older than the actual time of deposition (Benson et al. 2013b), but in this case the reservoir effect would have been minimal when Lake Lahontan was spilling into adjacent basins (Benson et al. 2013b).

Methods: Lithic, Geologic, and Spatial Analysis

I employed several methods to understand technological activities, mobility, and technological organization. They include energy dispersive XRF and obsidian hydration analysis, lithic artifact analysis focused on metric and non-metric variables, spatial and geomorphic context evaluation of the assemblage, and discussion of the site in terms of the regional Paleoindian record.
Lithic Analysis

Materials used in this study include artifacts analyzed both in the field and in the laboratory. Items collected from the Overlook Site were cleaned and catalogued in UNR’s Prehistoric Laboratory. Artifacts were assigned catalogue numbers and non-metric and metric variables were recorded on each one including material type and color, length, width, thickness, completeness, type of fragment, type of break (Lafayette 2006; Whittaker 1994), type of tool, percent cortex, and weight for complete artifacts. Measurements were taken with sliding calipers to the nearest millimeter (mm) and weight was taken with a digital scale to the nearest 0.1 g. These data were collected and entered into Microsoft Excel for cataloguing and further study.

Typological classification of artifacts from the Overlook Site was adapted from work at other Paleoindian sites in northwestern Nevada including the Parman Localities (Smith 2006) and Sadmat Site (Graf 2001). Tools were assigned to 10 categories including bifaces, cores/tested cobbles, crescents, drills, formed flake tools, simple/expedient flake tools, hammerstones, multifunctional tools, and WST points, or hafted bifaces (Table 2.3). Bifaces are defined as any tool or tool fragment that “exhibits flake removals on two faces that meet to form a single edge that circumscribes the entire artifact” (Andrefsky 2005:77). Bifaces were assigned to a particular reduction stage (1-5) using Callahan’s (1979) scheme. If bifaces possessed hafting elements (i.e., shoulders, stems) then they were classified as WST points. When hafting elements were missing but the blade fragments were consistent with WST point morphology and flaking pattern, they were typed as non-diagnostic WST point fragments. Cores are defined as objective
pieces that have had flakes removed from their surfaces (Andrefsky 2005:81). Crescents are bilaterally symmetrical bifaces exhibiting a crescentic shape (Tadlock 1966). Drills possess elongated, narrow, rounded bits at their distal ends (Duke 2011; Elston et al. 1977). Drill bits may exhibit use damage such as crushed and rounded edges (Elston et al. 1977:75). Flake tools were divided into two categories: formed and expedient. Formed flake tools are tools fashioned on pieces of debitage that exhibit considerable retouch and use wear. This category includes what have been referred to as steep-edged scrapers. Expedient flake tools exhibit incipient unifacial wear (Duke 2011).

### Table 2.3. Stone Tools from the Overlook Site.

<table>
<thead>
<tr>
<th>Tool Types</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifaces</td>
<td>139</td>
</tr>
<tr>
<td>Cores/Tested Cobbles</td>
<td>9</td>
</tr>
<tr>
<td>Crescent</td>
<td>1</td>
</tr>
<tr>
<td>Drills</td>
<td>5</td>
</tr>
<tr>
<td>Expedient flake tools</td>
<td>5</td>
</tr>
<tr>
<td>Formed flake tools</td>
<td>15</td>
</tr>
<tr>
<td>Hammerstone</td>
<td>1</td>
</tr>
<tr>
<td>Multifunctional tools</td>
<td>5</td>
</tr>
<tr>
<td>WST points</td>
<td>27</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>207</strong></td>
</tr>
</tbody>
</table>

Hammerstones are cobbles which exhibit battering on one or more ends. Tested cobbles are toolstone packages which have been battered and flaked to evaluate the lithic material but do not exhibit use as a core. Multifunctional or multipurpose tools are items that show evidence as use of two or more of the above functional categories (Duke 2011:142).
Researchers recognize various sub-types of WST projectile points. Cougar Mountain points are contracting stem points that generally possess sloping shoulders, edge grinding along their basal margins, convex bases, and are 10-13 cm long (Layton 1970). Radiocarbon dates range between ~8,000 and ~11,500 cal BP for Cougar Mountain points (Beck and Jones 1997). Haskett points are unshouldered, collaterally flaked, and lenticular in cross-section with a convex basal section accounting for approximately 60% of their length (Beck and Jones 2009; Butler 1965, 1967; Smith 2006; Wriston 2003). Current radiocarbon dates on Haskett points come from work in the northwestern United States. At the Sentinel Gap Site (45KT1362) in central Washington, Galm and Gough (2008) dated a hearth feature at a single component Haskett site to ~12,600 cal BP (10,680±190 14C BP). Bedwell (1973) also reported a radiocarbon date of ~13,100 cal BP (11,200±200 14C BP) associated with a Haskett point from the Connelly Caves in southeastern Oregon although some researchers question the association between the dated material and point (Beck and Jones 1997).

Debitage was classified using macroscopic morphological characteristics and a typology developed by Mr. William Bloomer for the Ruby Pipeline cultural resource management project (Hildebrandt et al. 2014). Flake types include cortical, simple interior, simple interior/complex platform, linear, complex interior, edge preparation, early biface thinning, late biface thinning, early pressure, late pressure, fragments, and shatter. Cortical flakes have cortex covering >25% of the dorsal surface. Other flakes with <25% cortex, such as late core or early biface reduction flakes, were not classified as cortical. Simple interior flakes are non-cortical flakes with ≤3 dorsal flake scars, (excluding platform preparation scars) with flat platforms. Linear flakes are long blade-
like flakes. Complex interior flakes are non-cortical flakes with ≥3 dorsal flake scars (excluding platform preparation scars). On complex interior flakes, negative flake scars emanate from various and opposing directions and platforms are typically complex.

Edge preparation flakes are wider than they are long with pronounced bulbs of percussion; they are the result of shaping an unworked edge of a flake blank. Early biface thinning flakes are often slightly curved with simple or complex bifacial platforms and a few dorsal scars which generally emanate from the flakes’ platforms. Late biface thinning flakes are curved or flat with bifacial platforms and multiple dorsal flake scars, which may reveal a complex pattern of previous flake removals. Typically, late stage thinning flakes retain partial dorsal scars showing previous flake removals from the opposite edge of the biface. Early pressure flakes removed from a flake blank or early stage biface show few to no dorsal scars. Platforms may be perpendicular or oblique to the long axis. Shapes vary from wide and short to long and narrow. Late pressure flakes have a complex dorsal surface and platforms typically oblique to the long axis.

Fragments are typed as proximal, medial or distal; however, if the flake retained enough characteristics it was classified under the flake types above. Shatter is defined as angular pieces of debitage without typical flake attributes.

Macroscopic characteristics such as size value, material type, material color, cortex presence/absence, platform type, fragment type, number of dorsal scars, and flake type were recorded in addition to classification using Far Western’s schema. Flake size was recorded as large, medium, and small, with small ranging between 0 and 1.3 cm (<½ in), medium ranging between 1.3 and 2.57 cm (½-1 in), and large being >2.57 cm (>1 in).
Platform types were defined following Andrefsky’s (2005) classification and include complex, flat, abraded, and cortical.

Lithic raw material was characterized using macroscopic traits such as color and texture (Smith 2006). Three categories were used to classify the toolstone on which artifacts were manufactured: (1) CCS, which includes chert, chalcedony, flint, silicified tuff, and jasper; (2) obsidian; and (3) FGV, which includes basalt, andesite, dacite, and rhyolite. Local toolstone was defined as materials occurring <50 km from the Overlook Site, whereas non-local toolstone was defined as materials occurring >50 km from the site.

*Obsidian Sourcing and Hydration.* A sample of 79 obsidian artifacts was compiled from the total collection of 138 pieces from the Overlook Site to submit for sourcing and hydration analysis. The sample was chosen to include less weathered pieces and larger fragments ≥1-cm in diameter. Dr. Richard Hughes at the Geochemical Research Laboratory in Portola Valley, California conducted XRF source provenance analysis on 68 of the 79 obsidian artifacts submitted from the Overlook Site. Measurements of specific elements were taken within the samples and compared to a database of known obsidian chemical groups (Appendix C). Artifact-to-source correlation is considered reliable if mean measurements for diagnostic elements of artifacts fell within two standard deviations of mean values for source standards.

The most important problem facing research using hydration rind values of volcanic glass is calculating a hydration rate, which is dependent on the chemical composition of the obsidian as well as its environment of deposition (Beck 1999). Obsidian hydration was employed in this study as a coarse-grained way to distinguish
Paleoindian artifacts from later artifacts. Eighty-three obsidian artifacts were submitted to Origer’s Obsidian Laboratory for hydration rind analysis. I selected the least weathered samples from surface and subsurface contexts; analyzed artifacts were limited to obsidian flakes and small biface fragments. Temporally diagnostic obsidian artifacts (e.g., WST points, crescents) were not recovered from the site. The methods utilized by Origer’s Laboratory are provided in the lab report (Appendix C). Hydration rind measurements have a range of ±0.2 microns due to normal equipment limitations. Six measurements were taken at several locations along the edge of each thin section. A mean of the six measurements is provided in the results report (Appendix C). The mean hydration rind value was analyzed as a group according to the source provenance. Chauvenet’s criterion was used to assess the samples for outliers (Taylor 1997).

**Geological Analysis**

Erosion, transport, and deposition of sediment related to climate change throughout the Holocene have created problematic environments for reconstructing systemic contexts at surface Paleoindian sites. Artifacts deposited during a single episode may later be moved by multiple cultural and/or non-cultural mechanisms and redeposited in different locations (Schiffer 1996, 2010). Therefore, discerning site formation processes (e.g., near-shore wave action, deflation, and bio- and pedoturbation) is important prior to interpreting behavior based on patterns in the archaeological record. The Paleoindian record is poorly understood in the southern Lahontan basin in part because of aforementioned long-term collecting by avocationalists but also perhaps due
to geomorphic and cultural processes as well. Post-depositional alterations include site burial by Holocene dunes and alluvial fans, recycling of artifacts for toolstone by later hunter-gatherers, and oscillations of the late Holocene low-elevation Fallon lakes (Adams 2003; Benson et al. 2013a; Morrison 1964).

Examining the surface and subsurface geological context at the Overlook Site rested on geologic mapping and excavating test units. Excavation provides a method with which to evaluate stratigraphic separation of accretionary occupation layers or single occupation events (Waters 1992). Evaluation of the soil, sediment, and stratigraphy included categorizing the strata exposed in excavation units by texture, particle size, fabric, and color using a Munsell chart. Clast and particle size were determined macroscopically and using the Wentworth scale. In addition, a review of aerial photos and Google Earth showed basic geomorphic and environmental contextual data. Three excavation units were placed across the site from north to south off the Universal Transverse Mercator (UTM) grid location of the datum. One drawing and photograph were taken of a profile exposed in one sidewall in each unit to show sediment change across the site. Excavation Unit 1 was placed at the interface between desert pavement and sandy silt in the central portion of the site. Excavation Unit 2 was placed in the central portion of the site, and Excavation Unit 3 was placed at the northern extent of the site. All three units were emplaced to define the relationship between sedimentary deposits and artifacts but also to evaluate clusters of artifacts for potential features.

Where vegetation is sparse at the southern and eastern areas of the site, the surface is characterized by a young desert pavement. Desert pavements are common in arid and semi-arid environments and generally consist of a one-to-two particle armor or
thick layer of closely packed angular to subrounded gravels (McFadden et al. 1987). The desert pavement at the Overlook Site is comprised of light-colored rhyolite and tufa weathering from the bedrock exposures on the southeastern edge of the site and upslope from the site to the northwest. Artifacts are also embedded alongside gravels in the pavement matrix. Desert pavement development is the result of wind deflation or sheetwash of fine sediment creating a coarse-grained lag. Alternatively, heaving (periods of shrinking and swelling due to cryoturbation or saturation and desiccation) may force the upward migration of larger clasts (McFadden et al. 1987; Wells et al. 1995). The artifacts and rock fragments have a light orange varnish, the matrix is still developing, and clasts are not completely interlocking, suggesting a relatively young pavement (Dickerson 2008). Rodent burrows are abundant in the soft silt and sand coppices in the center of the site. The sediment supports a vegetation community of greasewood and shadscale.

Spatial Analysis

Spatial analysis is the statistical investigation of two-dimensional locational information or point-pattern data (Orton 2004). Provenience data for spatial points were collected in UTM Cartesian grid coordinate units with GPS devices (Figure 2.4). Data collection sought to avoid common problems in data quality including errors in measurement of location and missing or damaged data (Orton 2004); however, these problems are often unavoidable. Due to time constraints, I was unable to collect UTM coordinates for every artifact on the surface of the site and artifacts may not have been
located. Surface analysis units (Southwest Surface Analysis Unit [SSAU] and Northeast Surface Analysis Unit [NSAU]) were emplaced to characterize 100% of the surface artifacts and sedimentological contacts in two areas of the site but also sample debitage and tool type and frequency in two separate areas of the site. The SSAU measured 2,691 m² area and the NSAU measured 100 m². Methods employed during fieldwork were inherently biased due to the artificial clustering inherent in recording artifacts in analysis units; therefore, each unit was analyzed for clustering separately. In addition, all tools on the surface of the site were recorded; therefore, tool classes were analyzed separately for spatial patterning. Another problem is “edge effects” wherein analytical techniques assume a theoretically infinite study universe, and of course, the Overlook Site is defined within recorded or perceived spatial boundaries (Orton 2004). These data were imported into ArcGIS 10.1 to test whether the surface horizontal spatial pattern represents randomness (Bivand et al. 2013). Ripley’s K function provides a basic description of the spatial data and is available in ArcGIS under the Multi-Distance Spatial Cluster Analysis tool (ESRI 2013).
Figure 2.4. Map showing distribution of artifacts, excavation units and surface analysis units.

Ripley’s K or \( K \)-function was formulated to assess aggregation and segregation or intensity of point data at different spatial scales and is defined as \( K(s) = \lambda^{-1} E[N_0(s)] \),
where \( E \) denotes the expectation and \( N_0(s) \) is the number of events up to a distance \( s \) (Bivand et al. 2013; Connolly and Lake 2006). Intensity is defined as \( \lambda \) and \( \lambda K(r) \) is the “expected number of neighbors in a circle of radius \( r \) at an arbitrary point in the distribution” (Connolly and Lake 2006:166). Figures 2.5 and 2.6 show how the \( K \)-function is transformed in ArcGIS 10.1 for clarity of presentation into \( L(d) \).

\[
L(d) = \sqrt{\frac{A \sum_{i=1}^{n} \sum_{j=1, j \neq i}^{n} k(i, j)}{\pi n(n - 1)}}
\]

**Figure 2.5.** Equation showing transformation of Ripley’s \( K \) into \( L(d) \) (ESRI 2013).

Figure 2.5 shows the equation with which Ripley’s \( K \) evaluates random, regular, and clustered features. Component \( d \) is the distance, \( n \) is equal to the total number of features, \( A \) represents the total area of the features, and \( k_{ij} \) is the weight. If there is no edge correction then the weight will be equal to one when the distance between \( i \) and \( j \) is less than \( d \) and will otherwise equate to 0 (ESRI 2013).
The transformation results in an $L(d)$ value either above, below, or within the envelope that represents complete spatial randomness. Below the envelope, the value signifies a dispersed point pattern and above the envelope, the point pattern represents a clustered pattern. Confidence envelopes are created using Monte-Carlo simulation of random distribution of points with a 95% confidence interval obtained within 1,000 to 5,000 iterations (Connolly and Lake 2006). If artifacts within the analysis units and across the site can be proven to cluster statistically – for example, if bifaces and biface reduction flakes tend to cluster in an area of the unit – then I considered them to be related. If core reduction flakes, cores, and tested cobbles appear to be clustered in space then I assumed that these items are related. Conversely, if the artifacts that are near each other in space but do not reveal a related functional relationship, then I assumed that the clustering is a result of eolian deflation and/or the result of multiple occupation events. If clustering is in the result of intrasite structure and not geological forces, then this result supports the hypothesis that this site represents one or more activity episodes that may comprise the
results of residential behavior a residential base camp. If the Ripley’s $K$-function returns data that suggest a random pattern, then this supports the null hypothesis that the array may be the result of geological and geomorphic processes.

Restatement of Hypothesis

The Overlook Site is a large, discrete scatter of tools and debitage exhibiting spatial patterning of artifacts and sedimentary deposits. Lithic cross-dating using two complete WST points (one CCS Cougar Mountain point and one refit FGV Haskett point) and a radiocarbon date on tufa recovered from bedrock at the bottom of Excavation Unit 1 reveals that occupation dates to between ~12,800 and 8,000 cal BP. Based on the methods described above, this study seeks to answer a few simple questions regarding Paleoindian mobility and site function by testing the hypothesis that the Overlook Site represents a residential base camp. Is spatial structure at the site the result of activities taking place in discrete areas of the site or is it the result of some other discernible process? Does the assemblage in combination with the internal structure at the site reflect use of the site as a Paleoindian residential base camp? Does the assemblage contain evidence that local toolstone was favored over exotic toolstone? These questions relate back to the idea of whether Paleoindians were highly mobile, as general theories suggest, or if at times and at certain favored places where resources may have been abundant, the mobility strategy shifted to one where occupation was lengthened.
CHAPTER 3: RESULTS

This chapter summarizes the characteristics of the flaked stone tools and debitage as well as site formation processes at the Overlook Site, and discusses the results of my assessment of internal spatial aspects of the sedimentary and cultural deposits.

The Overlook Site Lithic Assemblage

Raw Materials

The tools and debitage at the Overlook Site are fashioned from three material types: (1) CCS; (2) FGV; and (3) obsidian (Table 3.1). Flakes and tools are most commonly fashioned on CCS with FGV and obsidian less represented.

CCS artifacts exhibit a variety of colors including brown, red, yellow, pink, gray, black, orange, green, white, and mottled. Textures vary between very fine-grained silicified silt- and mudstones to coarse-grained inclusion-rich material.

<table>
<thead>
<tr>
<th></th>
<th>CCS</th>
<th>FGV</th>
<th>Obsidian</th>
<th>Sandstone</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools</td>
<td>158</td>
<td>37</td>
<td>11</td>
<td>1</td>
<td>207</td>
</tr>
<tr>
<td>Debitage</td>
<td>811</td>
<td>113</td>
<td>137</td>
<td></td>
<td>1061</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>969</td>
<td>150</td>
<td>148</td>
<td>1</td>
<td>1268</td>
</tr>
</tbody>
</table>
Some of the CCS is visually similar to material found just downslope, ~30 m, from the site (Figure 3.1).

![Figure 3.1. Example of local varieties of CCS toolstone.](image)

Petrified wood and wonderstone are included in the CCS category as well and come from sources from within Lahontan Valley.

FGV is locally available and is high quality gray and black material. As noted in Chapter 2, FGV cobbles are abundant in fan and reworked fan deposits and many outcrops of Tertiary volcanics are present in the valley.
The obsidian from which artifacts are fashioned is variable in color and texture, either suggesting procurement from numerous sources or variability within individual sources. Mahogany, gray, black, and opaque and translucent varieties were noted at the site.

*Obsidian XRF and Hydration Analysis*

Of the 79 obsidian artifacts submitted to Geochemical Research Laboratory, source provenance analysis was conducted on 59 flakes and nine obsidian tools (Table 3.2). Thirteen obsidian sources are represented among the samples from the Overlook Site (Figure 3.2). Because Garfield Hills and Pine Grove Hills are so close and similar in chemistry they are combined as a single source on Figure 3.2. Bodie Hills is the best represented obsidian source (n=32) followed by Sutro Springs (n=9) and Mount Hicks (n=7). Five bifaces and one flake tool are fashioned from Bodie Hills obsidian, one biface is fashioned from Massacre Lake/Guano Valley obsidian, one biface is made from Fox Mountain obsidian, and one flake tool is made from Sutro Springs obsidian (Table 3.2; Figure 3.3). The majority of flakes characterized are from sources located to the south of the Overlook Site.
Figure 3.2. Distribution of obsidian sources represented at the Overlook Site.
### Table 3.2. Obsidian Sources Represented at the Overlook Site.

<table>
<thead>
<tr>
<th>Obsidian Source</th>
<th>Bifaces</th>
<th>Flake Tools</th>
<th>Debitage</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodie Hills, CA</td>
<td>5</td>
<td>1</td>
<td>31</td>
<td>37</td>
</tr>
<tr>
<td>Sutro Springs, NV</td>
<td></td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Mt. Hicks, NV</td>
<td></td>
<td></td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Lookout Mountain/Casa Diablo, CA</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pine Grove Hills, NV</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Garfield Hills, NV</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Desert Mountains, NV</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bordwell Spring, NV</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Buck Mountain, CA</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fox Mountain, NV</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Massacre Lake/Guano Valley, NV</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Unknown A</td>
<td></td>
<td></td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td><strong>7</strong></td>
<td><strong>2</strong></td>
<td><strong>59</strong></td>
<td><strong>68</strong></td>
</tr>
</tbody>
</table>

Figure 3.3  Obsidian artifacts graphed by source.
As noted in the previous chapter, the same 79 pieces of obsidian were sent to Origer’s Obsidian Laboratory for hydration rind analysis. Eight pieces were too weathered to return viable results, leaving 71 pieces for analysis. Based on the standard deviation and coefficient of variation (Table 3.3) of Bodie Hills, Sutro Springs, and Mount Hicks rind thicknesses, the site was likely formed during occupation(s) within a single cultural period (i.e., Paleoindian). Additionally, the hydration rind values are significantly thicker than at other Archaic sites in the region, including Hidden Cave (Clay et al. 2014; Jackson 1985). The obsidian debitage is generally small and primarily from tools removed from the site (see Table 3.2). A few of the larger (>7cm) obsidian flakes were perhaps part of a transported toolkit of usable blanks (Kuhn 1994; Prasciunas 2007).

<table>
<thead>
<tr>
<th>Obsidian Source</th>
<th>Count*</th>
<th>Mean</th>
<th>SD</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bordwell Spring, NV</td>
<td>1</td>
<td>9.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Desert Mountains, NV</td>
<td>1</td>
<td>8.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fox Mountain, NV</td>
<td>1</td>
<td>9.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Garfield Hills, NV</td>
<td>1</td>
<td>11.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lookout Mountain, CA</td>
<td>1</td>
<td>13.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pine Grove Hills, NV</td>
<td>1</td>
<td>8.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Buck Mountain, CA</td>
<td>2</td>
<td>5.45</td>
<td>3.18</td>
<td>0.58</td>
</tr>
<tr>
<td>Massacre Lake/Guano Valley, NV</td>
<td>2</td>
<td>9.6</td>
<td>3.39</td>
<td>0.35</td>
</tr>
<tr>
<td>Unknown A</td>
<td>2</td>
<td>3.05</td>
<td>0.07</td>
<td>0.02</td>
</tr>
<tr>
<td>Mt. Hicks, NV</td>
<td>7</td>
<td>11.19</td>
<td>1.57</td>
<td>0.14</td>
</tr>
<tr>
<td>Sutro Springs, NV</td>
<td>9</td>
<td>8.27</td>
<td>1.11</td>
<td>0.13</td>
</tr>
<tr>
<td>Unknown</td>
<td>11</td>
<td>10.4</td>
<td>1.66</td>
<td>0.16</td>
</tr>
<tr>
<td>Bodie Hills, CA</td>
<td>32</td>
<td>10.5</td>
<td>1.38</td>
<td>0.14</td>
</tr>
</tbody>
</table>

*In order by counts, from smallest to largest
Debitage

Debitage at the Overlook Site consists of three material types: (1) FGV; (2) obsidian; and (3) CCS (Table 3.4). Not all CCS debitage was patinated, however, and a variety of colors was observed. Based on visual characteristics, local wonderstone and CCS comprise the bulk of lithic debris. A few CCS flakes exhibit a luster that suggests heat-treatment (n=4, SSAU). Flake fragments represent 19% (n=213, including all complex fragments and proximal, medial and distal fragments) of the total flakes analyzed from the surface of the site and within the excavation units (Table 3.5).

Table 3.4. Flake Types by Toolstone.

<table>
<thead>
<tr>
<th>Flake Type</th>
<th>CCS</th>
<th>FGV</th>
<th>Obsidian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Biface Thinning</td>
<td>202</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>Fragment</td>
<td>132</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Late Biface Thinning</td>
<td>129</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Simple Interior</td>
<td>125</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Cortical</td>
<td>62</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Complex Interior</td>
<td>48</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Shatter</td>
<td>61</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Primary</td>
<td>28</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Edge Preparation</td>
<td>21</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Complex Fragment</td>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Blade</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Early Pressure</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Late Pressure</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Split Cobbles</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td><strong>811</strong></td>
<td><strong>113</strong></td>
<td><strong>88</strong></td>
</tr>
</tbody>
</table>
Six hundred and fifty-eight flakes were analyzed in the SSAU, 166 flakes were analyzed in the NSAU, 88 obsidian flakes were analyzed across the entire surface of the site, and 149 flakes were removed from excavation units and analyzed, for a combined total of 1,061 flakes. Of this total, 811 flakes are CCS, 137 flakes are obsidian, and 113 are FGV (Table 3.6).

| Table 3.5. Flake Types by Site Area. |
|-------------------------------|-----|-----|-----|------|------|
| Flake Type                     | SSAU| NSAU| Obsidian | Excavation Units | Totals |
| Early Biface Thinning          | 172 | 38  | 8        | 18               | 236   |
| Fragment                       | 128 | 12  | 8        | 30               | 178   |
| Late Biface Thinning           | 90  | 56  | 12       | 5                | 163   |
| Simple Interior                | 116 | 14  | 5        | 15               | 150   |
| Cortical                       | 51  | 12  | 13       | 5                | 81    |
| Complex Interior               | 49  | 7   | 17       | 7                | 80    |
| Shatter                        | 6   | 9   | 5        | 57               | 77    |
| Primary                        | 26  | 9   | 0        | 0                | 35    |
| Edge Preparation               | 20  | 5   | 2        | 1                | 28    |
| Complex Fragment               | 0   | 0   | 16       | 5                | 21    |
| Blade                          | 0   | 1   | 2        | 0                | 3     |
| Early Pressure                 | 0   | 0   | 0        | 3                | 3     |
| Late Pressure                  | 0   | 0   | 0        | 3                | 3     |
| Split Cobbles                  | 0   | 3   | 0        | 0                | 3     |
| **TOTALS:**                    | **658** | **166** | **88** | **149** | **1,061** |

Table 3.6. Percent and Totals of Debitage Toolstone by Analysis Unit.

<table>
<thead>
<tr>
<th>Toolstone</th>
<th>SSAU*</th>
<th>%</th>
<th>NSAU</th>
<th>%</th>
<th>Obsidian</th>
<th>%</th>
<th>EU</th>
<th>%</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCS</td>
<td>571</td>
<td>83</td>
<td>143</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>97</td>
<td>65</td>
<td>811</td>
</tr>
<tr>
<td>OBS</td>
<td>30</td>
<td>4</td>
<td>9</td>
<td>67</td>
<td>58</td>
<td>0</td>
<td>40</td>
<td>27</td>
<td>137</td>
</tr>
<tr>
<td>FGV</td>
<td>87</td>
<td>13</td>
<td>14</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>8</td>
<td>113</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td><strong>688</strong></td>
<td><strong>100</strong></td>
<td><strong>166</strong></td>
<td><strong>100</strong></td>
<td><strong>58</strong></td>
<td><strong>0</strong></td>
<td><strong>149</strong></td>
<td><strong>100</strong></td>
<td><strong>1061</strong></td>
</tr>
</tbody>
</table>
Because artifact manufacture is a subtractive process, flake size generally decreases as reduction progresses (Andrefsky 2005). Flake size relates to the size of the objective piece (e.g., a core or biface) and its position in the reduction/manufacture trajectory (Andrefsky 2005). In the SSAU, 64% (n=424) of flakes were measured as large (≥1 in), 32% (n=206) of flakes are medium (between ½ in and 1 in) and 4% (n=28) are small (<½ in) flakes. In the NSAU, 67% of the analyzed flakes are large (n=111), 26% are medium (n=43), and 7% (n=12) are small. All obsidian flakes from the surface of the site were collected, mapped, and analyzed. Of those obsidian flakes, 34% (n=30) are large, 47% (n=41) are medium, and 19% (n=17) are small. One hundred and forty-nine flakes were recovered from the excavation units; of those, 9% (n=14) are large, 19% (n=28) are medium, and 72% (n=108) are small (Table 3.6).

Table 3.7. Flake Size by Analysis Area.

<table>
<thead>
<tr>
<th>Flake Size</th>
<th>SSAU</th>
<th>%</th>
<th>NSAU</th>
<th>%</th>
<th>Obsidian</th>
<th>%</th>
<th>EU</th>
<th>%</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>424</td>
<td>64</td>
<td>111</td>
<td>67</td>
<td>30</td>
<td>34</td>
<td>14</td>
<td>9</td>
<td>579</td>
</tr>
<tr>
<td>Medium</td>
<td>206</td>
<td>32</td>
<td>43</td>
<td>26</td>
<td>41</td>
<td>47</td>
<td>28</td>
<td>19</td>
<td>318</td>
</tr>
<tr>
<td>Small</td>
<td>28</td>
<td>4</td>
<td>12</td>
<td>7</td>
<td>17</td>
<td>19</td>
<td>107</td>
<td>72</td>
<td>164</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>658</td>
<td>100</td>
<td>166</td>
<td>100</td>
<td>88</td>
<td>100</td>
<td>149</td>
<td>100</td>
<td>1,061</td>
</tr>
</tbody>
</table>

EU = Excavation Units

Cortex is another indicator of reduction stage, as most researchers assume that it is primarily removed during early stages of reduction (Morrow 1997). This assumption corresponds well with the fact that most flakes that exhibit cortex, both cortical and primary, are also the largest (i.e., also those likely the earliest to be removed). In the reduction process, there should be fewer cortical flakes than interior flakes because they
merely represent the exterior rind of the cobble. Many of the large flakes in the sample were typed as early and late biface thinning flakes, indicating that early stage bifaces were manufactured at the site. In the SSAU, 28% (n=183) of flakes exhibit cortex, 33% (n=55) in the NSAU exhibit cortex, 18% (n=16) of the obsidian flakes from the surface exhibit cortex, and 5% (n=8) of the flakes from excavation units exhibit cortex.

The FGV debitage is visually similar to material observed at the nearby Hathaway Beach Quarry (26CH61). Conversely, FGV tools are not macroscopically similar to locally available material. This suggests that they may be made on non-local FGV and bifaces manufactured on local FGV were manufactured and taken away from the site. A similar trend is noted regarding the CCS debitage, where the flakes appear to be overwhelmingly of locally available material but some of the CCS tools do are not visually similar to local CCS.

Obsidian flakes are not overly weathered or sandblasted, as is often the case at sites on the floors or margins of playas (Duke 2011). Eighty-three percent (n=571) of flakes in the SSAU are CCS, 4% (n=30) are obsidian, and 13% (n=87) are FGV. Excluding the obsidian across the surface of the site, obsidian comprises 11% (n=97) of flakes analyzed at the site. Obsidian comprises 27% (n=40), CCS comprises 65% (n=97), and FGV comprises 7% (n=12) of the debitage recovered from excavation units.

Four platform types were recorded: (1) cortical; (2) flat; (3) complex; and (4) abraded. Flakes with flat platforms are interpreted as representing early stage reduction or flake removals from non-bifacial tools or cores (Andrefsky 2005). Cortical platforms are interpreted to represent early stage core reduction. Finally, complex and abraded platforms are interpreted to represent mid-to-late stage reduction. Complex platforms
represent 46% of the 1,061 flakes analyzed (n=347 SSAU; n=33 units; n=77 NSAU; n=34 surface obsidian). Abraded platforms represent 0.6% (n=4 SSAU; n=3 surface obsidian). Cortical platforms comprise 4.4% of the analyzed flakes (n=30 SSAU; n=4 units; n=9 NSAU; n=5 surface obsidian). Flat platforms represent 19% of the debitage (n=131 SSAU; n=17 units; n=41 NSAU; n=17 surface obsidian). Flakes that are either fragments, shatter, or possess indeterminate platforms represent 30% of the assemblage (n=146 SSAU; n=95 units; n=39 NSAU; n=29 surface obsidian).

Dorsal flake scars (Figure 3.4) often increase as reduction progresses towards finished implements (Andrefsky 2005; Gilreath 1983). They may also clarify the size of the objective piece being worked. Therefore, while dorsal scars should increase on flakes driven off smaller implements, they may not increase significantly if large bifaces were the ultimate goal of reduction.

![Figure 3.4. Dorsal scars by toolstone type.](image-url)
Data suggest that mid- to late-stage reduction occurred, with 0-3 dorsal scars present on 40% of the 1,061 analyzed flakes, 4-6 dorsal scars present on 23% of the sample, and 6+ dorsal scars present on 3% of the sample. Thirty-four percent of flakes exhibited dorsal flake scars but the flakes were either fragments or the scars could not be counted. One of the obsidian flakes had a very high number of scars, (I counted 24); this may suggest that obsidian tools were finely worked and reduced to a greater degree than those made on either FGV or CCS. Alternatively, this could simply reflect the relative workability of the different toolstone types. Furthermore, the fact that most CCS flakes have low flake scar counts suggests CCS was reduced to partially finished tools at the site.

Debitage was classified using a typology provided by lithic analyst Mr. William Bloomer. Based on his typology, thedebitage tells a similar yet different story (Table 3.8). If the flakes are categorized by type, then the totals for biface (n=433) versus core reduction (n=429) are nearly equal.

Table 3.8 shows early stages of reduction of CCS cobbles to cores and bifaces and limited tool maintenance, as might be suggested by the presence of pressure flakes. The exception is obsidian, which shows predominantly late biface thinning, suggesting tool maintenance but not early stage production.

Tools

Two hundred and seven tools were analyzed in the field and laboratory (Table 3.9). Sixty-three tools were collected representing 30% of the tools recorded at the site.
While a variety of raw materials is represented in the tool assemblage, it does not appear that particular toolstone types (FGV, CCS, and obsidian) were favored for specific tool forms.

Table 3.8. Core and Biface Classification System by Toolstone Type.

<table>
<thead>
<tr>
<th>Flake Type</th>
<th>CCS</th>
<th>FGV</th>
<th>OBS</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIFACE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Biface Thinning</td>
<td>202</td>
<td>22</td>
<td>12</td>
<td>236</td>
</tr>
<tr>
<td>Late Biface Thinning</td>
<td>129</td>
<td>13</td>
<td>21</td>
<td>163</td>
</tr>
<tr>
<td>Edge Preparation</td>
<td>21</td>
<td>4</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Early Pressure</td>
<td>3</td>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Late Pressure</td>
<td>3</td>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td>352</td>
<td>39</td>
<td>42</td>
<td>433</td>
</tr>
<tr>
<td><strong>CORE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blade</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Simple Interior</td>
<td>125</td>
<td>18</td>
<td>7</td>
<td>150</td>
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<tr>
<td>Cortical</td>
<td>62</td>
<td>5</td>
<td>14</td>
<td>81</td>
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<td>Complex Interior</td>
<td>48</td>
<td>10</td>
<td>22</td>
<td>80</td>
</tr>
<tr>
<td>Shatter</td>
<td>61</td>
<td>6</td>
<td>10</td>
<td>77</td>
</tr>
<tr>
<td>Primary</td>
<td>28</td>
<td>7</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Split Cobbles</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td>327</td>
<td>47</td>
<td>55</td>
<td>429</td>
</tr>
<tr>
<td><strong>FRAGMENTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex Fragment</td>
<td>0</td>
<td>0</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Fragment</td>
<td>132</td>
<td>27</td>
<td>19</td>
<td>178</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td>811</td>
<td>113</td>
<td>137</td>
<td>1061</td>
</tr>
</tbody>
</table>

In fact, a notable characteristic of the assemblage is the paucity of obsidian tools, although perhaps this is not surprising given that the site is far (>120 km) from obsidian sources containing packages large enough to manufacture WST points or preforms.
The assemblage includes 139 bifaces, nine cores and tested cobbles, one crescent, four drills, five simple/expedient flake tools, 15 formed flaked tools, one graver, one hammerstone, five multifunctional tools, and 27 WST points and fragments (Table 3.9).

### Table 3.9. Tool Classes by Toolstone.

<table>
<thead>
<tr>
<th>Tool Type</th>
<th>CCS</th>
<th>FGV</th>
<th>OBS</th>
<th>Other</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifaces</td>
<td>114</td>
<td>17</td>
<td>8</td>
<td></td>
<td>139</td>
</tr>
<tr>
<td>Cores/Tested Cobbles</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Crescent</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Drills</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Simple Flake Tool</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Formed Flake Tool</td>
<td>12</td>
<td>3</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Graver</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Hammerstone</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Multifunctional</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>WST Point</td>
<td>15</td>
<td>12</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>158</strong></td>
<td><strong>38</strong></td>
<td><strong>11</strong></td>
<td><strong>1</strong></td>
<td><strong>207</strong></td>
</tr>
</tbody>
</table>

**Bifaces.** One hundred and thirty-nine bifaces were recorded at the Overlook Site, comprising 66.9% of the entire tool assemblage. Bifaces are fashioned on CCS, FGV, and obsidian. CCS bifaces (n=114; 82%) range in color and include brown, brown-orange, brown-red, gray, gray banded, gray green, gray-orange, red, pink, red-gray, white, and yellow material. Bifaces fashioned from FGV toolstone (n=17; 12%) include varieties of brown, black, dacite and basalt and gray, pink, and white-pink rhyolite. Finally, obsidian bifaces (n=8; 6%) include black opaque, semi-translucent, gray opaque, and mossy varieties.
Broken bifaces were categorized as complete, distal, end, margin, medial, and proximal fragments. The distal end of an implement is opposite to the base or proximal portion. Medial fragments are the middle portion of a biface. Recording the fragment type is important because it may reveal discard patterns and suggest how local versus non-local material is being utilized (Figure 3.5). Most bifaces are broken end or medial fragments with only 16% (n=22) of the 139 bifaces representing complete or refitting specimens. Breakage patterns were typed using three categories: (1) bending; (2) lateral; and (3) twist (Figure 3.6). Bending breaks can be caused by impact stress during manufacture or use (Whittaker 1994). The breaks are flat and usually take off one end of the tool. Lateral and twisting breaks are generally associated with impact stress during use of the implement (Whittaker 1994).

Figure 3.5. Bifaces fragment type by toolstone.
A review of biface types by breakage (Figure 3.7) reveals that bending breaks are common. CCS bifaces are primarily Stage 3 and 3-4 with Stage 2, 3, and 4 also represented. Such a pattern is consistent with on-site biface manufacture as most specimens that break during production are somewhere near Stage 3 (Beck et al. 2002; Elston 1990). A few mid-and late-stage bifaces exhibit lateral and twisting breaks. FGV biface fragments primarily represent early to mid-stage reduction and obsidian bifaces of early and late stage reduction exhibit both bending and lateral breaks. No real pattern is revealed in this analysis; for example, not all late stage bifaces are broken nor do they exhibit consistent breakage patterns. These data suggest that early and late stage bifaces were not utilized strictly for a singular activity but likely utilized for a number of purposes resulting in various types of breaks. Alternatively, mid-stage bifaces may have been the ultimate goal of reduction and broken during use. Breakage associated with use is not the only explanation for breakage patterns at the Overlook Site, however, as two
desiccated cow hooves were noted suggesting that post-depositional formation processes (e.g., trampling) have been acting on the assemblage.

Figure 3.7. Frequency of biface stages by breakage.

*Obsidian Tools.* Twelve obsidian tools were recorded at the Overlook Site, making up 5.7% of the tool assemblage. One of the obsidian tools (A1) initially recorded by Far Western was not relocated during fieldwork and one obsidian flake tool (A113) was not submitted for sourcing. The remaining nine obsidian tools (seven bifaces and two flake tools) were submitted for geochemical sourcing and hydration rind value analysis (Table 3.10).

The obsidian tools are extremely reworked, down to nubs in some cases, but not all of the obsidian flakes, even large ones, appear to have been utilized.
Table 3.10. Obsidian Tool Hydration and Sourcing Data.

<table>
<thead>
<tr>
<th>OBS Cat. No.</th>
<th>Tool Type</th>
<th>Condition</th>
<th>Mean</th>
<th>SD</th>
<th>CV</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Biface Fragment</td>
<td>Weathered</td>
<td>10.7</td>
<td>0.1</td>
<td>0.01</td>
<td>Bodie Hills</td>
</tr>
<tr>
<td>8</td>
<td>Flake Tool</td>
<td>Weathered</td>
<td>8.1</td>
<td>0.15</td>
<td>0.02</td>
<td>Sutro Springs</td>
</tr>
<tr>
<td>23</td>
<td>Biface Fragment</td>
<td>Weathered</td>
<td>DH</td>
<td>-</td>
<td>-</td>
<td>Bodie Hills</td>
</tr>
<tr>
<td>57</td>
<td>Biface Fragment</td>
<td>Weathered</td>
<td>9.5</td>
<td>0.1</td>
<td>0.01</td>
<td>Bodie Hills</td>
</tr>
<tr>
<td>72</td>
<td>Biface Fragment</td>
<td>Weathered</td>
<td>8.3</td>
<td>0.15</td>
<td>0.02</td>
<td>Bodie Hills</td>
</tr>
<tr>
<td>133</td>
<td>Biface Fragment</td>
<td>Weathered</td>
<td>9.3</td>
<td>0.15</td>
<td>0.02</td>
<td>Fox Mountain</td>
</tr>
<tr>
<td>134</td>
<td>Biface Fragment</td>
<td>Band 1; Weathered</td>
<td>7.2</td>
<td>0.15</td>
<td>0.02</td>
<td>Massacre Lake</td>
</tr>
<tr>
<td>134</td>
<td>Biface Fragment</td>
<td>Band 2; Crack</td>
<td>12</td>
<td>12.0</td>
<td>0.01</td>
<td>Massacre Lake</td>
</tr>
<tr>
<td>135</td>
<td>Flake Tool</td>
<td>Weathered</td>
<td>7.4</td>
<td>0.08</td>
<td>0.01</td>
<td>Bodie Hills</td>
</tr>
<tr>
<td>136</td>
<td>Biface Fragment</td>
<td>Weathered</td>
<td>9.3</td>
<td>0.19</td>
<td>0.02</td>
<td>Bodie Hills</td>
</tr>
</tbody>
</table>

DH = diffuse hydration

Cores and Tested Cobbles. Cores (n=9) are made on CCS, with one example produced on banded silicified petrified wood. Six of the cores are tested cobbles which merely exhibit primary reduction where only a few flakes have been removed. The remaining three cores are small and expended with multidirectional flaking. The tested cobbles are visually similar to the material available just below the site on a broad gravel lag pavement.

Crescent. One quarter moon (sensu Tadlock 1966) bifacial crescent made on gray FGV was also found at the site (Figure 3.8). The convex margin shows use wear damage and one tip is missing. The remaining tip appears to have been utilized as well. The specimen is large, measuring 7.4 cm long by 2.8 cm wide by 0.6 cm thick. Although larger than usual crescents, the width and thickness fall within the range of crescents found elsewhere in the Great Basin (Beck and Jones 2009).
Drills. As noted in Chapter 2 drills are implements possessing elongated, narrow, rounded bits at their distal ends. Although this type name implies function, for the current study it is simply the best way to describe the morphology of such artifacts. Five drills were recorded at the Overlook Site. One is fashioned on gray-brown FGV and four on gray and brown CCS. The FGV drill is a recycled WST point with the distal end broken and reworked and the proximal end broken at the bit. One rounded tapered drill bit tip was recorded. Two drills are made on flakes: one has a small bit that is thicker and reworked than the ovate portion of the tool and the other is also ovate and exhibits cortex on the ventral surface. One drill is fashioned on a large flake and exhibits unifacial flaking with one spur showing fine pressure flaking (A153).

Simple and Formed Flake Tools. Simple flake tools represent 2.4% (n=5) of the assemblage and formed flake tools comprise 7.2% (n=15). Three expedient flake tools are made on obsidian, one is made on gray CCS, and one is made on gray FGV. The obsidian simple flake tools exhibit expedient use wear damage along one margin. Two of
the five expedient flake tools are fashioned on non-local obsidian from Bodie Hills and Sutro Springs (see Table 3.2).

Fifteen formed flaked tools were recorded at the Overlook Site: 12 are made of CCS and three are made of FGV. CCS varieties include orange, red yellow, brown, gray, pink and mottled brown and black. Five of the formed flake tools exhibit cortex suggesting they are fashioned from primary and secondary flake blanks. Scrapers are included in this category and defined as artifacts that are round in planview and exhibit steep edge angles where use wear and reworking is evident along their entire circumferences. While these types of artifacts have been described in regional studies (Graf 2001) as a separate category, I include them with formed flake tools to present them in a more functionally neutral way (McGuire and Stevens 2014) (see Chapter 2).

Six of the formed flaked tools fall into the scraper morphology. Generally, they are round, more smooth on the ventral surface than on the dorsal surface, exhibit bifacial flaking along the entire circumference, and/or are flaked and abraded crudely for handling along one edge with use wear visible along the opposite edge. All are heavily patinated and caliche has formed on one margin of one of the FGV flake tools (A106).

Hammerstone. The assemblage includes one complete brown sandstone hammerstone/battered cobble. The specimen measures 7.7 cm long by 8.1 cm wide by 4 cm thick and displays one battered edge. The sample may be biased, as there are hundreds if not thousands of cobbles on the surface of the site and in the desert pavement surface which were not dug out and examined for use.

Multifunctional Tools. Multifunctional tools make up 2.4% (n=5) of the assemblage. Multifunctional tools are implements with more than one inferred use based
on the presence of more than one use edge (Duke 2011). Based on macroscopic analysis of these tools, the material used in their manufacture appears more resilient than other artifact classes. All of these types are complete except one which appears to be a reworked biface end (A83). Generally, they have either two beaks and/or margins that exhibit use.

Miscellaneous. One large basalt handstone with incipient wear was recorded during the initial survey and reevaluated during the current investigation. The artifact exhibits slight polish but this wear could be natural as the cobble is well-rounded. It was found upon a ledge on the tufa-covered rhyolite outcrop on the southeastern margin of the site. While it is undoubtedly in a secondary context and the result of human agency, the artifact was near an historic coyote trap placed under the outcrop. With the absence of later diagnostic points and the provenience of the cobble close to an historic trapping feature, I assume that it is not actually ground stone and ultimately unrelated to the Paleoindian occupation of the site.

WST Points. WST points (n=27) are the second most common artifact type at the Overlook Site, comprising 12.9% of the tool assemblage (Figure 3.9; Table 3.11). Specimens are fashioned on CCS and FGV. Twenty-three fragments and complete specimens are tapered; three have very straight parallel lateral margins and rounded bases. One WST point was not collected and therefore not examined for shape type. Proximal fragments are most common (n=17). Two WST fragments are distal pieces, two are complete, two are medial fragments, and four are indeterminate end fragments.
Table 3.11. Western Stemmed Tradition Points from the Overlook Site.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Material</th>
<th>Breakage</th>
<th>Fragment</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>CCS</td>
<td>bend</td>
<td>proximal</td>
<td>47</td>
<td>19</td>
<td>8.6</td>
<td>-</td>
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<tr>
<td>A11</td>
<td>FGV</td>
<td>bend</td>
<td>proximal</td>
<td>37</td>
<td>18</td>
<td>6.0</td>
<td>-</td>
</tr>
<tr>
<td>A12</td>
<td>FGV</td>
<td>bend</td>
<td>distal</td>
<td>65</td>
<td>26</td>
<td>7.0</td>
<td>-</td>
</tr>
<tr>
<td>A13</td>
<td>CCS</td>
<td>complete</td>
<td>complete</td>
<td>89.5</td>
<td>36.8</td>
<td>6.5</td>
<td>20.5</td>
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<tr>
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<td>FGV</td>
<td>bend</td>
<td>proximal</td>
<td>34</td>
<td>22</td>
<td>11.0</td>
<td>-</td>
</tr>
<tr>
<td>A24</td>
<td>FGV</td>
<td>bend</td>
<td>medial</td>
<td>33</td>
<td>21</td>
<td>8.0</td>
<td>-</td>
</tr>
<tr>
<td>A31</td>
<td>CCS</td>
<td>complete</td>
<td>complete</td>
<td>60</td>
<td>25</td>
<td>9.0</td>
<td>14</td>
</tr>
<tr>
<td>A32</td>
<td>CCS</td>
<td>twist</td>
<td>distal</td>
<td>64.4</td>
<td>38.7</td>
<td>7.5</td>
<td>-</td>
</tr>
<tr>
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<td>CCS</td>
<td>bend</td>
<td>proximal</td>
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<td>25.2</td>
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<td>A49</td>
<td>CCS</td>
<td>bend</td>
<td>end</td>
<td>43.2</td>
<td>21.5</td>
<td>7.3</td>
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<td>CCS</td>
<td>twist</td>
<td>proximal</td>
<td>81.1</td>
<td>33.7</td>
<td>9.2</td>
<td>-</td>
</tr>
<tr>
<td>A97</td>
<td>FGV</td>
<td>bend</td>
<td>medial</td>
<td>46.3</td>
<td>29.8</td>
<td>6.6</td>
<td>-</td>
</tr>
<tr>
<td>A110</td>
<td>FGV</td>
<td>bend</td>
<td>proximal</td>
<td>57.2</td>
<td>27.2</td>
<td>6.3</td>
<td>-</td>
</tr>
<tr>
<td>A118</td>
<td>CCS</td>
<td>bend</td>
<td>proximal</td>
<td>80.7</td>
<td>34.5</td>
<td>9.6</td>
<td>-</td>
</tr>
<tr>
<td>A131</td>
<td>CCS</td>
<td>twist</td>
<td>proximal</td>
<td>43.2</td>
<td>25</td>
<td>6.6</td>
<td>-</td>
</tr>
<tr>
<td>Artifact</td>
<td>Material</td>
<td>Breakage</td>
<td>Fragment</td>
<td>Length (mm)</td>
<td>Width (mm)</td>
<td>Thickness (mm)</td>
<td>Weight (g)</td>
</tr>
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<td>---------</td>
<td>----------</td>
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<td>----------</td>
<td>-------------</td>
<td>------------</td>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>A132</td>
<td>FGV</td>
<td>bend</td>
<td>end</td>
<td>32.6</td>
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<td>8.1</td>
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<td>A135</td>
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<td>9.4</td>
<td>-</td>
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<tr>
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<td>proximal</td>
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<td>6</td>
<td>-</td>
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<tr>
<td>A175</td>
<td>CCS</td>
<td>twist</td>
<td>end</td>
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<td>32.5</td>
<td>9.4</td>
<td>-</td>
</tr>
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<td>7.9</td>
<td>-</td>
</tr>
<tr>
<td>A195</td>
<td>FGV</td>
<td>bend</td>
<td>proximal</td>
<td>24.3</td>
<td>17.7</td>
<td>6.1</td>
<td>-</td>
</tr>
</tbody>
</table>

Summary of the Overlook Lithic Assemblage

The lithic assemblage at the Overlook Site consists of a diverse assortment of artifacts. Debitage at the site reflects a range of toolstone sources and variety within CCS, FGV, and obsidian raw material types. Large CCS flakes with 3-6 dorsal scars and complex platforms make up the majority of chipped stone debris. Early biface thinning flakes are among the most abundant. I consider the debitage sample to be biased toward larger flakes due their visibility on the surface but also given the flake sizes recovered from the excavation units (described below). Obsidian debitage generally represents late stage reduction toolstone packages that originated up to 340 km (Massacre Lake/Guano Valley) from the Overlook Site. FGV debitage is from local and non-local sources and varies in color and texture.
Bifaces make up the bulk of the discarded tools and associated debris at the site. CCS is the material most commonly represented among this type of artifact and bifaces are mostly mid-late stage specimens broken during manufacture. Bifaces are primarily represented by proximal, medial or distal, or non-diagnostic end fragments with only 22, of the 139, complete bifaces recorded. While FGV flakes look as if they are quarried from material available locally, the FGV tools may be made on non-local FGV, evidence that bifaces manufactured on local FGV were taken away from the site. Obsidian bifaces are heavily reworked and made on material from sources up to 340 km away (Massacre Lake/Guano Valley).

Cores and tested cobbles are predominantly made of locally available raw material. Flake types indicate that both biface and core reduction took place on-site. The expended cores do not appear to be of local CCS available directly below the site, suggesting some favored extra-local material was brought into the site.

The single nearly complete crescent is unusual in that it is large, made of gray FGV, and not similar to crescents recorded elsewhere in Lahontan Valley (McCabe and Clay 2012). It is a quarter moon type with use damage on the convex margin. The material seems to be non-local, and is weathered with a dark patina on the surface that was facing up when the item was found.

The assemblage contains items classified as drills, although their function is ambiguous. Two specimens are fragments: one is a small CCS bit and the other is a medium, heavily reworked, nearly expended WST point fragment. The point fragment is worked (possible use wear damage) on what was the proximal end and the distal end
(what would have been the base) has been fashioned into a drill, although the tip is missing.

Formed flake tools (n=15) are more abundant than simple flake tools (n=5) although post-depositional processes may have obscured incipient use. Formed flake tools are extremely well made, reworked, and made using a variety of CCS and FGV material types. Simple flake tools are fashioned on local and non-local material, including obsidian from Sutro Springs and Bodie Hills.

The singular hammerstone from the site is made of sandstone and is relatively small and of a soft, pliant material. Sandstone is available within Lahontan Valley.

Multifunctional tools are perhaps the most interesting and enigmatic items in the assemblage at the Overlook Site. They are diverse in form and based on visual inspection these materials appear more resilient varieties of CCS and FGV toolstone.

Miscellaneous tools, which consist of a single piece of possible ground stone make up the last category. The item is a large, heavy, oblong coarse-grained volcanic cobble. The wear is very incipient and localized on the cobble and the entire surface of the cobble exhibits unground high spots. The artifact was found on a tufa ledge above an historic-period animal trap feature. Careful contextual evaluation of this artifact leads me to believe that this item is related to historical trapping at the site and not the Paleoindian component.

WST projectile points/hafted biface fragments (n=27) are second in number to bifaces (n=139). Only two were recorded as complete. Although a refit Haskett point was recorded during survey, the two fragments were not relocated during the current study. A CCS Cougar Mountain point and a small tapered point make up the complete
points recorded at the site. Two nearly complete Cougar Mountain points were also recorded.

Overall, the assemblage appears to represent the remains of activities by one or more mobile groups, either performing varied tasks or visiting the location repeatedly over time. Items are reworked and recycled, and discarded items are generally broken or expended. Local cobbles were tested at the site in order to identify viable toolstone packages. Some bifaces were manufactured on site, with some broken and discarded, but others were ostensibly transported offsite. This is most evident in the lack of FGV bifaces fashioned on presumably local FGV. Generally, the debitage and tools suggest that the Overlook Site was a place where broken and expended tools were discarded and Stage 3 bifaces were fashioned from local and extra-local CCS and FGV toolstone.

**Spatial Analysis**

The site was divided into analysis units not only because of time constraints but because areas appeared to exhibit, differences in density in tool and debitage types (see Figure 3.2). All tools and obsidian debitage across the site were flagged. The surface analysis units were flagged, mapped, and analyzed to assess them as separate units of space. The bulk of the debitage analyzed at the Overlook Site was from within the southwest quad or SSAU, comprising approximately 39.4% of the site area (Figure 3.10).
I ran the Multi-Distance Spatial Cluster Analysis (Ripley’s K) tool in ArcGIS 10.1 and applied the tool to all artifacts within the SSAU and separately to all of the tools across the entire site area (Figures 3.11 and 3.12). The results show that artifacts within the SSAU are significantly clustered; however, a review of artifacts by toolstone type and assessment of clustering of tools shows that items that should occur together (e.g., CCS
debitage and CCS tools) do not cluster together. Therefore, clusters of artifacts on the surface are likely the result of natural rather than cultural processes. Just as decomposing gravels are being lagged into concentrations, so too are artifacts.

![Figure 3.11. Results of multi-distance spatial cluster analysis of artifacts within the SSAU.](Image)

These data suggest that with increased distance across the surface of the site, artifacts are more clustered within the SSAU. The iteration (see red line in Figure 3.11) generated from ArcGIS 10.1 shows the observed artifacts are extremely clustered and distinctly outside and well above the Monte Carlo envelope representing random distribution. The expected value falls above the envelope as well, perhaps a result of the size or shape of the analysis area or that the tool was run using the unweighted K-function.
Figure 3.12. Results of Multi-Distance Spatial Cluster Analysis of Artifacts.

Figure 3.12 shows the results of Multi-Distance Cluster Analysis of artifacts across the entire surface of the site. The expected value falls within the random distribution envelope and smaller distances and proves to become increasingly clustered at greater distances. The observed value, like the value for the SSAU above, falls above the confidence envelope, suggesting clustering at all distances.

In addition to spatial statistical tools, I also mapped out obsidian artifacts across the surface of the site in ArcGIS 10.1 and expected to see some clustering by obsidian source, where flakes and/or tools fashioned from particular materials would be found together (Figure 3.13). Items of similar raw material are not found in discrete clusters. In addition, mapped artifacts do not exhibit any sort of spatial arrangement as would be
expected if different activities occurred in spatially discrete areas and/or the site was occupied only a limited number of times (Figure 3.14).

Figure 3.13. Map of sourced obsidian artifacts at the Overlook Site.
Figure 3.14. Mapped artifacts by tool class.

Use of the RTK GPS was effective during fieldwork although the data we relied on had to be corrected due to the wrong and unknown coordinate system set in the
machine when it was rented. I used a separate Trimble GeoXM to map the NSAU and used locational data from Far Western’s initial survey for artifacts that were not relocated. Three datasets were employed, which may have limited accuracy of data analysis described in this section.

**Geomorphic and Geologic Analysis**

Three excavation units were placed along a north-south transect across the center of the site (see Figure 3.13). Crews removed 0.8125 m$^3$ of sediment from the units and 149 CCS, FGV, and obsidian flakes were recovered. No tools were recovered from within the units. Units were excavated to bedrock which varied across the site from 55 cmbs to 70 cmbs.

Excavation units exposed a series of sedimentary deposits comprised of three undulating and generally horizontal strata conformable across the site (Figures 3.15 and 3.16). Rodent burrows, roots, and rootlets were present throughout the strata in each unit. Stratum 1 is the first in the depositional sequence and varied between 10 and 25 cm in thickness, depending upon the depth of the unit. The deposit is medium to fine sand (10YR4/4) with rounded gravels and angular tufa gravels. The rounded gravels are coated in caliche. Excavations uncovered tufa-covered rhyolite bedrock at the base of Stratum 1 approximately 55 centimeters below surface (cmbs) in Excavation Unit 1 (ST1).
Figure 3.15. Stratum sequence revealed in excavation.
As noted in Chapter 2, a sample of the tufa was collected for radiocarbon analysis and returned a calibrated age of between 12,810 and 12,730 cal BP (2σ). Excavation Unit 2 (ST2) exposed weathered bedrock in the form of subrounded to subangular tufa-covered rhyolite cobbles 62.5 cm bs, slightly deeper than in ST1. Excavation revealed rounded, caliche-covered, rounded bar gravels at the base of Stratum 1 in Excavation Unit 3 (ST3) 70 cm bs. Stratum 2 consists of fine to coarse sand (10YR6/4) with angular tufa gravels along with rounded caliche-covered pebbles and is 12.5-42.5 cm thick. Stratum 3 is 13-18 cm thick and is comprised of medium to fine sand (10YR6/4) above the gravel layer. The surface of the site is most active and characterized by loose sandy silt with angular exfoliated rhyolite and tufa lag gravels.

Excavation Unit 1, the southernmost unit, was placed just north of the deflated southern margin of the site near an obsidian flake (obsidian catalogue number 19) in the southeastern section of the SSAU. The unit measured 0.50-x-0.50 m and was excavated to 55 cm bs, with 0.1375 m³ sediment removed in 11, 5-cm levels. Forty-two flakes were collected from the screened sediments. Flakes increased slightly in frequency and size with depth.

Excavation Unit 2 (see Figure 3.15) was placed in the northeastern portion of the SSAU between obsidian flakes 25 and 27 approximately 7 m south of the site datum. The unit measured 1.0-x-0.50 m and was excavated to 65 cm bs, with 0.3250 m³ removed in 13 5-cm levels. Sixty-four flakes were collected from excavated sediments. The flake count doubled between 35 and 40 cm bs, and then decreased by half before picking up to nine flakes each in levels 12 and 13, finally falling to one flake at Level 14, the terminal
level. Overall, the flakes are small with a few large and medium flakes occurring intermittently.

Figure 3.16. Excavation unit 2 overview facing northeast.

Excavation Unit 3 was placed at the northwestern edge of the site approximately 1 m south of a complete CCS WST point (A13). The unit measured 0.50-x-1.0 m and was
excavated to 70 cmbs with 0.35 m³ removed in 14 5-cm levels. Forty-three flakes were recovered from excavated sediments (Table 3.12).

<table>
<thead>
<tr>
<th>Unit</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9</th>
<th>L10</th>
<th>L11</th>
<th>L12</th>
<th>L13</th>
<th>L14</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>3</td>
<td>1</td>
<td>7</td>
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<td>15</td>
<td>7</td>
<td>18</td>
<td>16</td>
<td>7</td>
<td>1</td>
<td>145</td>
</tr>
</tbody>
</table>

Summary of Geomorphic Investigations

The Overlook Site is a surface lithic scatter where turbative processes are primarily moving small clasts downward into older lakebed sediments. While initial recording and mapping of the site indicated the potential for burial of part of the site under Holocene-age sand, subsurface testing revealed no buried or preserved features. Clastic and chemical sediments exposed in profiles are the result of transgressive and regressive cycles of Lake Lahontan from the time of tufa deposition ~12,800 cal BP to the end of the Younger Dryas ~11,600 cal BP. After this time, the landform was first exposed. Although sand is still being deposited via eolian processes, this investigation did not uncover a buried feature or intact buried living/occupation surface. Crews recovered debitage to a depth of 70 cmbs in ST3; however, the stratigraphic profile exposed in the units is composed of homogenous lakebed silts and sands with small rounded gravels. Small clustered gravels in hummocks and a young desert pavement on
the east and west side of the site suggest that deflation is playing a role in clustering cultural and non-cultural sedimentary clasts.

On the northeastern and southern margins of the site, stone tools and flakes have deflated or lagged out and are embedded in a young, indurated desert pavement along with tufa and rhyolite clasts (Figure 3.17). The induration may be the result of carbonate cohesion observed in the excavation units. This suggests eolian processes are removing sediment either off-site during high winds or to other areas (i.e., the northern end) of the site during less energetic winds. Soil development, or horizonization, at the site has been hindered by aridity and bioturbation (root and rodent).
Summary

Flaked stone analysis indicates that the assemblage at the Overlook Site exemplifies the entire range of reduction debris, with mid- and late-stage biface reduction debris of CCS toolstone being most common. Evidence of FGV reduction is also common among the flaked stone debris. Local material is overly represented in the flake stone artifacts and not well-represented among discarded broken bifaces. Tool diversity is highest for CCS, pointing to use of local raw material to replace the few transported and exhausted obsidian implements. Obsidian is rare in the assemblage, representing only 17% of flakes and 5% of tools. Given that most obsidian sources are some distance from the Overlook Site, I initially expected obsidian artifacts to be rare and extensively reworked; however, with the discovery of the local Dead Camel/Desert Mountains obsidian source during my research (Clay et al. 2014), I subsequently expected to find an abundance of flakes made of that material. Source provenance analysis of a sample of flakes shows that only one piece of debitage is from the local source. The local source is nearby within 1-2 kilometers, however, the size of the nodules is gravel and pebble-sized, practicable for use as flake tools but too small for reduction of large bifaces. Many flakes are large, made of CCS, and exhibit 0-3 dorsal scars reflecting primarily mid-stage reduction. CCS dominates the flaked stone debris, comprising 76% of all of the mapped flakes. Obsidian flakes make up 13% of the assemblage while FGV comprises 11%. Among all raw material types, large flakes (>1 in) are the most common size class; however, smaller flakes were recovered from the excavation units, suggesting that large flakes are differentially sorting on the surface of the site and biasing the sample.
Tools are generally broken end fragments of bifaces and WST points. There are a few tested cobbles and cores. Tools vary in morphology and there are at least 10 classes found at the site. Mid-stage bifaces dominate the tool assemblage. Breakage patterns of bifaces indicate that items were broken during use and manufacture. Based on Elston and Raven’s (1992) work at Tosawihi, a large CCS quarry in northern Nevada, Beck et al. (2002) suggest that Stage 3 is when most bifaces break during production. Based on such research, groups apparently often reduced bifaces to that stage within 10-km of quarries so that if they broke, it happened at/near a raw material source. This is clear evidence that worn out bifaces were replaced with ones made on local CCS at the Overlook Site.

The results of spatial analysis must be carefully evaluated and several iterations must be applied (e.g., assessing flakes by toolstone type, artifact classes, etc.) to bounded areas where locations were recorded for 100% of the objects under study (Dixon 2002). Ripley’s K analysis confirms clustering of artifacts, yet when the results are evaluated by artifact type the pattern suggests a natural, rather cultural, clustering process at work.

Geomorphic and geologic evaluation of the stratigraphic profiles evinces a homogenous series of lakebed sands and silts extremely bioturbated by rodents and vegetation over many millennia. Weathered fragments of rhyolite and tufa are clustered in lag deposits on the surface of the site within the loose sandy silt.
CHAPTER 4: DISCUSSION

This study set out to test the hypothesis that the Overlook Site represents the remains of a Paleoindian residential base camp, a place from which local toolstone was procured to replace exhausted and expended tools fashioned on non-local material. WST points and a crescent are the only temporally diagnostic artifacts present; elsewhere they have been dated to ~13,000-8,000 cal BP (Beck and Jones 2009, 2010; Galm and Gough 2008; Jenkins et al. 2013). As such, the Overlook Site was probably occupied at some point within this period. A study of the geological and sedimentological deposits at the Overlook Site dovetailed with a spatial analysis to understand the vertical and horizontal distribution of artifacts. Below I discuss mobility models in terms of the results of flaked stone, spatial, and geological analyses. Specifically, I consider whether the artifact assemblage reflects the remains of a group practicing a provisioning individual or provisioning place strategy (sensu Kuhn 1995). Is it possible to determine the settlement system of the people who occupied the Overlook Site? Finally, how does the Overlook Site compare to other Paleoindian sites in the Carson Desert and how does it fit into the pattern of regional land use?

Lithic Technological Organization at the Overlook Site

The flaked stone assemblage from the Overlook Site was analyzed with regards to specific assumptions presented in the literature (Table 4.1; also see Chapter 1). For
example, the composition of an assemblage can be evaluated with the expectation that
debitage produced during short-term occupations will contain items made from exotic
toolstone which are refined and fashioned for multiple purposes. Such formal tools
would have been critical for mobile groups who had to transport a reliable technology
when toolstone sources may have been unknown or unavailable.

Table 4.1. Archaeological Expectations for Residential and Short-Term Sites.

<table>
<thead>
<tr>
<th>Residential Sites</th>
<th>Short-Term Occupation Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of locally-derived toolstone</td>
<td>Heavy use of high-quality exotic toolstone</td>
</tr>
<tr>
<td>Expedient tools</td>
<td>Formalized tools</td>
</tr>
<tr>
<td>Internal structure and/or features</td>
<td>No internal structure/features</td>
</tr>
<tr>
<td>High diversity in assemblage composition</td>
<td>Low diversity</td>
</tr>
<tr>
<td>Expended/broken tools</td>
<td>Expended/broken tools</td>
</tr>
<tr>
<td>Cached blanks or cores</td>
<td>No caching of toolstone</td>
</tr>
<tr>
<td>Limited exotic toolstone represented</td>
<td>Multifunctional tools</td>
</tr>
</tbody>
</table>

In contrast, artifacts associated with longer-term stays, perhaps associated with a
more provisioning place strategy, should contain informal items fashioned expediently
from local toolstone. Informal items fashioned from nonlocal stone should also be
expended, and due to the site being utilized as a base camp, the assemblage may contain
stockpiled tool blanks such as early stage bifaces, cores, and/or cobbles (Andrefsky
Formal tools may not have been critical if local material is readily available, and the time devoted to making them could be spent performing other tasks. Expedient tools could have been made, used, and discarded without the contingencies of organization around transporting the implements.

**Expedient and Formal Tools and Core/Biface Ratios**

Many researchers have argued that with increased sedentism, toolkits should exhibit a less formal design and become more expedient (Andrefsky 1991, 1994a; Bamforth 1986, 1990; Bamforth and Becker 2000; Kelly 1988; Kuhn 1994, 1995; Parry and Kelly 1987; Torrence 1983). Parry and Kelly (1987) argue that sedentism changed the priorities of many foraging groups, bringing about synchronous technological change. As toolstone becomes increasingly available through use and mapping of an area, benefits of planning and carrying a mobile toolkit cease and expedient technology becomes more cost effective. This diachronic shift may be evident in the archaeological record vis-à-vis decreases in standardized cores or formal bifaces and increases in unprepared, amorphous (i.e., informal) cores. Therefore, low core/biface ratios have long been thought to reflect greater mobility. A residentially mobile group could have employed bifaces for multiple uses including as portable cores (Parry and Kelly 1987), although Prasciunas (2007) found that bifacial cores were never more efficient in terms of weight for producing usable flakes than unprepared or amorphous cores (Prasciunas 2007). These concepts fit well with Kuhn’s (1995) idea of provisioning places versus provisioning individuals outlined in Chapter 1.
It is important to note, however, that Parry and Kelly (1987) also suggest that expedient technology may be used by highly mobile foragers when toolstone is locally abundant (also see Andrefsky 1994a). This argument has many implicit assumptions, including that the proportions of different kinds of artifacts in archaeological assemblages accurately reflect the quantities of artifacts in the toolkits used by the occupants of a site (Bamforth and Becker 2000). Bamforth and Becker (2000:273, cf. Binford 1977) suggest “under some conditions the suite of artifacts used on a site and the suite of artifacts discarded there differ substantially”. They also point out that variations in the ratios of cores to bifaces may change in response to shifts in mobility without changes in overall technological organization (Bamforth and Becker 2000:285). In their analysis of Paleoindian sites on the Great Plains, they found that although cores were absent, and therefore core/biface ratios were low, flakes with core reduction characteristics were present, suggesting that “phantom” cores moved through the site but were not discarded (Bamforth and Becker 2000:286). Quantification of informal versus curated or retouched artifacts has been attempted as well, with limited replicable results (Andrefsky 2006, 2009; Clarkson 2002; Clarkson and Hiscock 2011; Hiscock and Clarkson 2005; Kuhn 1990; Shott 2000; Shott and Seeman 2014). It has also become increasingly clear in lithic studies that while a continuum of reduction stages is useful, functional and economic considerations may also have influenced formal and informal technological strategies (Andrefsky 2009; Duke 2013; Elston and Brantingham 2002).

In the Great Basin, the informal versus formal technological analysis approach has been applied to Paleoindian assemblages, where ratios of cores to bifaces are considered a proxy for degree of mobility. Table 4.2 shows the ratios of cores to bifaces
at Paleoindian sites in the region. Although the aggregations presented in Table 4.2 do not account for flake tool production and maintenance, if core-to-biface ratios are a useful proxy for mobility, then these data suggest a pattern of mobility and land use quite similar across areas of the western Great Basin.

Table 4.2. Core/Biface Ratios at Paleoindian Sites in the Great Basin.

<table>
<thead>
<tr>
<th>Paleoindian Sites</th>
<th>Core</th>
<th>Bifaces</th>
<th>Core/Biface Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson Desert Paleoindian Sites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26CH3543/CFSA</td>
<td>1</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>26CH3613/CFSA</td>
<td>1</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Overlook Site, western Nevada</td>
<td>9</td>
<td>139</td>
<td>0.065</td>
</tr>
<tr>
<td>Sadmat Site, western Nevada</td>
<td>95</td>
<td>955</td>
<td>0.099</td>
</tr>
<tr>
<td>Coleman Site, western Nevada</td>
<td>32</td>
<td>420</td>
<td>0.076</td>
</tr>
</tbody>
</table>

A similar pattern of discard should be evident and ratios of expedient to formal flake tools should be low as well. At the Overlook Site, I analyzed over 1,000 flakes. Additionally, during fieldwork we picked up each flake and looked for use wear. Despite these efforts, few simple or expedient flake tools were encountered (Table 4.3). The ratio of expedient to formed flake tools at the site is 0.5. This low number may be due to the fact that an expediently used flake tool may not exhibit macroscopic use wear or that weathering and post-depositional processes have obscured use wear on simple flake tools (Schiffer 1987). Nevertheless, overall the assemblage suggests limited use of expedient technology at the Overlook Site, with a heavy reliance on biface production and discard of broken and/or expended bifaces.
Table 4.3. Expedient and Formed Flake Tools at the Overlook Site.

<table>
<thead>
<tr>
<th>Flake tool type</th>
<th>No.</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expedient Flake Tools</td>
<td>5</td>
<td>2.4</td>
</tr>
<tr>
<td>Formed Flake Tools</td>
<td>10</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Raw Material Procurement and Transport

The use of either formal or expedient technology is clearly not mutually exclusive (Haynes 2004). Andrefsky (1994a) proposes that while there is a link between mobility and the organization of technology, mobility constraints are secondary to raw material availability in influencing formal versus informal tool production. Toolstone quality is also another important consideration in the manufacture of tools. Mobility may not always be a major influence when high-quality raw material is locally abundant (Andrefsky 1994a). With these points in mind, if all CCS and FGV tools at the Overlook Site are considered to have been fashioned on local or extralocal material and all but a few obsidian artifacts made of non-local material, in addition to the density and diversity of artifacts, then the results suggest that longer-term occupation took place at the Overlook Site. Alternatively, they may reflect the fact that high quality material is scarce near the site. Table 4.4 provides a list of recorded toolstone quarry sites in Lahontan Valley. It is important to note, however, that the quality of the materials and/or package sizes is poorly known for many of these locations.

CCS is available within 1-2 km of the Overlook Site on the valley floor below. However, the quality of the material varies considerably. During the course of this study we found high-quality CCS and FGV in cobbles large enough to manufacture bifaces.
Unfortunately, a study of the geochemical signatures that may be unique to CCS and FGV sources in Lahontan Valley was beyond the scope of the current study. Macroscopic analysis of color, texture, luster, and presence or absence of inclusions and/or phenocrysts does support the claim that a majority of the debitage at the site is made from locally available source material.

Obsidian is available in Lahontan Valley but it is a relatively small gravel-sized, secondary or tertiary source that occurs in drainages and playa margin deposits from an unknown primary source in the Desert or Dead Camel Mountains (Vickie Clay, personal communication, 2014). Source provenance analysis shows that groups either travelled from the Overlook Site to at least 13 other obsidian source areas, or acquired toolstone from them via exchange within the western lithic conveyance zones proposed by Smith (2010) (Table 4.4). Sources include the local Dead Camel/Lahontan Valley/Desert Mountains noted above, Sutro Springs to the west, Bordwell Spring, Fox Mountain, Buck Mountain, and Massacre Lake/Guano Valley to the north, Garfield Hills, Lookout Mountain/Casa Diablo, Pine Grove Hills, Mt. Hicks, and Bodie Hills to the south, and two unknown sources. The presence of obsidian from these sources, located to both the north and south of the Carson Desert, supports the hypothesis presented by Smith (2010) that the Carson Desert may have been a borderland between two overlapping foraging territories. The preponderance of obsidian from southern sources suggests that groups may have visited them or tapped exchange networks connected with them more often, perhaps indicating stronger socioeconomic ties to that area.
Table 4.4. Toolstone Sources in Lahontan Valley.

<table>
<thead>
<tr>
<th>Toolstone</th>
<th>Number of Sources in Lahontan Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGV</td>
<td>1</td>
</tr>
<tr>
<td>CCS</td>
<td>40</td>
</tr>
<tr>
<td>OBS</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>42</strong></td>
</tr>
</tbody>
</table>

Interestingly, when these data are compared to obsidian sources represented at Archaic sites in the valley, a shift away from a more wide-ranging mobility structure is evinced in the introduction of additional, closer sources to the profile (Hughes 1985). For example, at Hidden Cave far-flung sources in the north like Massacre Lake/Guano Valley drop out of the assemblage in favor of closer sources like Mt. Majuba, Mt. Hicks, and Bodie Hills (Hughes 1985; Kelly 2011). These data also support Smith’s (2010) hypothesis regarding change in land use and mobility over time.

Table 4.5. Summary of Obsidian Source Data.

<table>
<thead>
<tr>
<th>Obsidian Source</th>
<th>n</th>
<th>%</th>
<th>Distance (km)</th>
<th>Direction</th>
<th>Obsidian Form</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bordwell Spring, NV</td>
<td>1</td>
<td>1.4</td>
<td>211</td>
<td>North</td>
<td>Cobbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Desert Mountains/Dead Camel Mountains/Lahontan Valley, NV</td>
<td>1</td>
<td>1.4</td>
<td>3-9</td>
<td>Local</td>
<td>Pebbles and gravels</td>
<td>NWROSL (2014)</td>
</tr>
<tr>
<td>Fox Mountain, NV</td>
<td>1</td>
<td>1.4</td>
<td>200</td>
<td>North</td>
<td>Cobbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Garfield Hills, NV</td>
<td>1</td>
<td>1.4</td>
<td>89</td>
<td>South</td>
<td>Unknown</td>
<td>No Reference</td>
</tr>
<tr>
<td>Lookout Mountain/Casa Diablo, CA</td>
<td>1</td>
<td>1.4</td>
<td>173</td>
<td>South</td>
<td>Cobbles and outcrops</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Pine Grove Hills, NV</td>
<td>1</td>
<td>1.4</td>
<td>84</td>
<td>South</td>
<td>Pebbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Buck Mountain, CA</td>
<td>2</td>
<td>2.8</td>
<td>300</td>
<td>North</td>
<td>Outcrop and needles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Massacre Lake, NV</td>
<td>2</td>
<td>2.8</td>
<td>285</td>
<td>North</td>
<td>Cobbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Unknown A</td>
<td>2</td>
<td>2.8</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>No Reference</td>
</tr>
<tr>
<td>Obsidian Source</td>
<td>n</td>
<td>%</td>
<td>Distance (km)</td>
<td>Direction</td>
<td>Obsidian Form</td>
<td>References</td>
</tr>
<tr>
<td>----------------</td>
<td>----</td>
<td>----</td>
<td>---------------</td>
<td>-----------</td>
<td>--------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Mt. Hicks, NV</td>
<td>7</td>
<td>10</td>
<td>113</td>
<td>South</td>
<td>Outcrops and boulders to cobbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Sutro Springs, NV</td>
<td>9</td>
<td>13</td>
<td>53</td>
<td>West</td>
<td>Cobbles and pebbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td>Unknown</td>
<td>11</td>
<td>15.2</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>No Reference</td>
</tr>
<tr>
<td>Bodie Hills, CA</td>
<td>32</td>
<td>45</td>
<td>120</td>
<td>South</td>
<td>Outcrops and cobbles</td>
<td>Moore (2009)</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>71</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Distances are based ArcGIS measurements from Overlook Site datum to the closest source plotted for that particular geochemical type. Location data are from Northwest Research Obsidian Studies Laboratory (NWROSL).

**The Lithic Assemblage**

*Debitage.* Aggregate debitage analysis shows that mid-to-late biface reduction was the primary form of tool production at the Overlook Site (see Table 3.1); however, lithic debris related to all stages of reduction is represented as well. Debitage is predominantly made on locally available CCS (Table 4.6). Flake types are very similar between the SSAU and NSAU, counter to initial assumptions that these two analysis units represented areas where core versus biface reduction activities took place. Large CCS and FGV flakes comprise the majority of analyzed flakes, whereas small and medium obsidian flakes are nearly equally represented. I interpret this to mean that larger flakes were lagged out on the surface and more obvious during fieldwork than small flakes; this interpretation is supported by the fact that a number of small flakes were recovered from the excavation units. Small obsidian flakes may have been more easily identified on the surface than small patinated CCS or FGV flakes. However, the data show that large CCS and FGV bifaces and early to mid-stage blanks were
manufactured at the site based on the size of the bifaces recorded at the Overlook Site (see below).

Table 4.6. Debitage at the Overlook Site.

<table>
<thead>
<tr>
<th>Toolstone</th>
<th>SSAU</th>
<th>NSAU</th>
<th>Obsidian</th>
<th>Excavation Units</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCS</td>
<td>571</td>
<td>143</td>
<td>0</td>
<td>97</td>
<td>811</td>
</tr>
<tr>
<td>FGV</td>
<td>87</td>
<td>14</td>
<td>0</td>
<td>12</td>
<td>113</td>
</tr>
<tr>
<td>OBS</td>
<td>0</td>
<td>9</td>
<td>88</td>
<td>40</td>
<td>137</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>658</td>
<td>166</td>
<td>88</td>
<td>149</td>
<td>1061</td>
</tr>
</tbody>
</table>

*Tools.* Assuming that mobility structures technological organization more than other economic considerations, transport efficiency, in addition to raw material availability, would be of primary importance to mobile groups (Shott 1986). Based on ethnographic data from Lee’s (1979) work with the !Kung San, Shott (1986:20) suggests that among people that are residentially mobile, “tools should become less specialized and more multifunctional in character”. There are few multifunctional tools at the Overlook Site but the overall assemblage consists of a diverse suite of tools. Shott (1986) demonstrated that assemblage diversity should decrease as mobility increases. Therefore, as occupation span increases, so too should assemblage diversity. However, as a site is repeatedly visited, perhaps over a number of years or seasons, assemblage diversity should also increase (Surovell 2009). In either case, the archaeological signature suggests either repeated visits to the site or a long-term stay. Based on geochronological data presented in Chapter 3 I suggest that the diversity in artifact types at the Overlook
Site is the result of repeated shorter occupations rather than a single long-term occupation.

Tools discarded at the site suggest that the location was used as a locale to gear up and replace broken tools with raw materials available nearby (Table 4.7). The obsidian hydration and

<table>
<thead>
<tr>
<th>Stage 1-2</th>
<th>Stage 2</th>
<th>Stage 2-3</th>
<th>Stage 3</th>
<th>Stage 3-4</th>
<th>Stage 4</th>
<th>Stage 4-5</th>
<th>Stage 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Distal</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>End</td>
<td>1</td>
<td>9</td>
<td>7</td>
<td>23</td>
<td>10</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Margin</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Medial</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>Proximal</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>1</strong></td>
<td><strong>27</strong></td>
<td><strong>13</strong></td>
<td><strong>47</strong></td>
<td><strong>20</strong></td>
<td><strong>21</strong></td>
<td><strong>7</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

*Geological and Site Formation Processes*

Natural processes interacted with cultural processes to create the structure of the Overlook Site. The Overlook Site formed on lacustrine silts deposited by Lake Lahontan around a bedrock promontory likely affected by rebound faulting. The lake regressed and the landform was exposed. This exposure also allowed for new processes of deposition and during the TP-EH transition, where eolian processes became increasingly important. Sand and silt cap the lacustrine silt and clay evident at the contact between the deflated areas of the site. While the sand cap suggested potential for buried occupation events during initial site recording, excavation revealed a mixture of artifacts, lake sediment, and rounded pebbles – clear evidence of turbative processes. Arid ambient conditions in
conjunction with turbative processes hampered soil formation at the Overlook Site. As demonstrated in Chapter 3, artifacts do not cluster by 5-cm level nor is there any pattern in occurrence of artifacts. Debitage removed from the excavation units was generally small. Rodent mounds and deep-rooted vegetation are prominent at the site, especially in the soft eolian sand and silt in the central area of the site. The artifacts cluster on the surface in a similar fashion as natural angular, weathered bedrock gravel that is lagging out. This pattern is the result of deflationary processes but also erosion of the gentle slope present on the western edge of the site (Rick 1976).

Spatial Patterning

In the absence of complete collection of artifacts and subsequent refitting of artifacts, spatial analysis via detailed mapping of artifacts present on the surface of a site can provide a look at the \textit{in situ} record. The Overlook Site exhibits a pattern in the distribution of artifacts on the surface of the site with a maximum artifact density of \(~20/m^2\). I studied the pattern with maps, spatial statistics by point plotting tools and debitage across the site and within two discrete sampling areas, and focusing on arrays in specific aspects (e.g., obsidian) of the record. Specific accumulations of debitage could not be associated with particular tools and do not represent \textit{in situ} reduction events. Discrete activity areas are only likely to be identifiable if the occupation(s) at the site was relatively short and, if several occupations occurred, where subsequent occupants maintained consistently the internal space at the site (O’Connell 1987). In addition, based on ethnoarchaeological studies, structure at residential base camps varies by the
season in which the camp is occupied (Binford 1978; O’Connell 1987). For example, whereas a winter camp may exhibit high degrees of spatial segregation due to occupants being restricted to single structure or hearth area, a summer camp may be variable in size and space may be less constrained. Based on my analysis, artifacts cluster in a natural configuration rather than a logical cultural pattern. As pointed out by Bamforth et al. (2005:572), patterns of site formation observed in the ethnoarchaeological literature must be “filtered through natural site formation processes” due to the temporal scales with which archaeologists often work. Reoccupation events at the Overlook Site in conjunction with sedimentation and turbation have altered observable patterns in the surface archaeological record. Hearths or other residential features and fire-cracked rock were not discovered at the Overlook Site during fieldwork. This suggests either the site was not occupied for any appreciable amount of time or that the same post-depositional processes affecting the scatter of artifacts on the surface and moving items vertically in the stratigraphic profile may be affecting discernable feature structures. It is important to note that larger areas would need to be exposed to confirm the lack of features at the Overlook Site suspected based on my work.

The Paleoindian Regional Record and the Overlook Site

Mobility can be understood based on the components of a single site but also on a region-wide scale (Panja 2003). As mentioned in previous chapters, the Paleoindian record in the Carson Desert is limited and characterization of the toolstone sources in the valley is still in the early stages (Clay et al. 2014). With those caveats in mind, the
Overlook Site is different from the other recorded sites in the valley due to the location of the site and the composition of the assemblage. In Chapter 2, I discussed the typology employed by Far Western to classify sites in order to provide management recommendations. Based on these types of sites, how does the Overlook Site fit into settlement patterns in the region?

An extensive record search resulted in the identification of 31 Paleoindian sites in the Carson Desert region which I described using Far Western’s site typology (see Chapter 2). Figure 4.1 shows a map of the distribution of Paleoindian sites in the Carson Desert. The Overlook Site is clearly a Complex Flaked Stone Assemblage (CFSA) similar in content to the Sadmat Site, Hathaway Beach Site, and eight other sites in the region (Table 4.8). Complex Flaked Stone Assemblages contrast with Simple Flaked Stone Assemblages in that they often contain an abundance of artifacts with a range of inferred functions suggesting that multiple tasks occurred at a single location. As noted above, a site that is repeatedly visited, perhaps seasonally, may also exhibit a range of items simply as a function of discard rather than site function. Moreover, sites that contain a range of tools that are located near toolstone sources may simply be the result of tool discard and replacement.

It is difficult to compare the size of the Overlook Site to other CFSA Paleoindian sites in the region due to the disparity between recording efforts; however, when compared to the Sadmat Site, which is a broad continuous scatter covering more than two square miles, the Overlook Site is relatively small and discrete. The Overlook Site is within walking distance (~1 km north) of the Hathaway Beach Site and Hathaway Beach Quarry and just south of a series of Paleoindian sites recorded recently but not yet
reported on a lower shoreline at ~1,210 m amsl (Vickie Clay, personal communication 2014). In general, the Overlook Site is similar in location to other Paleoindian sites in the region. The distribution of sites along relict shorelines suggests a pattern of repeated short-term stops of groups arriving from the north and south (Smith 2010).

The presence of an historic trapping feature and the fact that the site is located on an active military base suggest people have visited the site in recent times; however, overall the assemblage appears to be intact. This is likely due to the withdrawal of the land from public use in the 1940s but also the isolated setting of the site some distance from paved and even two-track roads. An inspection of the historic General Land Office (GLO) maps shows no historic nineteenth-century routes through this isolated area.

Table 4.8. Paleoindian Sites by Type in the Carson Desert Region.

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caves</td>
<td>3</td>
</tr>
<tr>
<td>Complex Flaked Stone Assemblage</td>
<td>8</td>
</tr>
<tr>
<td>Complex Ground Stone Assemblage</td>
<td>1</td>
</tr>
<tr>
<td>Quarry</td>
<td>4</td>
</tr>
<tr>
<td>Simple Flaked Stone Assemblage</td>
<td>15</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td><strong>31</strong></td>
</tr>
</tbody>
</table>
Figure 4.1. Paleoindian sites in the Carson Desert area and surrounding region.
Summary

The data presented in this thesis do not support the hypothesis that the Overlook Site represents a residential base camp; however, they do provide evidence that local CCS and FGV were used to replace broken and expended tools. The assemblage at the Overlook Site exhibits a high degree of diversity among artifacts and visual and geochemically sourced toolstone samples, and debitage that mainly represents mid-to-late stage biface reduction. Toolstone diversity is a hallmark of early far-ranging groups, indicating recurring moves within large foraging ranges and access to varied toolstone sources (Smith 2010). Tools are primarily broken – either hafted or unhafted biface fragments – but the assemblage is diverse and some tools show multiple use edges. The record is mixed and based on geomorphic and spatial distributional patterns as well as source provenance data I interpret the assemblage to represent an accretionary deposit of repeated short-term visits to the Overlook Site by mobile groups of people traveling in overlapping foraging territories circumscribing a generally north-south route.
CHAPTER 5: CONCLUSIONS

This study tested the hypothesis that the Overlook Site was a residential base camp occupied during the TP-EH: a place from which short logistical forays occurred to procure local toolstone to replace exhausted tools made on non-local material. To test this hypothesis I used the lithic assemblage to determine whether it reflected a toolkit carried by either a group practicing a strategy of provisioning individuals or a group practicing a strategy of provisioning a place. A group who provisioned themselves should have been principally concerned with economizing behavior. Tools should be transportable (e.g., thinned bifaces) and the toolstone should be from a wide variety of sources encountered during residential moves. This is in contrast to a toolkit reflecting a strategy where places were provisioned in anticipation of spending extended periods there, presumably exploiting stable lacustrine resources. Alternatively, perhaps this strategy was the result of a changing climate where drier conditions prompted increased “settling in” around lacustrine refugia (Duke 2011). Either way, if a provisioning of place strategy was employed, then sites may preserve internal structure as space is occupied longer. For example, discrete areas might be apportioned for specific activities. Portability of tools and toolstone should be less important where resources are more predictable. Local raw materials would be favored over non-local obsidian.
Paleoindian Lifeways and the Overlook Site

The data presented herein builds upon extensive Paleoindian research in the Great Basin which suggests that early groups were far-ranging, residentially mobile, and had a diverse diet. WST points were employed as part of a composite technology used for hunting and perhaps other tasks. These projectiles/hafted bifaces are often found with a suite of tools including steep-edged scrapers, gravers, bifaces, and other implements. The WST point types at the Overlook Site have been dated at other sites to between 13,100 and 8,000 cal BP (Beck and Jones 1997; Galm and Gough 2008). Recent research in the Old River Bed of the Bonneville Basin places both Haskett and Cougar Mountain points on the earlier end of the Paleoindian point spectrum (Duke 2011), suggesting that the Overlook Site dates to the earlier end of the date range just after 12,800 cal BP when the lake covering the site recessed.

The Overlook Site is a rare site type in the Carson Desert as it is one of the only early sites in the region classified as a CFSA. This may be in part due to protection of the site from avocational collectors but also the distinctive location as well. Ultimately, the lithic analysis evinces a group provisioning themselves with mobile tools. Stage 3 and 3-4 bifaces are most prevalent amongst the tools indicating manufacturing of bifaces on local CCS. Although, given the diverse and dense assemblage perhaps this site was a repeatedly visited residential camp positioned near to favored toolstone and an extensive basin wetland. The primary question of whether this site was a residential base camp, does not necessarily relate to the large scale foraging territories proposed by Jones et al. (2003, 2012; Smith 2011) but how the group who was occupying the Overlook Site
would have moved within the southern Lahontan basin. If environmental conditions were good and there was an extensive marsh; why wouldn’t people have spent more time in Lahontan Valley, creating signatures of residential occupation in the archaeological record? As Duke and Young (2007) suggest, while Paleoindians were highly mobile, focusing on high-ranking plant and animal resources, did the organization of movement change within select basins?

Upon initial inspection, the Overlook Site seemed to exhibit spatial structure in the arrangement of artifacts and sedimentary deposits on the surface. Originally, I wanted to collect all of the artifacts after mapping them and conduct refitting and conjoining studies using Kelly’s (1983) minimum number of nodule analysis. However, due to time in the field and preservation considerations I determined that GIS provides a less invasive way to reconstruct activities at the site. Ripley’s K evaluates statistically significant relationships between mapped features. ArcGIS 10.1 offers a platform from which to apply this tool to archaeological space. All of the stone tools, obsidian artifacts, and NSAU and SSAU debitage were piece plotted using two high precision GPS units. Spatial statistical analysis using Ripley’s K via ArcGIS confirmed that the assemblage at the site is clustered; however, the clustering was determined to be the result of natural rather than cultural process. Moreover, investigation of the relationship between surface array of artifacts and surface sediment, gravels, and stratigraphy revealed a simple horizontal sedimentary sequence comprised of bioturbated sand and silt with some beach gravels showing up in the bottom of the unit closest to the northern edge of the wave-cut landform on which the site rests. The stratigraphy shows that the assemblage is a surface phenomenon and that the clustering is likely the result of eolian deflation of fine-grained
sand and silt. Gravel clasts and stone tools are being lagged out as the sediment is being winnowed away, leaving behind concentrations of debris. Geomorphic and spatial analysis allowed for a coherent interpretation of the distribution of the lithic assemblage and provided a bounding date to the site of ~12,800 cal BP. Spatial analysis shows that post-depositional processes are altering the distribution of artifacts on the surface of the site, creating natural clusters rather than evidence of discrete activities.

**Avenues for Future Research**

Investigations of single sites provide us with “insight into location-specific glimpses into settlement organization, and as such they represent only a limited time slice of a mobility regime” (Surovell 2009:67). However, a more succinct regional analysis, one in which intersite space is considered (e.g., isolated artifacts) together with a more cohesive view of environmental strata, would present a broader picture of TP-EH settlement patterns (Dunnell and Dancey 1983). In the absence of subsistence data, more refined paleoenvironmental datasets and models like those presented by Duke and King (2014) lend to discussions of formal relationships between past environments and stone tools at archaeological sites.

Due to the nature of the Paleoindian archaeological record, lithic studies have focused on understanding site function. In the world of cultural resource management, open-air lithic scatters without features are often considered to lack integrity or potential for buried deposits; as such, they are viewed as not worthy of further study (Shroedl 2011). However, as shown here, site structure analysis is a source of information
important to understanding Paleoindian prehistoric settlement and movement across a landscape (Morgan et al. 2013; Schroedl 2011). Intrasite and intersite landscape analysis in conjunction with geomorphic and paleoenvironmental studies may prove a valuable resource in modeling buried and surficial Paleoindian sites in Lahontan Valley where eolian forces have been preeminent in site formation.

The notion of site is more of an archaeological construct to aid in the management of resources rather than a useful heuristic in academic studies (Dunnell 1992). I tried to understand broader patterns of land use in the Carson Desert but efforts were limited to old site records, some with inaccurate locational data and limited assemblage information. However, recent surveys prove it is an ideal place to conduct targeted surveys of relict shorelines (Clay and McCabe 2012; Clay et al. 2011; Clay et al. 2014) and update the records of known Paleoindian sites by recording them systematically using new GPS devices. Spirit Cave Man is one of the most significant Paleoindian burials discovered in North America. An effective and collaborative relationship with local tribes could aid in future research into the many unexplored cave sites, which ring the entire valley.

Characterization of geological sources of toolstone in Lahontan Valley is still in the early stages. Recent methodologies are proving valuable in geochemically characterizing CCS (Speer 2014). Previously recorded FGV quarries like Hathaway Beach are sometimes difficult to locate (despite repeated attempts by the author). Nonetheless, a concerted effort to find and systematically characterize toolstone by quality and size of packages would increase our understanding of viable sources, economic choices, and movement between sources.
**Final Thoughts**

This study is a first step toward a better understanding of Paleoindian settlement and land use in Lahontan Valley. Lahontan Valley is likely to remain a place where the Paleoindian record is scant relative to other areas; however, as this study and other recent works (e.g., Clay et al. 2014) show, it is certainly not absent. Lithic analysis suggests that the Overlook Site assemblage is similar in composition to other CFSA sites documented in the region (e.g., the Hathaway Beach and Sadmat sites). Spatial structure was not evidenced at the site and geomorphic processes are creating a palimpsest of lagged artifacts on the sandy substrate. The multidisciplinary approach to studies of archaeological sites in the Great Basin is not new (Thomas 1985); however, the study of intrasite and intersite space at Paleoindian sites in the Great Basin is relatively uncharted (Dunnell and Dancey 1983; but see Smith et al. 2013). Using paleoenvironmental models (Duke and King 2014) and GIS it may be possible to view the Paleoindian record as a landscape rather than singular sited events, thereby presenting a cohesive view of mobility patterns and land use.
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Appendix A
Research Design
Original Site Record
A View from the South:
Paleoarchaic Land Use and Mobility in the Carson Desert
A Research Design for Work at 26CH3413

October 2013

By:
Sarah K. Rice and Geoffrey M. Smith

Great Basin Paleoindian Research Unit
Department of Anthropology
University of Nevada, Reno
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APPENDIX A.

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Memorandum of Agreement between BLM and SHPO. ............................................................................................ A

Memorandum of Agreement between SHPO, the Navy, and BLM. .......................................................................... A
INTRODUCTION

The Paleoarchaic record (ca. 13,500-9,000 cal B.P.) is poorly represented in the southern Lahontan Basin (Beck and Jones 1997; Graf and Schmitt 2007); this is in part because of avocational artifact collecting, incomplete survey coverage, and restricted land access. In the winter of 2011, Far Western Anthropological Research Group, Inc. located a unique upland Paleoarchaic site, 26CH3413, (The Seal Beach Overlook Site) while conducting pedestrian survey on Naval Air Station, Fallon, in Churchill County, Nevada. The site is a large, 6,823 m² lithic scatter located atop a promontory on the east side of the Dead Camel Mountains and the north end of the Desert Mountains. The site is situated between two tufa-covered rhyolite outcrops at 1,250 meters above mean sea level (amsl) with a substantial 360-degree viewshed overlooking Lahontan Valley and the surrounding mountain slopes. The surface assemblage contains numerous lithic tools and more than 1,000 pieces of debitage. Analysis of a sample of 300 flakes demonstrates that cryptocrystalline silicate (CCS) and fine-grained volcanic (FGV) material are the dominant toolstone. Many tools and flakes are incorporated into the desert pavement and exhibit substantial weathering rinds and rubification patina. Formal tools are noticeably denser in two areas of the site, indicating that the surface assemblage retains a degree of spatial patterning. The site’s central sand sheet contains abundant artifacts, suggesting subsurface cultural deposits that might preserve buried features.

26CH3413 is one of the few surface sites containing Great Basin Stemmed Series (GBSS) artifacts in the Carson Desert, or anywhere else in the Great Basin, that has potential for buried preserved features and subsistence remains. The research strategy at this site ultimately seeks to address two basic questions: (1) what are the geological processes that formed the site and have they affected the spatial arrangement of artifacts at the site? (2); based on toolstone profiles, can we infer the mobility strategy of the occupants at the site? Answering these questions will contribute to larger theoretical models of Paleoarchaic foraging strategies. In order to answer these questions I will revisit the Overlook Site and implement the research strategy outlined here. I will also revisit other sites in the Carson Desert containing GBSS technology and work with existing museum collections from such sites to understand land use and mobility on regional and local scales.

This research project, in fulfillment of the Master’s degree program in Anthropology at the University of Nevada, Reno, will focus on questions of Paleoarchaic behavior by assessing land use and mobility at 26CH3413. In this research design, I provide background information, outline my research questions, define my methods for fieldwork, and establish a frame of reference for analysis of Paleoarchaic assemblages in the Carson Desert.

PREHISTORIC BACKGROUND

The ultimate purpose of this project is to understand Paleoarchaic behavior by assessing settlement and subsistence patterns during the Terminal Pleistocene-Early Holocene (TP-EH) transition. However, the archaeological record for the Paleoarchaic period, ~13,500-9,000 cal B.P., lacks radiometric chronological control, subsistence remains, and a large sample of intact buried sites (Beck and Jones 1997; Elston and Zeanah 2002; Graf 2001; Graf and Schmitt 2007; but see Stoner’s [2012] work at Fire Creek). Although the Carson Desert contains Spirit Cave where a tule wrapped burial has been radiocarbon dated to 9,415±25 years ago (~11,400 cal B.P.) this remains an area where few Paleoarchaic archaeological sites have been studied (Dansie 1997). This may be due to the fact that a majority of the Paleoarchaic sites in the Great Basin are surface manifestations located on relict shorelines of late Pleistocene lakes with little potential for intact features. In addition, the dataset which may be derived from these lithic assemblages is skewed due to long-term artifact collecting by looters who target formal tools (e.g., projectile points) along prominent shorelines and in and around Lahontan Valley.

Paleoarchaic archaeological sites are cross-dated using the GBSS temporally diagnostic typology. This typology contains large, morphologically variable stemmed projectile points, concave base (sometimes fluted) lanceolate points, unhafted bifaces, crescents, unifaces, scrapers, gravers, and utilized flakes (Beck and Jones 2009; Graf 2001; Lafayette and Smith 2012; Pendleton 1979). Large stemmed points/knives placed within the GBSS consist of Windust (Rice 1972), Haskett (Butler 1965), Cougar Mountain (Layton 1970; 1972), Parman (Layton 1970), Lind...
Coulee (Daugherty 1956), Lake Mohave (Amsden 1937), and Silver Lake (Beck and Jones 2009). Fine-grained volcanic toolstone was most commonly used to make GBSS tools, except in the obsidian-rich territory in the northwestern Great Basin (Beck and Jones 1997). Researchers distinguished this series of artifacts from other early assemblages (i.e., the San Dieguito complex of southern California and assemblages on the plains of North America [Bedwell 1973; Fiedel 1992; Tuohy 1967; Warren 1967, 1968]) and named the toolkits associated with lakeside settings the Western Pluvial Lakes Tradition, (Bedwell 1970, 1973) and later the GBSS (Tuohy and Layton 1977). The marsh-adapted culture who lived on the edges of these lakes and used the GBSS toolkits were deemed the Pre-Archaic (Smith 2006) or Paleoarchaic (Willig 1989) – a precursor to later Archaic traditions. Limited subsistence residues suggest that early foragers had a broad diet which included grouse, hare, artiodactyls, fish, small game, and birds (Graf and Schmitt 2007; Haynes 2002; Hockett 2007; Madsen 2007; Pinson 2007).

Kelly (2007) and others (e.g., Murdock 1967) have made the case that the scale of hunter-gatherer movement is tied to environmental productivity. Underlying such arguments is evolutionary theory; the assumption that foragers will maximize returns and those who are most efficient in maximizing returns will enjoy a competitive and selective edge over those less efficient (Stephens and Krebs 1986). In the Carson Desert, many researchers have argued that a marsh ecosystem provided a resource base large enough to sustain year-round limnosedentary populations (Aikens 1978; Heizer and Napton 1970; Kelly 1983; Madsen 1982; Zeannah et al. 1995). Limnosedentism as defined by Thomas (1985), is a cultural and subsistence emphasis on procuring lacustrine resources and the relatively reliable ecological potential of marsh resources which may allow for a group to limit residential mobility and remain tethered to an area (see also Barrett 1910; Heizer 1967; Jennings and Norbeck 1955). Other investigators have proposed that limnosedentism is too simplistic an explanation and suggest another adaptive strategy termed limnomobile (Hemphill and Larsen 1999: xvi). Limnomobility, as defined by Thomas (1985) and Kelly (1985), recognized that upland resources are more cost-effective in terms of calories while marsh resources are more expensive to process. Hidden Cave, a logistical cache cave, provides support for the hypothesis that lacustrine communities were only utilized when upland resources were unpredictable (Thomas 1985; Zeannah et al. 1995). Archaeologists noted that large residential bases were absent in Lahontan Valley and the Carson Sink, consequently, Archaic-period sites were deemed logistical outposts (Kelly 1983; Thomas 1985). The role of marsh environments had to be re-evaluated, however, due to widespread flooding in the Carson Sink between 1982 and 1987 which uncovered complex residential sites on the edges of the marsh (Raven and Elston 1988; Kelly 1992, 2001). Raven and Elston (1989) reexamined the structure and potential biomass of marsh communities based on soil types and developed a predictive model to determine the location of archaeological sites. Their study offers a persuasive argument in favor of a limnosedentary model in the Stillwater Marsh. In addition, Thomas (1999) argues that neither limnosedentism nor limnomobility are mutually exclusive strategies. Hunter-gatherers often employ more than one strategy to adapt to their environment and it is up to researchers to illuminate strategies which comprise long-term adaptations. Although these mobility models have been applied to sites dated to the Archaic period, by reconstructing past environments and analyzing lithic technological organization we can apply these models further back in time.

Research Domain 1: SITE FORMATION PROCESSES

Lake Lahontan reached its late Pleistocene highstand of approximately 1,332 meters amsl prior to 15,000 cal B.P. (Benson et al. 1992). Wave-cut shoreline scarps and benches are visible throughout Lahontan Valley which contains the basin of Carson Lake, the terminus of the Carson River, and its broad delta. Morrison (1964) used stratigraphic relationships between nearshore and shoreline deposits and later radiocarbon and uranium series dating (Morrison and Frye 1965) to determine that at least two lake cycles formed these features, which he dubbed the Eetza and Sehoo-age lakes. Dates on tufa place the Sehoo shoreline between ~30,000 and 15,000 cal B.P. and the Eetza between 100,000 and 30,000 cal B.P (Benson and Thompson 1987; Morrison and Frye 1965). Although lake levels are still being established for the period after the highstand, paleoclimatic data suggest wetlands expanded due to decreased water depth within the subbasins by the end of the Younger Dryas, ~11,600 cal B.P., creating rich and productive resource patches for expanding populations (Adams et al. 2008; Goebel et al. 2011; Young 1995, 2000).
Determining and outlining the past environmental setting of an archaeological site is important because it allows the researcher to make inferences about past behavior based on the location of archaeological sites on the landscape and availability of local resources that have since gone extinct. In addition, it provides a basis for determining landscape evolution, climate change, predictive modeling for potentially buried sites and potential disturbance at the site by geologic processes (Ferring 1994). The Great Basin has a complicated environmental and climatic history, wherein landforms and basins responded not as a single ecological entity but a family of systems often at odds with one another (Davis 1982). This complexity is one of scale, and a single archaeological site may provide evidence for local environments vastly different than today. Environmental reconstruction aids the researcher in determining if natural processes are affecting the cultural deposits and therefore skewing the inferences we are making about past behavior (Stein 2001). That being said, before we can characterize the behavior of inhabitants of a particular site we must determine how the artifacts were deposited and how the pattern we are seeing in the archaeological record may relate to the prehistoric inhabitants at the site or later cultural or natural processes (Schiffer 1983). Understanding geological process on scales that are relevant to the archaeological record is key to identifying the development of the deposits at the site, the effects erosion of the surface and weathering may have had on the surface assemblage, and an age range for occupation at the site.

New archaeology has defined itself by rigorous method and theory, especially in regards to site formation processes and notable names within the field have contributed to the discussion (Binford and Binford 1968; Butzer 1960; Clarke 1968; Reid et al. 1975; Schiffer 1976, 1995; Stein 2001). It was in these discussions that archaeologists subsequently incorporated methods from the earth sciences into archaeology and developed the subdiscipline of geoarchaeology (Renfrew 1976; Stein 2001). “Every archaeological problem starts as a problem in geoarchaeology,” consequently in order to study the artifacts and the assemblages within an archaeological context we must look at the archaeological sedimentary matrix not as a single depositional episode or the result of a single activity but a combination of processes (Renfrew 1976:2; Schiffer 1987). At 26CH3413, it is essential to determine a sedimentary context for the assemblage and establish the formation processes at the site in order to ascertain the effects natural and later cultural processes may have had on the archaeological record. In order to do this we need to simply test the site and draw profiles for stratigraphic boundaries and characterize these deposits using geoarchaeological methods (Waters 1992).

The Overlook Site is situated atop a lacustrine silt-covered volcanic outcrop at the southern end and western side of the Dead Camel Mountains (Figures 1. and 2.). The lacustrine silt is likely Eetza and Sehoo-age lakebed sediment deposited during highstands of Lake Lahontan which would have covered the site area. The site contains a sand deposit atop the lakebed strata in the broad central portion of the site with artifacts resting atop this surface as well as observed within the silt on the deflated edges of this landform. The rhyolite outcrops which bound the site to the east and west reside at slightly higher elevations above gentle slopes and a portion of the surface sediment at the site is from the physical weathering of the tufa-coated rhyolite. A further examination of these deposits and formal geologic mapping will provide limiting (i.e., post-Sehoo highstand) ages for the occupation at the site. Horizonation within probes and test units (see “Methods”, below) will define the relationship between the sandy loam matrix that characterizes the broad flat area of the site and the lithic debitage and tools which are within and atop the sand.

Domain 1: SITE FORMATION PROCESSES RESEARCH QUESTION AND DATA NEEDS

- Does the Overlook Site contain spatial patterning of artifacts? What are the natural processes taking place at the site? How are natural processes affecting the prehistoric deposit at the site?
  - Detailed mapping of the site including surface artifacts, geological contacts, and potential sources areas for sediments at the site.
  - Testing at the site primarily by excavating 20 (or less) shovel probes (0.50m² units) will define the deposits’ stratigraphy and determine if the site contains a buried component. In addition, testing will define the contacts between sediments at the site in order to determine sedimentological context of the surface and subsurface artifacts at the site.
  - One sidewall in all of the probes and units will be hand drawn to define the stratigraphy across the site.
Research Domain 2: MOBILITY MODELS AND TECHNOLOGICAL ORGANIZATION

Based on evolutionary ecology, lithic technological strategies mediate risk and provide a selective advantage based on energetic returns (Kuhn 1995:19). Depending on the conditions and distribution of usable stone, foragers rely on technological planning strategies to solve future demand for usable cutting edge (Kuhn 1995:24). Tool design is commonly equated with the degree of mobility of the foraging group employing the technology (Bamforth 1986; Kelly 1988; Parry and Kelly 1987; Shott 1986). Mobile gear must be portable, flexible, versatile, durable, and reliable in order to diminish transport cost and be available for immediate use when moving across the landscape (Shott 1986; Torrence 1983). Kuhn’s (1995) concept of provisioning individuals highlights a strategy that supplies an individual with the manufactured, transportable, and maintainable toolkit prior to use with some future need in mind. Tools and toolstone are heavy, the high cost of transport requires the highly mobile individuals to provision themselves with portable gear comprised of nearly finished tools rather than cobbles or cores. In a situation where quality toolstone is not available, tools should exhibit maintenance, reworking, or modification for reuse (Kuhn 1995:23). Conversely, a strategy of provisioning place anticipates a future need for tools or the materials to make tools at particular localities. This strategy is only useful if there is some regularity to the use of an area or resource (Kuhn 1995). With no carrying costs, except to transport the needed material to the site, place may be provisioned more often with tool-making potential or items which may serve a broader range of functions (Kuhn 1995: 24). In contrast to provisioning individuals, where carrying costs are of the utmost importance, places with cached items may contain a large number of items, a diversity of artifacts that do not exhibit reworking or situational reuse, and discarded, broken tools (Kuhn 1995). People that move residential locations often would likely have provisioned individuals whereas if places are revisited and reoccupied, a strategy of provisioning places would have been favored (Kuhn 1995). Depending on the priority of foraging groups or perhaps time of year, either or both strategies may have been utilized.

To interpret the relationship between provisioning strategies and land use using the archaeological record we must consider how tools and raw material reached sites (Kuhn 1995). Tracking movement of obsidian and FGV toolstone from source areas using x-ray fluorescence (XRF) analysis has served to establish regional Paleoarchaic hunter-gatherer ranges in the Great Basin (Jones et al. 2003, 2011; Smith 2010). Exchange of toolstone packages rather than direct procurement could have been employed as a conveyance mechanism; however, it is likely that due to low population density during the Paleoarchaic period, this type of activity would not have had a significant effect on assemblages (Beck and Jones 2011; Jones et al. 2003). Jones et al. (2003; however, see Jones et al. 2012) proposed foraging ranges, based on toolstone sourcing from their work in eastern Nevada, comprised of five north-south trending lithic conveyance zones between ca. 46,000 km² and 107,000 km² (Smith 2010:866) that circumscribed geographic territories used by different Paleoarchaic groups. They proposed that Paleoarchaic hunter-gatherers were both highly mobile and tethered to wetland patches and toolstone procurement was likely embedded within movements between resources as part of a cyclical mobility pattern. Using Bettinger and Baumhoff’s (1982) mobility continuum, they suggest that early populations were travelers who foraged within vast, constrained territories while later Archaic groups established a processor (less mobile) strategy. Smith (2010) tested this mobility model by geochemically sourcing Paleoarchaic and Archaic projectile points from numerous archaeological sites in the western Great Basin. His results scaled down the westernmost lithic conveyance zones into two smaller foraging territories during the Paleoarchaic. He also noted that the Carson Desert might represent a boundary between those territories, but that argument remains untested. Work at the Overlook Site, within the proposed boundary between the two western foraging territories, may provide data to test Smith’s (2010) model. Furthermore, work there can help to assess the relationship between occupation span and technological organization. Toolkits associated with shorter spans should contain items: (1) made on fine-grained exotic toolstone; (2) fashioned for multipurpose flexible uses; and (3) items which have been refined and reworked (Duke and Young 2007). In contrast, assemblages produced during longer occupations should contain items: (1) fashioned on local coarse-grained material; (2) few items of exotic toolstone acquired during logistical forays that exhibit a high degree of reworking; (3) stockpiled local toolstone (blanks or cores) acquired as part of an embedded strategy; (4) tools made for immediate use with little refinement; (5) high toolkit diversity; and (6) fashioned on local material which exhibit minimal reworking.
Domain 2: MOBILITY RESEARCH QUESTION AND DATA NEEDS

- How mobile were the hunter-gatherers at 26CH3413? Based on local and non-local toolstone ratios, spatial patterning of artifacts, and the types of artifacts at the site, can we determine whether the occupants at the site were provisioning individuals or provisioning place? Was this a short or long duration stay, or a palimpsest of short-duration stays?
  - Mobility range will hinge upon sourcing of the obsidian and FGV tools and obsidian debitage at the site. XRF analysis will reflect mobility trends and land use patterns. I project ~25% of tools and 50% of the obsidian debitage will need to be sourced. I will collect all tools fashioned on obsidian and FGV.
  - Lab analysis using Kuhn’s (1995) technological paradigm, Duke and Young’s (2007) model, and toolstone ratios (Smith 2010) will elaborate duration of occupation and relative mobility of the foraging group.
  - To characterize the assemblage requires analysis of all tools. Formal tools will be analyzed in the lab.
  - Study of the assemblage including artifacts and over 50% of the debitage, will define movement of toolstone and reduction activities at the site.

METHODS

To achieve my research goals and address the data needs cited above, I propose utilizing several field and laboratory methods. These methods include site mapping, photography, surface artifact collection, in-field and laboratory lithic analysis, subsurface testing, and toolstone sourcing. Fieldwork will comply with all Bureau of Land Management (BLM), State Historic Preservation Office (SHPO), and United States Navy protocols. The Field Director, Sarah K. Rice in collaboration with Dr. Geoffrey M. Smith, Principal Investigator, and NAS Fallon Archaeologist, Robin Michel will confer on all decision-making (see attached Appendix A – Memorandum of Agreements composed for this project) during fieldwork. NAS Fallon Archaeologist, Robin Michel will be on-site during fieldwork. In the case of an on-site emergency, NAS Fallon Archaeologist, Robin Michel will be notified as will Range Control. If the unanticipated emergency requires medical attention, injured parties will be taken directly to Renown Urgent Care Hospital in Fallon or emergency services will be contacted for immediate transport of the injured person.

Acquiring and managing all equipment including shovels, screens, excavation kits, paperwork, cameras, artifact collection kits, Geographic Positioning System (GPS) units and vehicles will be the sole responsibility of Ms. Sarah K. Rice. Fieldwork will involve six experienced crewmembers or less and Sarah K. Rice will serve as Field Director. Dr. Geoffrey Smith, Assistant Professor of Anthropology, will serve as Principal Investigator for this project. Work is proposed to begin in October 2013 and end November 2013 in order to allow for a feasible amount of time in the field and accommodate scheduling on the NAS. Fieldwork will likely take less than ten, eight-hour work days to complete.

Mapping

Far Western Anthropological Research Group, Inc. field crews recorded the site during inventory and provided a record of their findings (Clay and McCabe 2012). These data will be supplemented during the current research project and any new artifacts will be given artifact numbers contiguous with those given during inventory. To retain a map of spatial patterning observed at the site during inventory, I will piece plot all new in situ lithic tools and map obsidian debitage on the surface and within test units using a GPS unit. First, we will resurvey the site area at one-meter intervals to re-locate all originally recorded tools and flag new tools. Concentrations will also be flagged and evaluated for potential testing and debitage analysis. Mapping will comply with Appendix F and G of the Guidelines and Standards provided by the Bureau of Land Management Nevada State Office (2011).

Geological mapping will commence with a survey of the area surrounding the site, an extent large enough to characterize the sedimentologic and geologic context of the site. One profile within each of the shovel probes and
A View from the South: Paleoarchaic Land Use and Mobility in the Carson Desert

units will be drawn to illustrate the vertical and horizontal relationships between deposits on the site and those observed elsewhere. A resulting geological map will be produced using ArcGIS 10.1.

Photography
Crewmembers will take photographs of the site, all features, all units, and document excavation work using digital cameras. All of the digital photographs will be stored on the camera and backed up onto a computer after every work day. Photographs will include a north arrow and scale and each frame will be logged using field forms. A copy of digital photographs will be included with curated artifacts and the resultant Master’s thesis. Photography will comply with Appendix H of the Guidelines and Standards provided by the Bureau of Land Management, Nevada State Office (2011).

Surface Collection and Curation Strategy
In order to define the activities that produced the surface scatter at the site, I will re-analyze over 50% of the debitage, collect all tools fashioned from obsidian and FGV, and all formal tools. Formal tools are defined here as tools that possess clear evidence of being hafted, projectile points that can be visually placed into the GBSS typology (i.e., Cougar Mountain), stemmed point fragments, and artifacts that exhibit fine pressure flaking. Artifacts excluded from this collection strategy are expedient flake tools, rough percussion worked bifaces, and roughout bifaces fashioned on CCS. Sixty tools were recorded and at least five more were noted during the survey project conducted by Far Western and I project there to be around 75. I will collect no more than 45% of the 75 tools at the site (n=33).

In-field debitage analysis will include recording flake type (i.e., cortical spall, retouch, shatter, biface thinning flake), raw material type, flake size value, platform angle, number of flake scars, amount of cortex, and type of platform (if present). Tool analysis will follow that used by, Beck and Jones (2009), Duke and Young (2007), Graf (2001), and Smith (2006). Lab and in-field analysis of tools will include weight, type, dimensions, index of reduction for unifaces (edge angle), whole or complete, type of break, type of flaking, and type of fragment. These categories break down even further and will be used on our field and lab analysis paperwork.

Artifacts recovered in test units will be collected and analyzed in the laboratory following fieldwork. Artifacts will be analyzed in the secure Prehistoric Laboratory in the Anthropology Department at the University of Nevada, Reno, and ultimately curated at the at the Nevada State Museum under the curation agreement with NAS Fallon after work is completed.

Testing, Excavation and Sampling
Digging at the site will begin with testing the subsurface potential by placing 0.50-m² units in the central portion of the site. Their locations will tie into the datum and mapped accordingly. Units placed for subsurface testing will be dug to sterile. If we encounter a feature during testing, we will proceed by excavating 1-m² units adjacent to the find to expose the feature in plan view, bisect the feature, sketch the feature, and obtain a sample of sediment for flotation. The number of units will be determined upon revisit to the site, however, 20 units maximum should be sufficient and placement of the units will require some flexibility based on what is revealed during testing. To define the cultural and geological deposits probes will be placed within the sandy area, at presumed and known geological contacts, and within artifact concentrations.

Toolstone Sourcing
To reconstruct mobility strategies, territorial range, and how the Overlook Site can be used to test Smith’s (2010) hypothesis that two western foraging territories intersected in the Carson Desert, I need to map all available but currently un- and/or under-documented toolstone sources. This will require a visit to the Bureau of Land Management, Carson City, to perform a file search. For my study, I define local toolstone as within Lahontan Valley or adjacent ranges. Non-local is defined as outside the basin and over 50 kilometers away from the site. By establishing distances to the quarries from the site, I will be able to characterize the relationship between lithic reduction trajectories and distance to toolstone sources. After reviewing the geological and archaeological records for known toolstone-quality sources, I will compare those data to geochemically referenced sources in the Northwest
Obsidian Labs database. This will determine if and where there is a gap in known and unknown sources. CCS toolstone is prevalent on the site and, other than visual and color characteristics, cannot currently be geochemically sourced.

To assess and characterize the assemblage will require post-field and in-field analysis of tools and debitage (see Surface Collection and Curation section above). Surface debitage will be analyzed in the field and characterized by toolstone type and flake type in order to evaluate the reduction activities at the site. All surface obsidian debitage will be mapped and collected. Debitage from excavation and test units will be analyzed in the lab after fieldwork is complete. Tools that are fashioned on either obsidian or FGV will be collected for analysis and XRF. XRF will be conducted at Northwest Research Obsidian Laboratory. Lab fees will be provided by NAS Fallon, the University of Nevada, Reno, and Ms. Sarah K. Rice. All other tools will be collected for post-field lab analysis.

**Lab Analysis**

Analysis of artifacts will take place in the Prehistoric Lab, in the Anthropology Department at the University of Nevada, Reno. Study of the artifacts should take approximately four months and no more than six months from the date of collection. All artifacts collected during fieldwork will be curated at the Nevada State Museum. Curation fees will be covered by funds provided by NAS Fallon. In the event that I am unable to complete analysis of artifacts, Dr. Geoffrey M. Smith has kindly agreed to complete the analysis and curation of the artifacts at the museum. During lab work, all artifacts will be catalogued using Nevada State Museum protocol. The Museum charges $270 for half a cube and $540 for a cubic foot box, I anticipate only having to curate one cubic foot box.

**Unanticipated Discovery**

NAS Fallon and BLM Stillwater Field Office will consult with the Fallon Paiute Shoshone Tribe in regard to this proposed project and work plan. In the event that human skeletal remains, associated and unassociated funerary objects, or sacred objects are found during excavations, all work will cease in the area surrounding the find, and NAS Fallon Archaeologist, Robin Michel, and local law enforcement will be notified immediately. The State Historic Preservation Office will be notified within 24 hours of the discovery. Ms. Michel will notify the appropriate persons and a site visit will be arranged. The Field Director will secure the area and will cease work at the site until appropriate tribes and agencies make decisions regarding proper disposition of the remains. The decision to protect and preserve in place or remove will be made by the appropriate tribes and the Navy.

**REGULATORY DRIVER AND FINDING OF EFFECT**

The work outlined in this research design will be conducted under Section 110 of the National Historic Preservation Act (NHPA) 1966, as amended, which outlines historic preservation responsibilities of Federal agencies, ensuring historic preservation is integrated into their ongoing programs. Each agency must establish a preservation program for identifying, evaluating, and nominating sites or buildings to the National Register of Historic Places (National Register), and for preserving their historic properties. Site 26CH3413 is located on NAS Fallon bombing range B-16 on land withdrawn from the Bureau of Land Management. The testing program presented in this research design will aid the Department of the Navy in its efforts to comply with Section 110 of the NHPA.

**National Register of Historic Places Eligibility Status of 26CH3413**

Undertakings that involve Federal funding, lands, or permits require that the significance of cultural resources within the project area be measured against the National Register criteria for eligibility (36 CFR 60.4) which state, in part, that:

“"The quality of significance in American history, architecture, archaeology, engineering, and culture is present in the form of districts, sites, buildings, structures, and
(A) that are associated with events that have made a significant contribution to the broad patterns of our history; or

(B) that are associated with the lives of persons significant in our past; or

(C) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(D) that have yielded, or may be likely to yield, information important in prehistory or history.”

While historic-age cultural resources may be found National Register-eligible under virtually any of these criteria, prehistoric archaeological sites are usually evaluated with respect to Criterion D. Prehistoric archaeological sites can rarely be associated with past events or people under Criteria A and B. Some prehistoric sites in the Great Basin can be eligible under Criterion C, such as sites that contain rock art. In other words, to be considered eligible for the National Register, most prehistoric archaeological sites must have the potential to yield:

important information about some aspect of prehistory or history, including but not limited to, events, processes, institutions, design, construction, settlement, migration, ideals, beliefs, lifeways, and other facets of the development or maintenance of cultural systems. Any consideration of a property’s eligibility under Criterion D must address and (1) whether that information is important (2) whether the property has information to contribute to our understanding of history or prehistory [National Park Service (NPS) 1982:28].

An eligible property must also be at least 50 years old (with a few special exceptions) and retain a certain level of integrity sufficient to convey its association with past patterns, persons, designs, technologies, or events. The seven aspects of integrity that are evaluated include: location, setting, design, material, workmanship, feeling, and association (NPS 1991).

Site 26CH3413 was first recorded in 2012 by Far Western Anthropological Research Group Inc. Their survey-level eligibility recommendation stated:

This site is a Paleoarchaic (Terminal Pleistocene-Early Holocene Period) assemblage on a promontory overlooking Lahontan Valley. It contains an undisturbed and potentially buried cultural assemblage from a temporal period that has relatively few sites and is still poorly understood throughout the Great Basin. The relatively high number of artifacts, presence of obsidian and basalt for analysis, internal spatial patterning, and potential for depth and buried features could provide significant information on Paleoarchaic Chronology, Subsistence and Settlement, Mobility and Land Use, and Paleoenvironments in Lahontan Valley. The site is recommended eligible to the National Register under Criterion D (Clay and McCabe 2012).

Archaeological site 26CH3413 warrants further investigation because there is little data pertaining to Paleoarchaic subsistence and mobility in the Carson Desert. Due to the work in the northwestern Great Basin by colleagues at the University of Nevada, Reno, and in the eastern Great Basin by the Desert Research Institute and numerous cultural resource management firms, Paleoarchaic land use and mobility in those regions are becoming well-understood (Goebel et al. 2003; Graf and Schmitt 2007[entire volume]; Smith 2006; 2010; 2011; Smith and Kielhofer 2011; Smith et al. 2012; Duke 2011; Duke and Young 2008). However, the southern Lahontan Basin has received little attention and therefore remains a good place to begin to define regional and local patterns of movement and test current hypotheses related to Paleoarchaic behavior (Graf 2001). The proposed work will contribute to our
understanding of Paleoarchaic lifeways by characterizing the lithic assemblage and reconstructing the technological activities that took place at the site.

The methods presented in this research design were selected with the intention of preserving as much of the site as possible. Limited subsurface testing and less than 50% collection of surface artifacts will preserve sufficient integrity for the site to retain its National Register eligibility. Under the protocol agreement between Nevada SHPO and BLM, this falls below the threshold of an adverse effect finding. Perhaps more importantly, this means that other researchers will have the opportunity to work at the site.

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APPENDIX A.

IMACS Site Form for 26CH3413.

Memorandum of Agreement between BLM and SHPO.

Memorandum of Agreement between SHPO, the Navy, and BLM.
This medium-sized (6,823 square meters) Paleoarchaic assemblage is situated on a prominent saddle between two tufa-covered rhyolite outcrops at an elevation of 4,101 feet (1,250 meters). The site has an eastern-southeastern exposure overlooking Lahontan Valley and Paleoarchaic site 26CH3415, which lies 100 meters east and northeast and about 30 meters lower in elevation. Sediments include desert pavements of volcanic gravels on lacustrine silt and clay at the site margins, a thin sand sheet in the site center, and decomposing outcrops of tufa-coated rhyolite. A shadscale plant community grows on this upland terrace. Modern disturbances include a coyote trap location at the bottom of one of the outcrops and expended military armaments.

The surface assemblage contains numerous formed tools and more than 1,000 pieces of chert, basalt, obsidian, rhyolite, sinter, and wonderstone debitage representing both biface (early to late stage) and core reduction strategies. The 300 flakes examined show chert the dominant toolstone. Rhyolite is also a common toolstone, with basalt and obsidian used infrequently; sinter and wonderstone flakes are rare. Tertiary biface thinning flakes are dominant with tertiary core reduction types less common. Secondary decortication flakes and shatter are also common, while primary decortication types are rare. It is likely that toolstone, was initially reduced at 26CH3415, an opportunistic Paleoarchaic chert quarry nearby with visually similar materials, and high quality large flakes, bifaces, and cores transported upslope to this site where they were further reduced. This is indicated by numerous complete finished artifacts including stemmed points and formed scrapers. This site probably also served as a retooling location where broken tools such as those fabricated from obsidians and non-local cherts were left behind.

At least five Great Basin Stemmed series points or fragments are part of the surface assemblage; two complete and three proximal fragments. The complete points are similar to Haskett and Cougar Mountain styles (Beck et al. 2004). Other formed tools include a nearly complete drill or awl, one simple flake tool, two formed flake tool scrapers, one handstone, and more than 50 bifaces. The handstone was found on a tufa ledge just above the modern trap location. The drill or awl is bifacially pressure flaked, tan/brown chert and is missing the distal or working end. In addition to the 49 bifaces documented, several small fragments were observed but not formally recorded. All stages of bifaces are represented (i.e., 18 late stage, 14 middle stage, and 17 early stage forms) only ten are complete. As evinced by one of the stemmed points and one of the bifaces, it is likely that several biface fragments might be refitted. Many tools and flakes are incorporated into the desert pavement and exhibit substantial weathering rinds and patinas. The surface artifact assemblage retains clear spatial patterning, as formed tool density is noticeably greater in two areas of the site; one in the northeast and one on the south. The site’s central sand sheet also contains abundant artifacts suggesting good potential for buried features and deposits.

This site is situated well above the 1,203 meter Russell Shoreline, which may mark a substantial lake and associated wetland as early as 12,000 BP (Far Western 2007: 78-82). Great Basin Stemmed series points are thought to range in age from 7000-10,500 BP, but may overlap with the earlier Western Clovis period extending back to 11,500-12,000 BP. This site location is relatively unique with a vast 360 degree viewshed overlooking Lahontan Valley and the surrounding mountain slopes. It is also sheltered in a saddle between two tufa-covered rhyolite outcrops and knolls. Based on the presence of Great Basin Stemmed series points, large well-fabricated bifaces, and highly weathered artifacts in substantial numbers and concentrations, the site clearly represents the Paleoarchaic period. Bifaces and stemmed points were probably manufactured here using locally available cherts from the nearby toolstone source at 26CH3415. The artifact concentrations and promontory location suggest that this site may represent a camp and retooling location for a Paleoarchaic group, or multiple groups for a substantial period of time.

National Register Eligibility:
This site is a Paleoarchaic (Terminal Pleistocene-Early Holocene Period) assemblage on a promontory overlooking Lahontan Valley. It contains an undisturbed and potentially buried cultural assemblage from a temporal period that has relatively few sites and is still poorly understood throughout the Great Basin. The relatively high number of artifacts, presence of obsidian and basalt for analysis, internal spatial patterning, and potential for depth and buried features could provide significant information on Paleoarchaic Chronology, Subsistence and Settlement, Mobility and Land Use, and Paleoenvironsments in Lahontan Valley. The site is recommended eligible to the National Register under Criterion D.

10. Elevation: 4101 feet
11. UTM: Zone 11; 337620 mE 4350510 mN (datum)
**NEVADA IMACS SITE FORM**

State No.: 26CH3413  
Agency No.: CrNV-03-8569  
Temp. No.: TO31-03

12. PLSS: SW¼ of SE¼ of Sec. 31 T17N R28E

13. Meridian: Mt. Diablo (7)  
14. Map Reference: Salt Cave NV 7.5'

15. Land Owner: Military Reservation (MR)  
16. Fed. Admin. Units:

17. Photos: 1276JM01D: 016-047; 1276AM01D: 017-020

20. Dist. to Permanent Water: 0.4 km  
21. Geographic Unit: Carson Desert (BNA)  
22. Topographic Location (primary): Valley (E)

23. Depositional Context: Aeolian (S)  
24. Veg. Community (primary): Shadscale (O)

**Artifact summary:**

<table>
<thead>
<tr>
<th>Count</th>
<th>Density (count/m²)</th>
<th>Material/code</th>
<th>Artifact/code</th>
<th>Art no.</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>2</td>
<td>Various</td>
<td>Biface</td>
<td></td>
<td>Early to Late Stage forms present, noted addition fragments, many probably re-fit, three (A19, A24, and A49) are possibly Great Basin Stemmed point fragments.</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Various</td>
<td>Projectile Point</td>
<td></td>
<td>Great Basin Stemmed projectile points (A3, A11/12-refit, A13, A14 and A46), two are complete (A11/12 and A13) and three are proximal fragments</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Various</td>
<td>Flake Tools</td>
<td></td>
<td>2 chert and one rhyolite, unifacial edge-wear</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Rhyolite</td>
<td>Flake Tools</td>
<td></td>
<td>Perforator, nearly complete drill or awl-type implement (A47)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Basalt</td>
<td>Handstone</td>
<td></td>
<td>Complete implement with unifacial incipient use-wear</td>
</tr>
<tr>
<td>1000+</td>
<td>10</td>
<td>Various</td>
<td>Debitage</td>
<td></td>
<td>Few early core reduction flakes; biface and core reduction types most common</td>
</tr>
</tbody>
</table>

**Feature descriptions:**

**Comments:**

Attachments:  
- Location Map  
- Photos  
- Continuation Sheet  
- Rock Art Attachment  
- Site Sketch  
- Feature/Artifact Sketch  
- Other
<table>
<thead>
<tr>
<th>Artifact No.</th>
<th>Description</th>
<th>Dimensions (cm)</th>
<th>Locational Data</th>
<th>Collected?</th>
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<td>W</td>
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<tr>
<td>1</td>
<td>Stage 2 obsidian biface midsection exhibiting rough</td>
<td>-1.9</td>
<td>-1.8</td>
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<tr>
<td></td>
<td>percussion and fine percussion flaking and bending</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>Stage 2 orange-tan chert complete biface exhibiting rough</td>
<td>7.4</td>
<td>3.6</td>
<td>2.3</td>
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<tr>
<td></td>
<td>percussion and fine percussion flaking and 10% cortex</td>
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<td>3</td>
<td>Brown chert Great Basin Stemmed point proximal end fragment, bending</td>
<td>-4.7</td>
<td>2.0</td>
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<tr>
<td></td>
<td>break, possible grinding on margin</td>
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<td>4</td>
<td>Roughout dark red chert biface with 10% cortex</td>
<td>8.5</td>
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<td>5</td>
<td>Stage 2 orange-tan chert biface end fragment exhibiting rough</td>
<td>-5.8</td>
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<td>percussion and rough pressure flaking, bending break, and ventral scar</td>
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<td>6</td>
<td>Stage 2-3 tan-brown chert midsection exhibiting two bending breaks</td>
<td>-6.4</td>
<td>3.5</td>
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<tr>
<td>7</td>
<td>Stage 2 brown chert nearly complete biface exhibiting rough</td>
<td>-6.8</td>
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<td>8</td>
<td>Stage 2 tan chert biface midsection exhibiting rough</td>
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<tr>
<td></td>
<td>percussion and fine percussion flaking and two bending breaks</td>
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<td>9</td>
<td>Stage 2-3 red chert biface exhibiting fine percussion flaking and ~3% cortex</td>
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<td>10</td>
<td>Stage 4 pink chert biface midsection exhibiting fine</td>
<td>-5.1</td>
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<td>percussion and fine pressure flaking and two bending breaks</td>
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<td>11</td>
<td>Basalt Great Basin Stemmed point proximal fragment, refits with</td>
<td>-3.7</td>
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<td>Artifact #12, exhibits fine percussion and rough pressure flaking and a</td>
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<td></td>
<td>bend break</td>
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<td>12</td>
<td>Basalt Great Basin Stemmed point distal fragment, refits with</td>
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<td></td>
<td>Artifact #11, exhibits fine percussion and rough pressure flaking and</td>
<td></td>
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<td>bend break with come caliche on surface</td>
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<td>13</td>
<td>Tan-olive chert complete Great Basin Stemmed point exhibiting fine pressure</td>
<td>9.0</td>
<td>3.8</td>
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<td>flaking and ground proximal margins</td>
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<td>14</td>
<td>Basalt Great Basin Stemmed point proximal fragment exhibiting</td>
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<td>rough pressure flaking and bend break</td>
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<td>15</td>
<td>Stage 4-5 tan-gray chert biface exhibiting rough</td>
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<td>pressure and fine pressure flaking, 5% cortex and a small</td>
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<td>bending break on one margin</td>
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<td>16</td>
<td>Stage 3 red chert biface distal fragment exhibiting rough</td>
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<td>4.9</td>
<td>1.3</td>
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<td>percussion and rough pressure flaking and bending break</td>
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<td>17</td>
<td>Tan chert biface distal fragment exhibiting rough</td>
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<td></td>
<td>percussion and fine pressure flaking, bending break and step fractures</td>
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<td>18</td>
<td>Stage 3-4 red chert biface midsection fragment exhibiting fine</td>
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<td>percussion and rough pressure flaking, two bending breaks and caliche on</td>
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<td>margins</td>
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<td>19</td>
<td>Stage 3-4 wonderstone biface distal end fragment exhibiting</td>
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<td>rough pressure flaking and bending break; possible &quot;preform&quot; for a Great</td>
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<td>Basin Stemmed series point, similar to A13</td>
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<td>percussion flaking and two bending breaks</td>
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<td>21</td>
<td>Stage 2-3 complete basalt biface exhibiting rough</td>
<td>10.3</td>
<td>3.9</td>
<td>2.7</td>
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<td></td>
<td>percussion and fine pressure flaking</td>
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<td>Dimensions (cm)</td>
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<tr>
<td>22</td>
<td>Stage 4 tan chert biface midsection exhibiting fine pressure flaking, a ventral scar and three bending breaks</td>
<td>-3.2 -4.3 0.4</td>
<td>337632mE/4350534mN</td>
<td>No</td>
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<tr>
<td>23</td>
<td>Stage 3 brown chert biface distal fragment, exhibiting rough pressure flaking, ventral and dorsal scars and bending break</td>
<td>-7.9 3.6 1.1</td>
<td>337632mE/4350534mN</td>
<td>No</td>
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<tr>
<td>24</td>
<td>Basalt late stage 5 biface medial fragment, possible Great Basin Stemmed point midsection exhibiting rough pressure flaking and two bending breaks</td>
<td>-3.3 2.1 0.8</td>
<td>337624mE/4350526mN</td>
<td>No</td>
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<tr>
<td>25</td>
<td>Stage 4 tan-orange chert biface distal fragment exhibiting rough percussion and fine pressure flaking, ventral and dorsal scars, and a bending break</td>
<td>-4.7 4.0 1.0</td>
<td>337633mE/4350521mN</td>
<td>No</td>
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<tr>
<td>26</td>
<td>Basalt handstone exhibiting incipient polish on an irregular flat surface with some caliche and lichen on the surface, ~11 lbs; located on tufa shelf of an outcrop</td>
<td>20.6 12.8 7.0</td>
<td>337655mE/4350499mN</td>
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<td>27</td>
<td>Stage 4 tan chert proximal biface fragment exhibiting rough pressure and fine pressure flaking and a bending break</td>
<td>-4.2 2.5 0.9</td>
<td>337624mE/4350518mN</td>
<td>No</td>
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<td>28</td>
<td>Stage 2-3 tan-orange chert biface distal end fragment exhibiting rough percussion and fine percussion flaking and a bending break</td>
<td>-5.6 3.5 1.1</td>
<td>337624mE/4350518mN</td>
<td>No</td>
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<td>29</td>
<td>Stage 3 basalt biface end fragment exhibiting fine percussion and rough pressure flaking and a bending break</td>
<td>-4.0 3.1 0.7</td>
<td>337616mE/4350516mN</td>
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<tr>
<td>30</td>
<td>Stage 3-4 tan-red chert biface proximal end fragment, exhibits rough pressure flaking and bending break</td>
<td>-5.0 4.6 1.1</td>
<td>337595mE/4350515mN</td>
<td>No</td>
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<tr>
<td>31</td>
<td>Stage 4 mottled gray-orange chert complete biface, exhibits rough pressure and fine pressure flaking</td>
<td>6.0 2.5 0.9</td>
<td>337609mE/4350497mN</td>
<td>No</td>
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<tr>
<td>32</td>
<td>Stage 3 red rhyolite/chert biface distal fragment, exhibits rough percussion and rough pressure flaking and bending break</td>
<td>-6.2 4.0 1.1</td>
<td>337623mE/4350493mN</td>
<td>No</td>
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<tr>
<td>33</td>
<td>Stage 3 mottled gray-orange biface proximal end fragment, exhibits rough percussion and fine percussion flaking, a bending break and 10% cortex</td>
<td>-5.9 5.7 1.3</td>
<td>337625mE/4350474mN</td>
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<tr>
<td>34</td>
<td>Yellow-red mottled chert flake tool with rough percussion and fine pressure flaking</td>
<td>6.2 4.7 0.9</td>
<td>337625mE/4350474mN</td>
<td>No</td>
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<td>35</td>
<td>Stage 2-3 orange-red mottled rhyolite/chert biface margin fragment exhibits rough percussion and fine percussion flaking and 20% cortex fashioned out of a local cobble</td>
<td>8.0 3.8 1.5</td>
<td>337588mE/4350502mN</td>
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<td>36</td>
<td>Stage 2-3 orange-red mottled rhyolite/chert biface exhibits rough percussion and fine percussion flaking, a bending break, and 30% cortex</td>
<td>-5.7 -3.1 1.4</td>
<td>337583mE/4350494mN</td>
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<td>37</td>
<td>Stage 3-4 white chert biface, exhibits fine percussion and fine pressure flaking and 5% cortex</td>
<td>5.9 5.7 1.8</td>
<td>337583mE/4350491mN</td>
<td>No</td>
</tr>
<tr>
<td>38</td>
<td>Stage 3 red-brown rhyolite biface end fragment, exhibits fine percussion flaking, and bending break</td>
<td>-6.7 4.5 1.1</td>
<td>337602mE/4350476mN</td>
<td>No</td>
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<tr>
<td>39</td>
<td>Roughout tan-red chert biface with 10% cortex fashioned out of a local cobble</td>
<td>7.9 4.5 2.6</td>
<td>337602mE/4350476mN</td>
<td>No</td>
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<td>40</td>
<td>Stage 3-4 tan chert/rhyolite biface distal end fragment exhibits rough percussion and rough pressure flaking, a bending break, and a ventral scar</td>
<td>-6.7 4.6 0.9</td>
<td>337598mE/4350474mN</td>
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<tr>
<td>41</td>
<td>Stage 3 orange-brown chert biface end fragment exhibits fine percussion flaking, bending break, material is full of inclusions</td>
<td>-5.0 4.1 0.9</td>
<td>337607mE/4350468mN</td>
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<td>42</td>
<td>Stage 3 yellow-orange chert/rhyolite biface end fragment, exhibits fine percussion flaking, a bending</td>
<td>-4.9 4.3 0.9</td>
<td>337610mE/4350470mN</td>
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<tr>
<td>43</td>
<td>Stage 3 tan-orange chert/rhyolite biface end fragment exhibiting fine percussion flaking and a bending break</td>
<td>-6.6 4.0 0.9</td>
<td>337615mE/4350467mN</td>
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<td>44</td>
<td>Stage 3-4 tan-brown chert/rhyolite complete biface exhibiting rough pressure flaking and step fractures</td>
<td>7.3 3.4 1.0</td>
<td>337618mE/4350465mN</td>
<td>No</td>
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<tr>
<td>45</td>
<td>Stage 4 white-grey chert biface distal end fragment exhibiting rough pressure and fine pressure flaking, a bending break, ventral scar and slight longitudinal curvature</td>
<td>-3.8 3.2 0.8</td>
<td>337618mE/4350465mN</td>
<td>No</td>
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<td>46</td>
<td>Tan-brown chert/rhyolite Great Basin Stemmed point proximal end fragment exhibiting rough pressure flaking and a bending break</td>
<td>-5.0 2.6 0.8</td>
<td>337601mE/4350456mN</td>
<td>No</td>
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<tr>
<td>47</td>
<td>Tan-brown chert/rhyolite nearly complete drill or awl, tip broken, exhibiting rough pressure flaking and a bend break; bit measures 28mm long x 15 mm wide x 5 mm diameter</td>
<td>-6.3 2.8 0.7</td>
<td>337594mE/4350459mN</td>
<td>No</td>
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<td>48</td>
<td>Stage 3 brown-yellow chert biface end fragment exhibiting rough pressure flaking, a bending break and caliche on the bottom of the artifact</td>
<td>-5.7 2.9 0.9</td>
<td>337594mE/4350459mN</td>
<td>No</td>
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<td>49</td>
<td>Stage 5 tan-orange chert biface end fragment exhibiting fine pressure flaking, bending break, possible GB stemmed point fragment</td>
<td>-4.3 2.2 0.7</td>
<td>337595mE/4350459mN</td>
<td>No</td>
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<tr>
<td>50</td>
<td>Stage 5 yellow-tan chert biface end fragment exhibiting fine pressure flaking, bending break, ventral scar, slight longitudinal curvature, possible projectile point fragment</td>
<td>-2.6 2.0 0.6</td>
<td>337594mE/4350464mN</td>
<td>No</td>
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<td>51</td>
<td>Stage 2 tan-red mottled chert nearly complete biface missing distal tip exhibiting rough percussion flaking, bending break and step fractures</td>
<td>-5.9 4.7 1.8</td>
<td>337585mE/4350478mN</td>
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<td>52</td>
<td>Stage 2 white/grey chert biface end/margin fragment exhibiting rough percussion flaking, 30% cortex, and bending break</td>
<td>-4.4 -4.0 1.7</td>
<td>337583mE/4350473mN</td>
<td>No</td>
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<tr>
<td>53</td>
<td>Stage 3 tan-brown chert/rhyolite nearly complete biface, broken proximal, exhibiting fine percussion and rough pressure flaking and bending break</td>
<td>-9.6 4.5 1.8</td>
<td>337586mE/4350464mN</td>
<td>No</td>
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<tr>
<td>54</td>
<td>Orange-brown chert/rhyolite biface, in two fragments that refit, broken proximal exhibiting fine percussion and rough pressure flaking and bending breaks</td>
<td>-10.3 4.0 1.2</td>
<td>337586mE/4350464mN</td>
<td>No</td>
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<td>55</td>
<td>White-gray chert biface proximal fragment exhibiting fine percussion and rough pressure flaking, bending break and 5% cortex</td>
<td>-7.9 4.3 1.8</td>
<td>337595mE/4350459mN</td>
<td>No</td>
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<td>56</td>
<td>Orange-red mottled chalcedony edge damaged unifacial flake tool exhibiting fine pressure flaking, bending break, 30% cortex, and use wear along 24 mm of one margin</td>
<td>-3.5 2.5 1.2</td>
<td>337593mE/4350456mN</td>
<td>No</td>
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<td>57</td>
<td>Stage 3 red chert/rhyolite biface distal end fragment exhibiting fine percussion and rough pressure flaking, bending break</td>
<td>-8.0 3.4 1.1</td>
<td>337587mE/4350456mN</td>
<td>No</td>
</tr>
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<td>58</td>
<td>Stage 2-3 gray-white chert biface end fragment exhibiting rough percussion and fine percussion flaking and bending break</td>
<td>-4.3 4.1 1.0</td>
<td>337586mE/4350451mN</td>
<td>No</td>
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<tr>
<td>59</td>
<td>Stage 3 complete refit red-brown rhyolite biface exhibiting fine percussion flaking, rough pressure flaking 10% cortex, and bending break</td>
<td>15.5 5.1 2.0</td>
<td>337586mE/4350449mN</td>
<td>No</td>
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<tr>
<td>60</td>
<td>Gray rhyolite flake tool, unifacial edge damaged with 37 mm of edge damage along one lateral margin</td>
<td>9.6 5.5 1.2</td>
<td>337655mE/4350533mN</td>
<td>No</td>
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<tr>
<td></td>
<td>Analyzed Debitage: 193 chert, 63 rhyolite flakes, 15 flakes of mossy, smoky and opaque obsidian, 31 basalt, 3 wonderstone, 1 sinter (n=306) representing all stages of biface reduction and core reduction with a max. density of 10 per meter square.</td>
<td>L</td>
<td>W</td>
<td>TH</td>
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</table>
Artifact 11, Basal Fragment; Artifact 12, Distal Fragment
IMACS SITE FORM

State No.: 26CH3413
Agency No.: CrNV-03-8569
Temp. No.: TO31-03

Report No.: CRR3-2617(P)

Artifact 13

kathleen 2/15/2012 2:11:59 PM

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Artifact 3 - Tan Chert Great Basin Stemmed Point Base

Artifact 11 (distal) and Artifact 12 (proximal) - Refit Basalt Great Basin Stemmed Point
Artifact 13 - Brown Chert Great Basin Stemmed Point

Artifact 19 - Wonderstone Biface Fragment, Possible Stemmed Point Preform
Artifact 21 - Basalt Biface

Artifact 26 - Incipient Basalt Handstone
Artifact 26 Handstone in situ on Tufa Shelf within Outcrop (Southwest)

Stacked Rock Modern Animal Trap
Below Artifact 26 within Tufa-Covered Rhyolite Outcrop
Artifact 46 - Chert Biface, possible Great Basin Stemmed Point Base

Artifact 47 - Chert Drill
Artifact 49 - Chert Biface End Fragment

Artifact 54 - Rhyolite Biface Refit
Memorandum of Agreement
between
The Bureau of Land Management, Carson City Field Office
and
The Nevada State Historic Preservation Officer
Regarding
Recovery of Significant Information from 26CH3413

WHEREAS, BLM is responsible for ensuring that this Undertaking, excavation at archaeological site 26CH3413, is in compliance with section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), 16U.S.C. § 470f, and its implementing regulations, 36 C.F.R. § 800; as well as section 110 of the NHPA (16U.S.C. § 470h2(a-b)); and

WHEREAS, BLM has determined that the Undertaking will have an adverse effect on 26CH3413, which may be eligible for the National Register of Historic Places under criterion D, and has consulted with the Nevada State Historic Preservation Officer (SHPO) pursuant to NHPA; and

WHEREAS, BLM has not invited the Advisory Council on Historic Preservation (ACHP) to consult on this Undertaking as it does not reach the threshold of ACHP involvement, pursuant to the Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the manner in which BLM will meet its responsibilities under the National Historic Preservation Act; and

WHEREAS, BLM is responsible for conducting Native American tribal consultation on a government-to-government level and ensuring that it complies with the BLM manual 8120 and BLM Handbook, H-8120-1, guidelines for conducting tribal consultation. The tribe invited to consult for the Undertaking is: the Fallon Paiute Shoshone Tribe; and

WHEREAS, a cultural resource inventory records review for the Undertaking has been completed and BLM in consultation with SHPO have determined that only one historic property (26CH3413) will be adversely affected by this Undertaking; and

WHEREAS, any materials collected in association with this Undertaking will be curated at the Nevada State Museum, but remain the property of the BLM; and

WHEREAS, the Treatment Plan entitled "A View From the South: Paleoarchaic Land Use and Mobility in the Carson Desert, A Research Design for Work at 26CH3413" is attached to this agreement as the plan for carrying out the data recovery from site 26CH3413 (Attachment A); and
WHEREAS, BLM, in consultation with SHPO, has determined that the execution of the treatment plan attached will adequately recover the National Register values of 26CH3413 thus fulfilling BLM’s responsibilities under NHPA; and

WHEREAS, the United States Navy has developed a separate MOA, between the University of Nevada, Reno and Naval Air Station, Fallon for access to the site and monetary assistance; and

NOW, THEREFORE, BLM shall ensure that the following terms and conditions, including the appended Treatment Plan, will be implemented in a timely manner and with adequate resources in compliance with the National Historic Preservation Act of 1966 (16 U.S.C 470).

OTHER TERMS AND CONDITIONS:

• The signatories shall resolve disputes regarding the completion of the terms of this agreement. If the signatories cannot agree regarding a dispute, any one of the signatories may request the participation of ACHP to assist in resolving the dispute.
• This agreement shall be null and void if its terms are not carried out within five (5) years from the date of its execution, unless the signatories agree in writing to an extension for carrying out its terms.
SIGNATORIES

X

Terri Knutson
US Department of the Interior, BLM

X

Rebecca L. Palmer
Acting State Historic Preservation Officer
Memorandum of Agreement between
The Bureau of Land Management, Carson City Field Office
The Nevada State Historic Preservation Office,
And
US Naval Air Station, Fallon
Regarding
Recovery of Significant Information from 26CH3413

WHEREAS, the BLM is responsible for ensuring that this Undertaking is in compliance with section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), 16 U.S.C. § 470f, and its implementing regulations, 36 C.F.R. § 800; and

WHEREAS, BLM has consulted with US Naval Air Station, Fallon (NAS Fallon), who is responsible for the effect of the Undertaking on historic properties and has invited them to sign this Memorandum of Agreement as an invited Signatory; and

WHEREAS, the BLM has determined that the Undertaking will have an adverse effect on 26CH3413, which may be eligible for the National Register of Historic Places under criterion D, and has consulted with the Nevada State Historic Preservation Officer (SHPO) pursuant to NHPA; and

WHEREAS, BLM has not invited the Advisory Council on Historic Preservation (ACHP) to consult on this Undertaking as it does not reach the threshold of involvement, pursuant to the Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the manner in which BLM will meet its responsibilities under the National Historic Preservation Act; and

WHEREAS, Ms. Sarah K. Rice, University of Nevada, Reno (UNR) graduate student is responsible to produce and carry out the guidelines specified in the Research Design for work at 26CH3413 and has invited her, as representative of UNR, to sign this Memorandum of Agreement as a Concurring Party; and

WHEREAS, NAS Fallon is responsible for conducting Native American tribal consultation on a government-to-government level and ensuring that it complies with the BLM manual 8120 and BLM Handbook, H-8120-1, guidelines for conducting tribal consultation, the tribes invited to consult for the Undertaking were: the Walker River Paiute.
WHEREAS, comments have yet to be received from a tribal representative.

WHEREAS, a cultural resource inventory records review for the Undertaking has been completed and the BLM in consultation with the SHPO have determined that only one historic property will be adversely affected by this Undertaking; and

WHEREAS, any materials collected in association with this Undertaking remain the property of the Nevada State Museum;

WHEREAS, the Treatment Plan entitled "A View From the South: Paleoarchaic Land Use and Mobility in the Carson Desert, A Research Design for Work at 26CH3413" is attached to this agreement as the plan for carrying out the data recovery from site 26CH3413 (Attachment A); and

WHEREAS, the BLM, in consultation with the SHPO, has determined that the execution of the treatment plan attached will adequately recover the National Register values for 26CH3413 thus fulfilling the BLM's responsibilities under NHPA; and

NOW, THEREFORE, the BLM shall ensure that the following terms and conditions, including the appended Treatment Plan, will be implemented in a timely manner and with adequate resources in compliance with the National Historic Preservation Act of 1966 (16 U.S.C. 470).

OTHER TERMS AND CONDITIONS:

- The signatories shall accomplish modification, amendment or termination of this agreement as necessary in the same manner as the original agreement.
- The signatories shall resolve disputes regarding the completion of the terms of this agreement. If the signatories cannot agree regarding a dispute, any one of the signatories may request the participation of ACHP to assist in resolving the dispute.
- This agreement will be canceled if its terms are not carried out within five (5) years from the date of its execution, unless the signatories agree in writing to an extension for carrying out its terms.
SIGNATORIES

X
Terri Knutson
US Department of the Interior, BLM

X
Rebecca L. Palmer
Acting State Historic Preservation Officer

X
Naval Air Station, Fallon, NV
Appendix B

Radiocarbon Results
July 8, 2014

Ms. Sarah K. Rice
Far Western Anthropological Group
1000 S. Minnesota Street
Carson City, NV 89703
USA

RE: Radiocarbon Dating Result For Sample 26CH3413TUFA

Dear Ms. Rice:

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, specifics of the analysis are listed on the report with the result and calibration data is provided where applicable. The Conventional Radiocarbon Age has 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 csv spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

The reported result is accredited to ISO-17025 standards and all pretreatments and chemistry were performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO-17025 program participated in the analysis.

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.

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

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don’t hesitate to contact me.

Sincerely,
### REPORT OF RADIOCARBON DATING ANALYSES

Dr. William Hildebrandt/Sarah K. Rice  
Material Received: 6/30/2014

Far Western Anthropological Group  
Report Date: 7/8/2014

<table>
<thead>
<tr>
<th>Sample Data</th>
<th>Measured Radiocarbon Age</th>
<th>13C/12C Ratio</th>
<th>Conventional Radiocarbon Age(*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta - 384273</td>
<td>10530 +/- 30 BP</td>
<td>-0.7 o/oo</td>
<td>10930 +/- 30 BP</td>
</tr>
</tbody>
</table>

SAMPLE : 26CH3413TUFA  
ANALYSIS : AMS-Standard delivery  
MATERIAL/PRETREATMENT : (tufa): acid etch  
2 SIGMA CALIBRATION : Cal BC 10860 to 10780 (Cal BP 12810 to 12730)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by ****. The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.
(Variables: C13/C12 = -0.7 o/oo : lab. mult = 1)

Laboratory number  Beta-384273

Conventional radiocarbon age  10930 ± 30 BP

2 Sigma calibrated result  Cal BC 10860 to 10780 (Cal BP 12810 to 12730)
95% probability

Intercept of radiocarbon age with calibration curve  Cal BC 10805 (Cal BP 12755)

1 Sigma calibrated results  Cal BC 10840 to 10790 (Cal BP 12790 to 12740)
68% probability

Database used  INTCAL13

References
Mathematics used for calibration scenario

References to INTCAL13 database
Appendix C

Obsidian Hydration and Sourcing Results
September 10, 2014

Sarah Rice
Far Western Anthropological Research Group, Inc.
3656 Research Way, Suite 32
Carson City, NV 89706

Dear Sarah:

I write to report the results of obsidian hydration band analysis of 79 specimens from site 26CH3413, Churchill County, Nevada. This work was completed following source determination by Richard Hughes, Geochemical Research Laboratory, who forwarded the specimens to us on your behalf.

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

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

Correct thin section thickness is determined by the "touch" technique. A finger is rubbed across the slide, onto the sample, and the difference (sample thickness) is "felt." The second technique used to arrive at proper thin section thickness is the "transparency" test where the micro-slide is held up to a strong source of light and the translucency of each sample is observed. The samples are reduced enough when it readily allows the passage of light. A cover glass is affixed over each sample when grinding is completed. The slides and paperwork are on file under File No. OOL-845.

The hydration bands were measured with a strainfree 60-power objective and a Bausch and Lomb 12.5-power filar micrometer eyepiece mounted on a Nikon Labophot-Pol polarizing microscope. Hydration band measurements have a range of +/- 0.2 microns due to normal equipment limitations. Six measurements are taken at several locations along the edge of each thin section, and the mean of the measurements is calculated and listed on the enclosed data pages.
Thirteen specimens failed to yield useful hydration data. Six specimens (Cat. #3, #21, #23, #27, #55, and #56) were marked by diffuse hydration (DH) and had weathered surfaces. Four specimens (Cat. #4, #28, #42, and #110) were marked by hydration bands of variable width (VW) and had weathered surfaces. Three specimens (Cat. #9, #15 and #18) showed no visible band (NVB) and had weathered surfaces.

Seven specimens had two hydration bands. The thinner band of specimen 60 measured 3.2 microns and the thicker band measured 7.7 microns. The thinner band of specimen 17 measured 6.1 microns; the thicker band was marked by hydration of variable width (VW) and measured approximately 8.5 microns. Specimen 45 was marked by hydration of variable width (VW) and measured approximately 10.0 microns; a crack yielded a measurement of 13.0 microns. Specimen 58 yielded a hydration band measurement of 12.0 microns; a crack yielded a measurement of 14.2 microns. Specimen 103 yielded a hydration band measurement of 10.7 microns; a crack yielded a measurement of 13.2 microns. Specimen 109 yielded a hydration band measurement of 10.8 microns; a crack yielded a measurement of 10.7 microns. Specimen 134 yielded a hydration band measurement of 7.2 microns; a crack yielded a measurement of 12.0 microns.

The remaining specimens yielded normal hydration band measurements. Thirty-two specimens were marked by weathered surfaces, which are indicated as "Weathered" under the "Remarks" column on the data pages.

Please contact me with any questions.

Sincerely,

Julia Franco
Technician

for

Thomas M. Origer
Director
Energy Dispersive X-ray Fluorescence Analysis of Obsidian Artifacts from 26Ch3413, Located on the Western Edge of the Lahontan Valley in Churchill County, Nevada

Ms. Sarah K. Rice
Staff Archaeologist
Far Western Anthropological Research Group, Inc.
3656 Research Way, Suite 32
Carson City, NV 89706

Dear Sarah:

Enclosed with this letter you will find tables and figures presenting energy dispersive x-ray fluorescence (EDXRF) data generated from the analysis of 79 obsidian artifacts from the Overlook Site (26Ch3413) in Churchill County, Nevada. This research was conducted pursuant to your letter request of May 23, 2014.

Analyses of obsidian are performed at my laboratory on a QuanX-EC™ (Thermo Electron Scientific Instruments Corporation) EDXRF spectrometer equipped with a silver (Ag) x-ray tube, a 50 kV x-ray generator, digital pulse processor with automated energy calibration, and a Peltier cooled solid state detector with 145 eV resolution (FWHM) at 5.9 keV. The x-ray tube was operated at differing voltage and current settings to optimize excitation of the elements selected for analysis. In this case analyses were conducted for the elements rubidium (Rb Kα), strontium (Sr Kα), yttrium (Y Kα), zirconium (Zr Kα), and niobium (Nb Kα). Certain artifacts were analyzed for barium (Ba Kα), titanium (Ti Kα), manganese (Mn Kα), iron (as FeO), and to generate iron vs. manganese (Fe Kα/Mn Kα) ratios. X-ray tube current was scaled to the physical size of each specimen.

X-ray spectra are acquired and elemental intensities extracted for each peak region of interest, then matrix correction algorithms are applied to specific regions of the x-ray energy spectrum to compensate for inter-element absorption and enhancement effects. Following these corrections, intensities are converted to concentration estimates by employing a least-squares calibration line established for each element from analysis of up to 30 international rock standards certified by the U.S. Geological Survey, the U.S. National Institute of Standards and Technology, the Geological Survey of Japan, the Centre de Recherches Petrographiques et Geochemiques (France), and the South African Bureau of Standards. Further details pertaining to calibration appear in Hughes (1988, 1994).

Measurements in the EDXRF data tables are expressed in quantitative units (i.e. parts per million [ppm] by weight), and matches between the artifacts you sent and known obsidian chemical groups were made on the basis of correspondences (at the 2-sigma level) in diagnostic trace element concentration values (in this case, ppm values for Rb, Sr, Y, Zr, Nb and, when necessary, Bu, Ti, Mn and FeO) that appear in Hughes (1983, 1985, 1986, 1989, 1990, 2001a, 2005, 2010a), Jack and Carmichael (1969), Macdonald et al. (1992), Nelson (1984), Nelson and Holmes (1979), Noble (et al. 1979), and unpublished data in my possession on certain other Great Basin obsidians (e.g. Hughes 1999, n.d.). Artifacts-to-obsidian source (geochemical type; sensu Hughes 1998) correspondences were considered reliable if diagnostic mean measurements for artifacts fell within 2 standard deviations of mean values for source standards. I use the term "diagnostic" to specify those trace elements that are well measured by x-ray fluorescence, and whose concentrations show low intra-source variability and marked variability across sources. In short, diagnostic elements are those concentration values allowing one to draw the clearest geochemical distinctions between sources (Hughes 1990, 1993). Zn and Ga concentrations are not considered "diagnostic" because they don't usually vary significantly across obsidian sources (see Hughes 1982, 1984).

Trace element concentration measurements are reported to the nearest ppm to reflect the calibration-imposed resolution capabilities of non-destructive energy dispersive x-ray fluorescence spectrometry. The resolution limits
of the present x-ray fluorescence instrument for the determination of Rb is about 3 ppm; for Sr about 3 ppm; Y about 2 ppm; Zr about 3 ppm; and Nb about 2 ppm (see Hughes [1994] for other elements). When counting and fitting error uncertainty estimates (the "±" value in the table) for a sample are greater than element-specific resolution limits, the larger number is a more conservative indicator of composition variation and measurement error arising from differences in sample size, surface, and x-ray reflection geometry.

Sixty-eight of the artifacts you sent from 26Ch3413 were of adequate physical size (> ca. 10 mm in diameter and > ca. 1.5-2 mm thick) to generate reliable quantitative composition estimates. Edxrf data (Table 1 and Figures 1-3) document that 37 of these match the trace element profile of Bodie Hills volcanic glass (Jack 1976: Table 11.5), ten artifacts were made from Sutro Springs volcanic glass, six artifacts each were made from a geographically unknown variety of obsidian (termed Unknown A) and from Mt. Hicks obsidian (Jack 1976: Table 11.5). Three specimens were made from different varieties of northwestern Nevada obsidian (Fox Mountain, Bordwell Spring, and Massacre Lake/Guano Valley, n= 1 each; Hughes 1986:Table 9, Figure 9), and single artifacts were manufactured from obsidian of the Garfield Hills (Hughes 1985: Table 73), Lookout Mountain (Hughes 1994: Table 1 and 2), Buck Mountain (Hughes 1986: Table 7), Pine Grove Hills, and Desert Mountains chemical types. This latter attribution (Desert Mountains) is provisional since I currently lack comparative reference samples from this "source". One other artifact (no. 25) has a trace element composition unlike any of the geological standards in my current comparative reference collection. Figure 2 shows that there is overlap in Zr/Sr composition among Pine Grove Hills, Sutro Springs, and Garfield Hills obsidians, but the ambiguity among sources was resolved using other trace elements (see Figure 3).

Figure 1

Zr vs. Sr Composition of Obsidian Artifacts from 26Ch3413, NV

Dashed lines represent range of variation measured in geologic obsidian source samples. Triangles plot samples from Table 1. Error bars are two-sigma (95% confidence interval) estimates for each specimen.

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Figure 2
Zr vs. Sr Composition of Obsidian Artifacts from 26Ch3413 Highlighted in Figure 1

Dashed lines represent range of variation measured in geological obsidian source samples. Triangles plot samples from Table 1 enclosed in rectangular area of Figure 1. Error bars are two-sigma (95% confidence interval) estimates for each specimen.

Figure 3
Sr/Y vs. Zr/Nb Composition of Obsidian Artifacts from 26Ch3413 Undifferentiated by Zr/Sr Data

Dashed lines represent range of variation measured in geological obsidian source samples. Samples from Tables 1 and 2.
### Table 2

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</table>

Elemental intensities (peak counts/second above background) generated at 30 seconds livetime.

### Figure 4

Ternary Diagram Plot for Small Obsidian Artifacts from 26Ch3413

Dashed lines represent range of variation in geologic obsidian source samples. Symbols plot the artifacts listed in Table 2.
When possible I report trace element measurements in quantitative units (i.e., ppm) and make artifact-to-source attributions on the basis of correspondences in diagnostic trace element concentration values (e.g., those presented in Table 1), but 11 of the specimens you sent were too small and thin to generate x-ray counting statistics adequate for proper conversion from background-corrected intensities to quantitative concentration estimates (i.e., ppm). In a nutshell, what one finds is that very small specimens yield inflated ppm values for certain elements (by 10-20% or more) depending on the actual amount of sample area excited by the x-ray beam and the penetrating properties of the x-rays. Consequently, ppm values for certain trace elements generated on small artifacts are not only higher, but they have higher analytical errors (i.e., the ± values associated with computed composition estimates) which can compromise direct comparison with artifacts of adequate physical size and shape. To overcome this problem, I conducted a series of exhaustive experiments on size-graded samples, creating a way to translate the integrated net peak intensity data from large samples to their smaller equivalents (Hughes 2010b). In this case, I analyzed all of the small 26Ch3413 artifacts to generate integrated net count (intensity) data for the elements Rb, Sr, Y, Zr, Nb, Fe and Mn. After background subtraction, the intensities (counts per second) were converted to percentages. The counting data and derived ratios appear in Table 2, and the plotted values appear in Figures 3-5. The source assignment was made by comparing the plots for various element intensity ratios for the artifact against the parameters of known source types identified in my extensive in-house reference collection. Further discussion of this laboratory analysis protocol appears in Hughes (2010b). Figure 4 shows that there is overlap in normalized Rb/Sr/Zr composition among Bodie Hills, Pine Grove Hills, and Sutro Springs obsidians, but the ambiguity among sources was resolved using other trace elements (see Figure 3 and Figure 5).

---

**Figure 5**

Fe/Mn vs. Rb/Sr Composition of Small Obsidian Artifacts from 26Ch3413
Undifferentiated by Rb/Sr/Zr Values

Dashed lines represent range of variation measured in geological obsidian source samples. Triangles plot the artifacts listed in Table 2.
In summary, combining quantitative analysis results (Table 1) with integrated net count rate data (Table 2), this research shows that 43 artifacts from 26Ch3413 were made from Bodie Hills obsidian, eleven were manufactured from Sutro Springs material, eight were fashioned from Mt. Hicks, six were made from Unknown A obsidian, three artifacts were made from northwestern Nevada volcanic glasses (Bordwell Spring, Fox Mountain, and Massacre Lake/Guano Valley), and two other specimens were made from obsidian from the Casa Diablo area. Single artifacts match the trace element profile of Pine Grove Hills, Garfield Hills, Buck Mountain, and- perhaps- Desert Mountains. Two artifacts were manufactured from different chemical varieties of obsidian for which I have no counterparts in my current regional comparative reference collection.

I hope this information will help in your analysis of the assemblage from this site. Please contact me at my laboratory ([650] 851-1410; e-mail: rehughes@silcon.com) if I can be of further assistance. As you requested, I have forwarded the specimens to Tom Origer for obsidian hydration analysis.

Sincerely,

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

REFERENCES

Hughes, Richard E.

Geochemical Research Laboratory Letter Report 2014-51
Hughes, Richard E.


Jack, R.N., and I.S.E. Carmichael

Macdonald Ray, Robert L. Smith, and John E. Thomas

Nelson, Fred W., Jr.

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

Noble, Donald C., Ward L. Rigot and Harry R. Bowman

Geochemical Research Laboratory Letter Report 2014-51
### Table 1
Quantitative Composition Estimates for Obsidian Artifacts from 26Ch3413, Nevada

<table>
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Values in parts per million (ppm) except total iron (in weight percent) and Fe/Mn ratios; ± = two σ estimate (in ppm) of x-ray counting uncertainty and regression fitting error at 120-240 seconds livetime; nm = not measured; * = patinated.
Table 1

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