University of Nevada, Reno

Changing Landscapes During the Terminal Pleistocene/Early Holocene: The Archaeology and Paleoclimate of the Mud Lake Basin, Nye County, Nevada

A thesis submitted in partial fulfillment of the
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By

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ABSTRACT

Archaeological investigation along Pleistocene lakeshores is a longstanding and common approach to prehistoric research in the Great Basin. Continuing in this tradition, this thesis considers the archaeological remains present from pluvial Mud Lake, Nye County, Nevada coupled with an examination of paleoclimatic conditions to assess land-use patters during the terminal Pleistocene/early Holocene. Temporally diagnostic lithic assemblages from 44 localities in the Mud Lake basin provide the framework for which environmental proxy records are considered. Overwhelmingly occupied by Prearchaic groups, comprising 76.6% of all diagnostic artifacts present, Mud Lake was intensively utilized right up to its desiccation after the Younger Dryas, estimated at 9,000 radiocarbon years before present. Intermittently occupied through the remainder of the Holocene, different land-use strategies were employed as a result of shifting subsistence resources reacting to an ever changing environment. The results of this thesis complement the existing knowledge base on Prearchaic groups in the Great Basin, with particular contributions to the lesser studied small pluvial basins.

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INTRODUCTION

"In the absence of dated subsistence remains, the most reliable data for reconstructing prehistoric adaptive strategies are those generated from studies of ***site distribution*** and ***geomorphic context*** with respect to the paleolandscape and its resource constraints" (Willig 1991:105, emphasis added).

Archaeological investigation along Pleistocene lakeshores is a longstanding and common approach to prehistoric research in the Great Basin. Continuing in this tradition, the recent examinations of the remnant beach features around pluvial Mud Lake, Nye County, Nevada and an examination of prehistoric environmental conditions provide the focus of this thesis research. Although incredibly rich in Prearchaic resources (11,500–7,500 radiocarbon years before present [B.P.]), and well-known by avocational archaeologists for decades, until recently Mud Lake has received little attention from academic archaeologists.

Utilizing new data generated via pedestrian survey and an existing archaeological collection as well as drawing upon the extensive literature of climate proxy records and existing environmental reconstructions, I consider how, when, and why people visited Mud Lake during the terminal Pleistocene/early Holocene (TP/EH). I also consider how these occupations changed through time, and ultimately place them within the broader context of Prearchaic research in the Great Basin. The results of this work provide new insight into Prearchaic chronology and land-use in the region.

Pluvial Mud Lake

Mud Lake is a small, self-contained system at the terminus of Ralston Valley, in south-central Nevada (Figures 1.1 and 1.2). Today it is an ephemeral playa, but would have been part of the extensive system of pluvial lakes during the Pleistocene (Figure 1.3). Considerably smaller by the time humans reached the Great Basin ca. 11,500 B.P. (Grayson 1993), Mud Lake would have contained a functioning marsh system which likely provided abundant flora and fauna to these first inhabitants. While sensitive to the rapidly changing climate of the terminal Pleistocene, the lake was stable enough at certain elevations, for decades or longer (Adams and Wesnousky 1998), to facilitate the creation of as many as eight distinct beach ridges at varying elevations which can to this day be easily distinguished from the surrounding landscape (Figures 1.4 and 1.5).

Divided across its center, the northern and western portions of Mud Lake belong to the Bureau of Land Management (BLM) and the southern and eastern portions are controlled by Nellis Air Force Base (NAFB) and associated Nevada Test and Training Site (NTTS). This relationship has led the archaeological and geologic investigations at Mud Lake to evolve in a unique manner, particularly with the availability of the northern periphery to the public and the inclusion of the entire basin in NAFB studies and publications (Dickerson 2006, 2009; Haarklau et al. 2005). The vast majority of all academic and professional investigations, including this study, have come as a result of the extensive avocational archaeologists' knowledge of the basin. As early as the mid-1960's, though likely earlier, residents of the nearby town of Tonopah became interested in the abundant prehistoric artifacts that could easily be found on and around the playa.

Figure 1.1. Overview of the Mud Lake basin, looking east over the playa.

Many individuals and families became interested in the area and spent considerable amounts of time along the northern periphery of Mud Lake and began systematically recording archaeological sites and their contents, researching publications with similar geological and topographic landscapes, and contacting state and federal agencies, including the Nevada State Museum, BLM, and NTTS to share their findings. Despite the close working relationships created between avocational archaeologists and these groups, relatively little work has been done in terms of on the ground survey or publications by the latter.

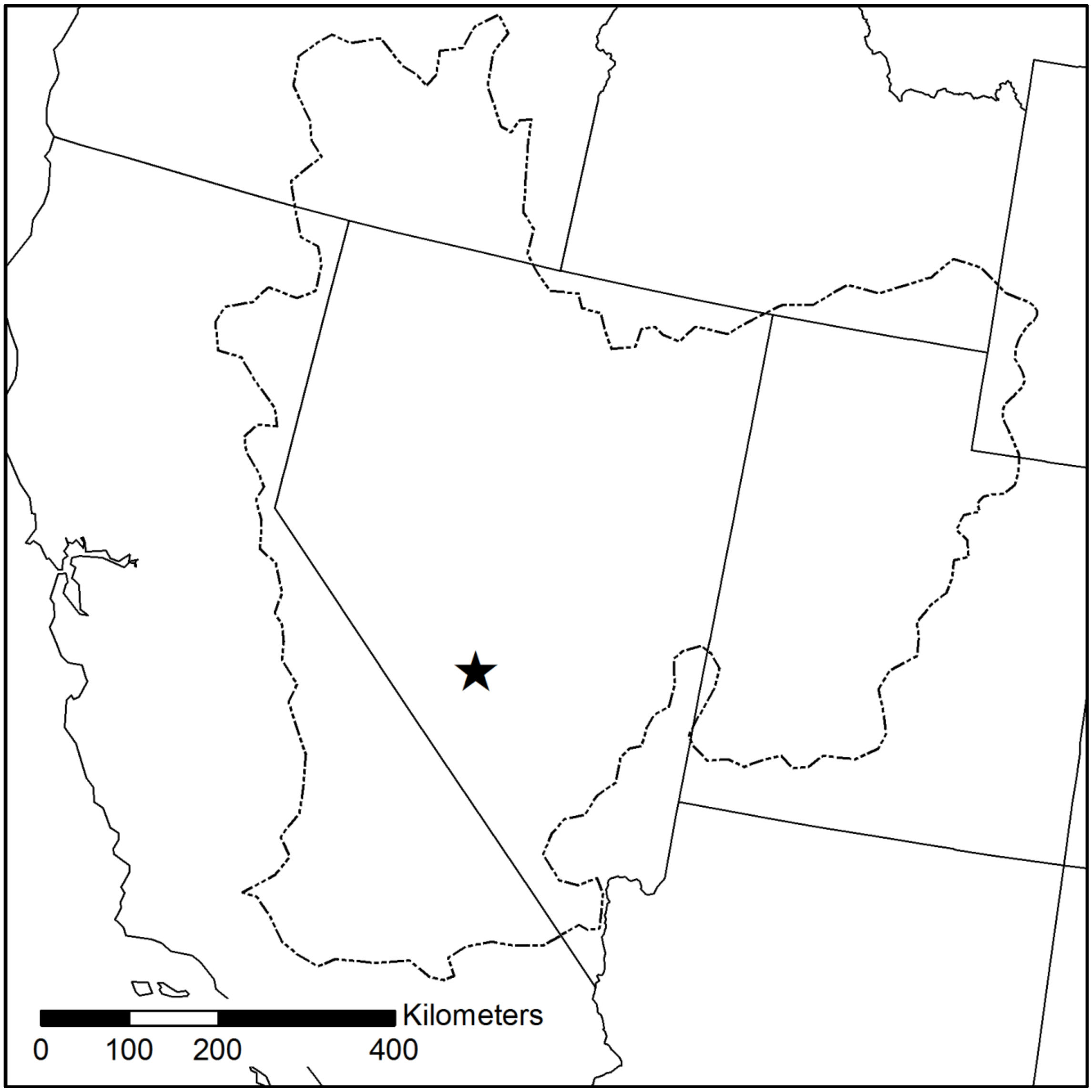

Figure 1.2. Hydrographic Great Basin with the location of Mud Lake (background adapted from Grayson 1993).

One of the features so fascinating to the avocational archaeologists was how directly tied the archaeology was to certain landscape features – particularly the remnant beach ridges. While archaeological materials have been identified throughout the entire basin at varying densities (Noyes, personal communication 2010, 2011), cultural artifacts are known to be most localized on the ridges. In particular, two closely positioned ridges

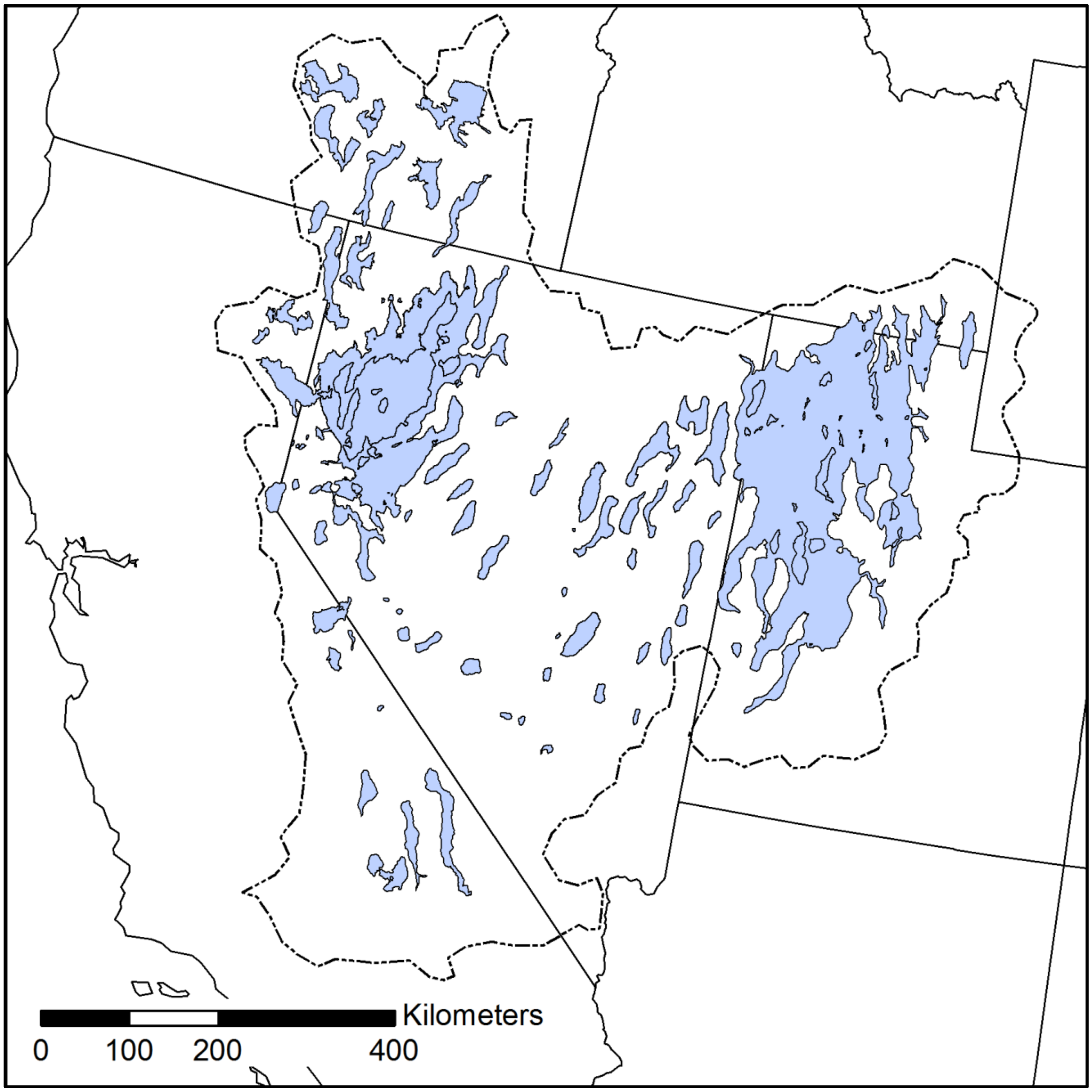

Figure 1.3. Hydrographic extent of the Great Basin with pluvial lakes at their Pleistocene maximums ca. 14,000 B.P. (after Mifflin and Wheat 1979 and Grayson 1993).

ranging in elevation between 1,591 and 1,595 m above sea level (a.s.l.), have been well known to contain dense archaeological remains which almost exclusively represent TP/EH occupations. These ridges were named the *Lowengruhn Ridges* by local avocational archaeologists after prominent members of the community and used in the

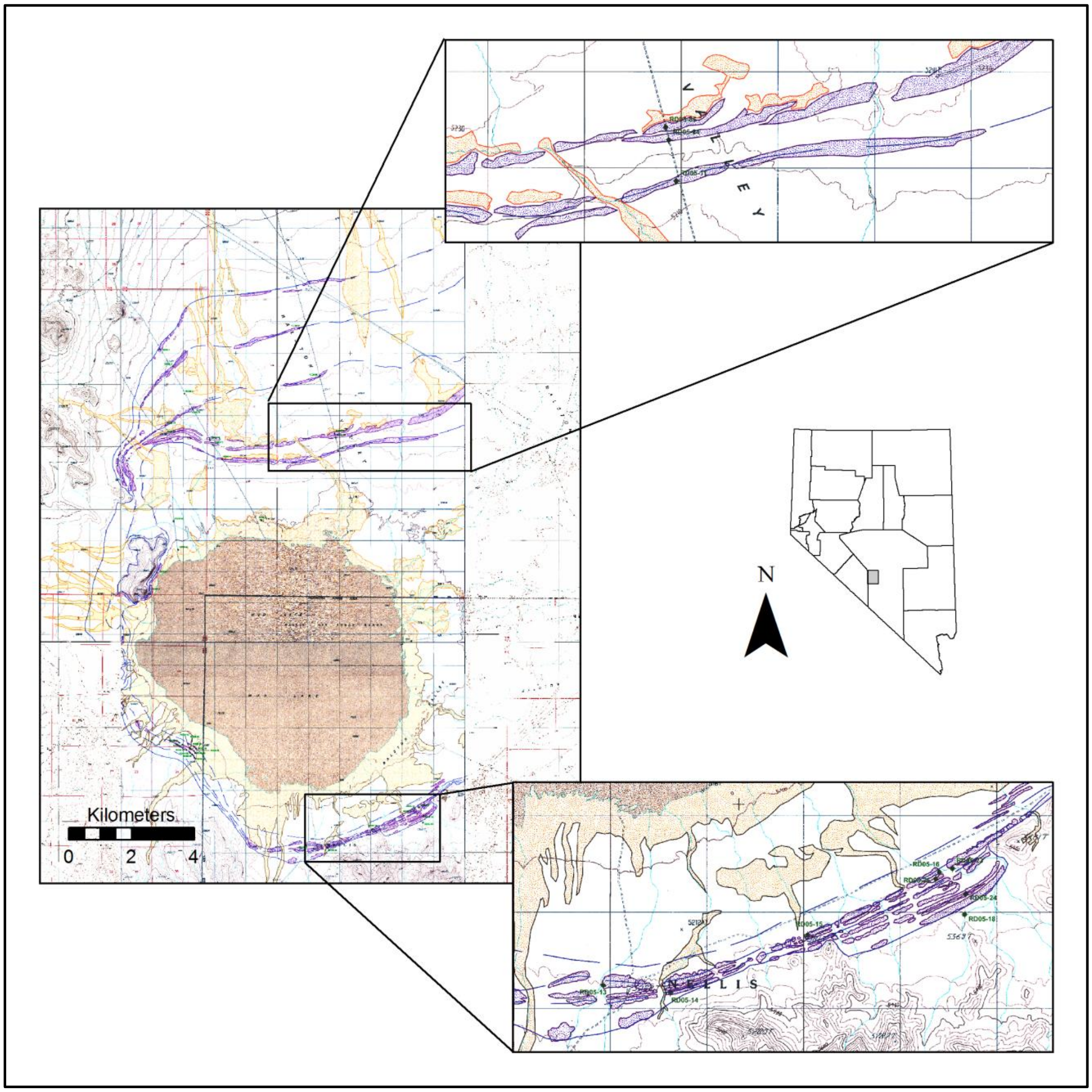

Figure 1.4. Geologic feature map displaying the variation in ridge formation between the northern and southern basin of Mud Lake (see Dickerson 2006, 2009 for geologic feature maps and discussion). Note: the purple features represent remnant pluvial shorelines and the tan represents areas of geologic activity.

literature (Tuohy 1968, 1978, 1988) thereafter as a means of easy identification (Noyes, personal communication 2010, 2011), something confirmed through our recent pedestrian survey of the area.

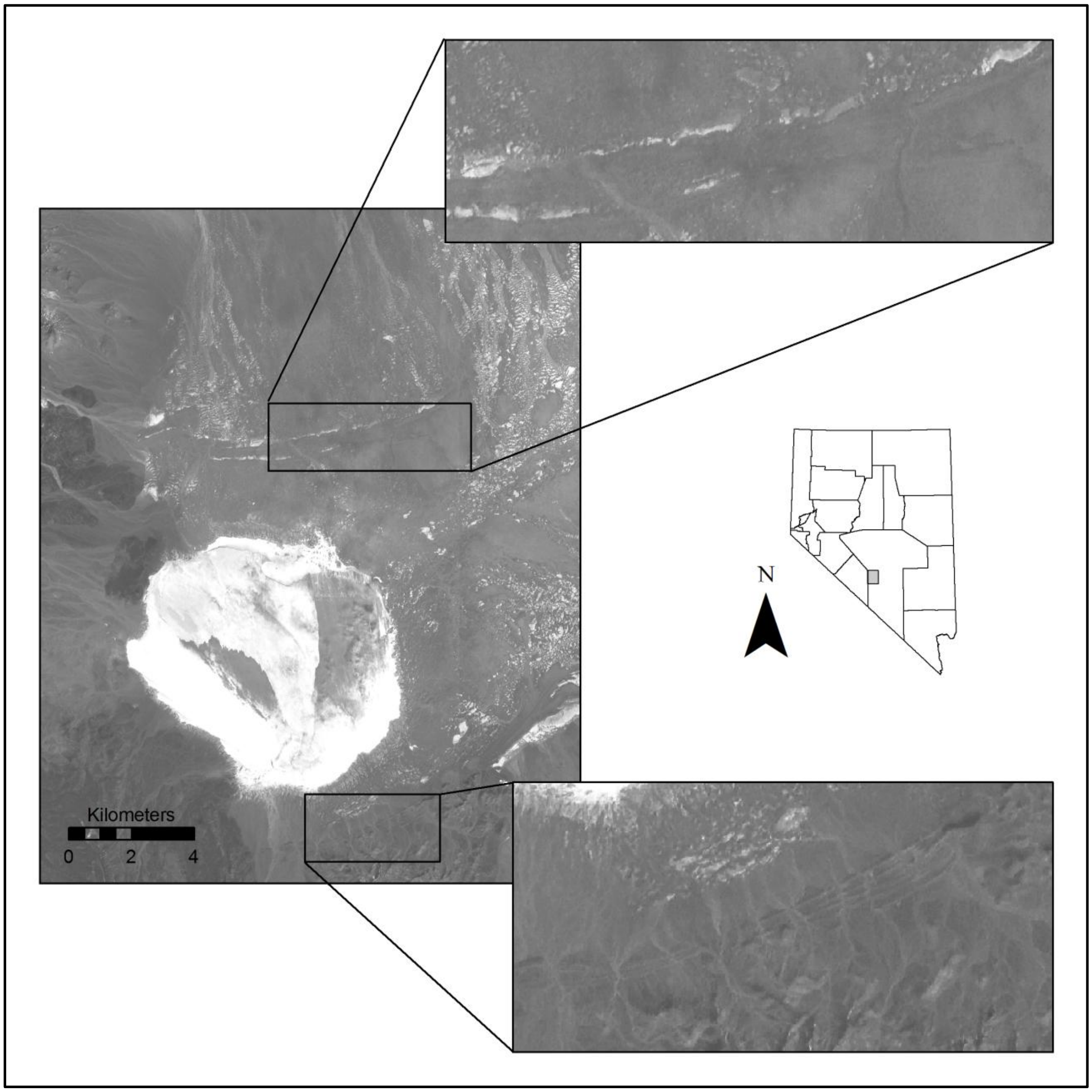

Figure 1.5. Satellite map displaying the variation in ridge formation between the northern and southern basin of Mud Lake.

Background

The Great Basin is a unique yet often complicated component to the story of New World prehistory. A considerable amount of debate surrounding the Great Basin exists due to how relatively little is known about the oldest people in this region. People are believed to have entered the New World about 11,500 B.P. with evidence of people in the Great Basin shortly thereafter (Beck and Jones 1997, 2001; Grayson 1993; Jones and Beck 2010; Willig and Aikens 1988). While this date has been recently contested (Gilbert et al. 2008; Jenkins 2007), it is believed that people would not have entered the Great Basin earlier than 13,000 B.P. as a result of the relatively inhospitable environmental conditions prior to this time (Beck and Jones 2001:463, 465).

A conglomeration of environmental conditions, technological expressions, and adaptive strategies has brought about the many loaded terms with which the earliest inhabitants of the Great Basin are commonly referred. Various monikers have been used historically, with the most common consisting of Paleoindian, Paleoarchaic (Beck and Jones 1997; Bryan and Tuohy 1999; Graf and Schmit 2007; Willig 1989; Willig and Aikens 1988), and Prearchaic (Elston 1986; G. Smith 2006). Designations have since been made in order to distinguish between the popular image of the Paleoindian, the extremely mobile, big-game hunter of the North American Great Plains, and the image of Great Basin peoples, who, in addition to having the means and technology to hunt megafauna, would have likely been more tethered around productive pluvial lake systems and would have utilized a more broad spectrum subsistence strategy commonly associated with later Archaic peoples. While in the grand scope of this type of research, the exact terminology does not matter except for consistency's sake, I will maintain the use of 'Prearchaic' strictly as a means of emphasizing the generalized lacustrine adaptations seen from these earliest peoples around Great Basin pluvial lakes and marshes.

In the sections that follow, I discuss the literature related to the factors that influenced the relationship between prehistoric people and the environment in which they lived during the TP/EH as well as the middle Holocene and late Holocene. Through a detailed discussion of these relationships, I outline environmental conditions, climatic events, and archaeological signatures to provide a general background of the prehistoric Great Basin. Additionally, I address various methods used to reconstruct past hydrographic settings and the means by which the ages of near-surface archaeological sites within pluvial settings are established, which is particularly useful in relating the ages of available landscapes to the locations and cultural phases of archaeological sites in the Great Basin.

Environment and Climate

Situated between the Sierra Nevada and the Wasatch Range, the Great Basin is immediately identifiable by its pronounced north-south trending mountain ranges that divide the landscape into an alternating range and valley configuration. These ranges, confined to Nevada and parts of California, Idaho, Oregon, Utah, and Wyoming, are not only obvious and well-defined features of the physical landscape, but they have also served a significant role in the movement and distribution of people, flora, fauna, and perhaps most significantly, water, throughout prehistory (Beck and Jones 1997; Jones et al. 2003; Rhode 2008; Thompson 1990; Wigand and Rhode 2002).

Any account of Great Basin prehistory, particularly one focused on the more distant past, must include at least a rudimentary account of the vast system of pluvial lakes and marshes that were once ubiquitous in the area. During the Pleistocene there existed nearly 120 pluvial lakes of varying areas, depths, and volume in the alternating valleys of the Basin and Range (Benson et al. 1990, 1992; Mifflin and Wheat 1979; Morrison 1965). The presence of these lakes has generally been attributed to greater levels of precipitation and lower levels of evaporation than those seen today and had a direct relationship with continental glaciers (Grayson 1993; Mifflin and Wheat 1979).

While these pluvial basins were filled with lakes or wetlands to varying degrees over millions of years (Benson and Thompson 1987a; Reheis 1999), most studies focus on the late Quaternary, with particular interest on the last, Sehoo, or second to last, Eetza, glacial maximums (Adams and Wesnousky 1998; Morrison 1965). The largest and most well studied of these pluvial lakes are Lahontan and Bonneville, in the western and eastern Great Basin, respectively. As not all of the pluvial lake basins left detailed records of their histories, parallels can be drawn from known environmental records, such as Lahontan and Bonneville, to areas with unknown histories. Mud Lake is once such system in need of environmental parallels, and as a result, this topic of lake-level reconstruction will be discussed in more detail at the end of this chapter as well as in the following two chapters.

Modern reconstructions and a collective understanding of past environments are indebted to the work of Ernst Antevs. Trained in recreating European environments through sediment analysis, Antevs believed that all climate changes were expressed simultaneously around the world and as a result, the changes he witnessed in Sweden were also displayed in the Great Basin (Grayson 1993). His chronology, termed the Neothermal, focused on the environment since the last glaciation (Antevs 1938, 1945, 1948). Comprised of three time periods, the Anathermal, the Altithermal, and the Medithermal, Antevs' chronology has since proven quite accurate in duration and condition, although the exact ages have been shifted back in time slightly. The Anathermal (10,000 to 7,500 B.P.) was described as being cooler than modern temperatures and roughly depicts the early Holocene. The Altithermal (7,500 to 4,500 B.P.) was determined to be warmer and dryer than today and roughly depicts the middle Holocene. The Medithermal (4,500 B.P. to the present) has been established to be approximately the same temperature as modern times and covers the late Holocene.

The Terminal Pleistocene/Early Holocene. Virtually synchronous throughout the entire Great Basin, the last pluvial highstand occurred between 14,000 and 13,000 B.P., with a near immediate reversal expressed in cumulative lake recession (Adams and Wesnousky 1998; Benson 1981; Benson et al. 1990; Reheis 1999; Thompson et al. 1986). Following a millennium long dry interval, coined the "Clovis Drought" (C. V. Haynes 1991), temperatures decreased and precipitation increased again during the Younger Dryas, roughly 10,900 to 9,800 B.P., and can be seen in the slight rebounds of lakes Lahontan and Bonneville (Adams et al. 2008; Benson et al. 1990; Grayson 1993; C. V. Haynes 1991, 2008; Madsen 2007; Morrison 1965, 1991). While these patterns are generally represented through the entire Great Basin, some regional variation and even system specific changes can also be seen from other pluvial basins. Many of the changes more pertinent to Mud Lake are discussed in greater detail in Chapter 4.

Broad records of the environmental past indicate that the earliest visitors to the Great Basin would have encountered a climate that was considerably cooler and moister than present, which not only served to sustain the many pluvial lakes but also affected the distributions of flora and fauna. Distributions of these resources would have also affected when and how the first inhabitants to the Great Basin utilized those resources. Early groups encountered communities of juniper-sagebrush steppe more widespread than today, with montane trees and shrubs occurring at considerably lower elevations than during historical times (Grayson 1993; Mehringer 1986; Rhode 2008; Wigand and Rhode 2002). Additionally, this environment likely supported levels of large-bodied herbivores well above those observed today (Beck and Jones 1997; Elston and Zeanah 2002; Grayson 1993, 2008; Madsen 2007; Thompson 1990).

The remainder of the early Holocene continued to be cooler than modern conditions, although no longer as cool or moist as the terminal Pleistocene. These conditions make up the Anathermal depicted by Antevs. While conditions warmed throughout the region, the early Holocene in the southern Great Basin remained cool enough to sustain juniper woodlands until 7,500 B.P. Even as temperatures continued to warm towards the end of this period, summer rainfall likely increased significantly with the appearance of hackberry in packrat middens (Wigand and Rhode 2002). The early Holocene still displays a considerable amount of the biotic diversity seen during the terminal Pleistocene. The existence of reoccurring black mats during this period (Quade et al. 1998) as well as regular patterning of multidecadal droughts (Benson et al. 2002; Mensing et al. 2004) indicate a fluctuating environment, while still being considerably moister than today. In addition to the relatively abrupt environmental change that occurred during the Younger Dryas, another quick change to a warmer environment occurred at the end of the early Holocene, which is displayed in tree rings, pollen records, small mammal distributions, and an end to black mats in certain areas of the southern

Great Basin (Feng and Epstein 1994, Grayson 1993; Madsen 2002; Mehringer 1986; Quade 1986).

Cultural expressions during this geologic period encompass the end of the Prearchaic and the beginning of the Early Archaic. As some lakes and marshes receded and many disappeared entirely, people became more mobile and practiced a generalized subsistence strategy; however, this subsistence expression was likely not drastically different than during the terminal Pleistocene (Grayson 1993; Madsen 2002; Mehringer 1986; Wigand and Rhode 2002).

The Middle Holocene. The middle Holocene (7,500 to 4,500 B.P.) has been characterized as considerably drier and warmer than modern conditions and represented a drastic change from the early Holocene. These conditions were so pervasive throughout the entire Great Basin during this time that it is often referred to as the Middle-Holocene Drought (Wigand and Rhode 2002:325). In many locations in the western Great Basin, this drought is expressed as a general lack of botanical remains, expressed as packrat midden hiatuses during the middle Holocene (Wigand and Nowak 1992), as well as a lack of black mat deposits, which are common around springs in southern Nevada except during this period (Quade et al. 1998). When packrat middens are present from this period, they display a displacement of semi-arid communities upward in elevation from 300 to 500 m and increased in warm-temperature plants (Spaulding 1991; Wigand and Rhode 2002). A tangible expression of this drought can be seen in the Tahoe basin, where submerged tree stumps dated to 4790±200 and 4870±60 B.P. (Lindstrom 1990) represent lower water levels near the end of the drought just before moisture rebounded in the late Holocene.

Cultural expression during this geologic period encompasses the majority of the Early Archaic. Continuing out of the more generalized lifeways seen in the early Holocene, the middle Holocene took generalization to an extreme. As part of this generalized lifeway, grinding stones appeared during this time, signaling the incorporation of lower ranked seeds into the diet as a subsistence staple (Elston 1986; Grayson 1993). Considerable effort was exerted on acquiring and processing lower return resources, as many subsistence reconstructions have made clear (Jones and Madsen 1989; Rhode 1990; Rhode et al. 2006).

The Late Holocene. The late Holocene (4,500 B.P. to present) has been characterized as displaying roughly the same climate as modern times. Just as climate change has been observed during historical times, this period was not environmentally static, and we have a good understanding of conditions during that time (Bettinger 1999; Grosscup 1963). Coming out of the Middle-Holocene drought, the late Holocene stayed relatively warm but increased in precipitation. Pollen and macrofossil records throughout the Great Basin display a redistribution of plant communities as well as an overall increase in plant densities, and the appearance of peats in southern Nevada indicate the renewal of spring systems there (Mehringer 1986; Wigand and Rhode 2002).

Cultural expressions during this geologic period encompass the Middle Archaic, Late Archaic, and Proto-Historic. Increased technological complexity is observed during this period and has been attributed to enhanced adaptation to local environmental circumstances, perhaps prompted by increased population densities (Bettinger 1999; Kelly 1997). As was the case during the TP/EH, wetlands and lacustrine resources once again became a vital resource during the late Holocene, with particular prominence after

4,000 B.P. at locations like Lovelock Cave and Falcon Hill in the western Great Basin (Ambro 1967; Hattori 1982; Heizer and Napton 1970; Napton and Heizer 1970) and Danger Cave and the Prison Site in the eastern Great Basin (Jennings 1957; Madsen and Berry 1975; Yentsch et al. 2009). Pinyon pine, a staple of Late Archaic and Proto-Historic peoples, intensifies in the pollen record during this period, beginning about 3,800 B.P. and expanded around 2,000 B.P. with a lessening in the harshness of winter conditions (Wigand and Rhode 2002).

Archaeology

The Great Basin's complicated history does not end with analysis of the geologic and environmental past; in fact, the physical remains left by prehistoric peoples, particularly during the TP/EH, leave even greater room for varied interpretations. A major hurdle in interpreting archaeological remains includes the lack of deposition in the Great Basin (Elston 1986; Willig 1989). Without vertical separation over vast time periods, environmental and cultural changes are obscured throughout much of prehistory. As a result, many prehistoric sites represent near-surface records of repeated occupations, called palimpsests, which in some cases span some 13,000 years. As a result other applications must be utilized.

Obsidian hydration is an increasingly common practice in the Great Basin. However, the necessity for cultural remains to be displaced during fieldwork, the considerable expense, the variable opinions of its reliability, and the method's destructive nature makes obsidian hydration an unreasonable dating method for most survey projects.

As such, lithic cross dating is the most common dating technique in Great Basin research. With the sheer frequency of surface sites, lithic cross dating relies upon a data set of diagnostic artifacts recorded from directly dated contexts to relatively date surface finds. While this method allows only coarse-grained age estimates, these ranges are often sufficient to place archaeological sites within periods of environmental and cultural change.

In the section that follows, I provide an overview of Great Basin prehistory with an emphasis on the TP/EH due to this study's focus on Prearchaic lifeways. Later cultural periods are also addressed to assess the full prehistory of the Great Basin, aspects of which are also expressed at Mud Lake, so that we may understand changes in land-use patterns through time. Table 1.1 synthesizes the broad cultural chronology and environmental conditions outlined below.

Prearchaic. The people ascribed as the original inhabitants of the Great Basin are known as Prearchaic. Diagnostic projectile points and associated tools utilized by these early groups are often their only enduring cultural remains, and as a result they often receive a disproportionate amount of attention from researchers. Prearchaic artifacts include concave base and stemmed points, as well as crescents (Beck and Jones 1997, 2010; Jones et al. 2003). Known under various names through the years, concave base points are locally referred as Great Basin Fluted (GBF) or Western Clovis variants and Black Rock Concave Base (BRCB) points, and stemmed points are known collectively as Great Basin Stemmed Series (GBSS) or Western Pluvial Lakes Tradition (WPLT) points (Beck and Jones 1997; Bedwell 1973; Clewlow 1968; Grayson 1993; Jones et al. 2003; Madsen 2007; Tuohy and Layton 1977; Willig 1989, 1991; Willig and Aikens 1988). For

Table 1.1. Broad cultural sequencing and associated environmental conditions of the Great Basin (Grayson 1993).

Cultural Sequence	**Radiocarbon Date Range**	**Primary Diagnostic Artifacts**	**Environmental Conditions**
Proto-Historic	700–80 B.P.	Desert Side-notched and Cottonwood series projectile points	Late Holocene; climate similar to today's
Late Archaic	1,300–700 B.P.	Rosegate series projectile points	Late Holocene; wetter and cooler but several century-long droughts
Middle Archaic	5,000–1,300 B.P.	Elko and Gatecliff series projectile points	Late Holocene; wetter and cooler
Early Archaic	7,000–5,000 B.P.	Gatecliff and Humboldt series projectile points	Middle Holocene; warmer with moderate summer precipitation; hot and dry throughout the Great Basin
	8,000–7,000 B.P.	Large Side-notched and Humboldt series projectile points	Early Holocene; warmer with moderate summer precipitation
Prearchaic	11,500–8,000 B.P.	Stemmed and fluted projectile points, crescents	Terminal Pleistocene/early Holocene; cooler with higher effective winter precipitation

the sake of this research I will use GBF and GBSS to refer to the point styles that represent this period.

The chronological place of fluted technology is not well understood in the Great Basin without solid radiocarbon dates. Elsewhere in North America, Clovis is tightly dated to 11,200–10,900 B.P., particularly in the Great Plains (Beck and Jones 1997; G. Haynes 2002; Haynes et al. 2007; Waters and Stafford 2007; Willig 1991). Clovis groups are thought to have practiced a more generalized subsistence pattern in the Great Basin than is seen in other areas, as it is generally believed that large herds of megafauna could not have been supported in the region (G. Haynes 1988; Simms 1988). Greater support for this theory is the lack of firm associations between Prearchaic tools and extinct megafauna in the archaeological record (Willig 1991; Willig and Aikens 1988).

In a number of places throughout the Great Basin, particularly around pluvial lake and marsh margins, GBF and GBSS projectile points are found in association, which has lead some researchers to propose various circumstances, including a simultaneous migration and concurrent occupation of the two complexes (Beck and Jones 2010; Bryan 1980, 1988), the subsequent evolution of GBSS points from a fluted progenitor (Aikens 1978; Willig 1989, 1991), or the possibility of GBSS point's greater antiquity than GBF points (Beck and Jones 2010; Bryan and Tuohy 1999).

Numerous Prearchaic sites have been identified on remnant pluvial beach ridges throughout the Great Basin and as a result a strong association between the prehistoric peoples and lacustrine environments of the TP/EH has been well established for the better part of a century. The first recorded evidence of this relationship came from a 1937 exploration made by Elizabeth and William Campbell and colleagues of the remnant beach ridges surrounding Pleistocene Lake Mojave (Campbell et al. 1937). Two previously unrecognized projectile point styles – Lake Mojave and Silver Lake – were identified by their unique stem bases, which were dissimilar to anything previously recorded. Gradually, numerous other stemmed point styles were identified, including Cougar Mountain, Haskett, Ovate, Parman, and Windust varieties (Beck and Jones 2009; Butler 1965; Layton 1970, 1979; Leonardy and Rice 1970). These projectile points were observed in various locations throughout the Great Basin, although they were almost always discovered in lacustrine environments beyond the highstands of pluvial lakes

(Adams et al. 2008; Beck 1998; Camp 2009; Hester 1973; Kelly 1978; Layton 1979; Pendleton 1979; G. Smith 2006; Tuohy 1968).

As the number of stemmed projectile point types and sites grew, so did the confusion over their typological relationships. While other terms have been proposed (primarily WPLT, see below), it was not until 40 years after their initial recordation that a definitive statement was made regarding the classification of these stemmed points. In 1977 Tuohy and Layton declared that these similarly stemmed projectiles should be collectively known as the Great Basin Stemmed Series, on the basis of their observed morphological, temporal, and geographical similarities.

Scores of surface sites containing GBSS points have been found; however, only a handful of such points have been recovered in buried, and even fewer in dated, contexts (Beck and Jones 2010; Elston 1986; Grayson 1993; Jones and Beck 1999; Willig 1989). Although few in number, radiocarbon dates associated with these stratified locations have proven to be quite reliable and consistent when dating these oldest remains. From the northern Great Basin, with Fort Rock Cave and Dirty Shame Rockshelter, the western Great Basin, with Last Supper Cave and Falcon Hill, the central Great Basin, with the Sunshine Locality and Smith Creek Cave, and the eastern Great Basin, with Danger Cave, Hogup Cave, and Bonneville Estates Rockshelter, GBSS points have been dated to between 11,500 and 7,500 B.P. (Aikens 1970; Beck and Jones 1997, 2009; Bedwell 1973; Bryan 1988; Goebel 2007; Grayson 1988, 1993; Hattori 1982; Rhode et al. 2005; G. Smith 2008; Willig and Aikens 1988). This range encompasses a large period of prehistory, crossing completely the environmental changes that characterized the TP/EH;

however, this estimate is often the only, albeit coarse-grained, means of dating the over-abundance of near-surface sites containing GBSS points in the region.

Given the relatively large 4,000 year span that the GBSS points appears to have been utilized, the usefulness of dating hydrographic landscapes can advance our archaeological understanding. For example, in a case study from the Black Rock Desert, Prearchaic sites were found to be concentrated between 1,205 and 1,225 m (Adams et al. 2008). These elevations mark the location of Lake Lahontan's shoreline immediately following the Younger Dryas. The physical relationship the archaeological sites have with the landscape, in association with the narrower time frame of the Younger Dryas, 10,900 to 9,800 B.P. (Benson et al. 1990; Grayson 1993; Morrison 1991), requires that these sites are younger than this highstand.

The creation of the WPLT, originally proposed by Stephen F. Bedwell (1970, 1973), was one of the earliest assertions of a cultural complex associated with the archaeological remains around the shores of pluvial lakes and wetlands. Dated to between 11,000 and 8,000 B.P. from a series of cave sites in the Fort Rock Basin, Bedwell noted similarities in stone tools, specifically stemmed projectile points, and prehistoric environments throughout the entire western Great Basin, and proposed that TP/EH groups were specialized foragers who never left the lacustrine environments for any length of time. The predominate theory for nearly two decades, the WPLT is still thought by many as the prevailing hunter-gatherer adaptation during the TP/EH.

The association of diagnostic artifacts with particular geographic landscapes is often the most informative interpretation possible, facilitating here a rudimentary correlation of spatial and temporal factors. This is because of how relatively little is still known about the people who resided along pluvial lake margins and the coarse-grained record of the pluvial lake fluctuations themselves. With very few buried sites and sparse lithic assemblages from surface sites, only a portion of these groups' environmental adaptations can be recreated. Even our understanding of the Prearchaic toolkit, GBSS points and crescents, leaves much to be desired (Amick 1993; Beck 1998; Beck and Jones 1993, 1997, 2009; Grayson 1993; Lafayette 2006).

Another method to better understanding TP/EH adaptation comes from parallels made between prehistoric and ethnographic populations (e.g., Fowler and Fowler 1990; Grayson 1993; Kelly 1990). With the aid of more complete archaeological collections throughout Nevada, including modern lacustrine locations such as Pyramid Lake and Stillwater Marsh (Heizer and Napton 1970; Orr 1956; Wigand 1997), the small collection of Prearchaic organic remains is able to make more sense as part of a larger, more complete wetland focused lifeway.

Woven goods, such as basketry and sandals, are uniquely helpful when preserved in the archaeological record. Such items can be directly radiocarbon dated and they also provide clues about the environments that people utilized based upon the materials used in their construction. While many of the oldest dates on these artifacts are on sagebrush, including Fort Rock-style sandals from Fort Rock Cave dated to 9188±480 B.P. (Connolly and Barker 2004), many woven items were made from resources found around lacustrine environments. For example, tule reeds, a common resource of the Proto-Historic Paiute (Fowler 1990; Fowler and Liljeblad 1986), were utilized by Prearchaic peoples as early as 9,000 B.P. Tule sandals from Elephant Mountain Cave in northwestern Nevada and Cougar Mountain Cave in central Oregon have been dated to

8720±40 and 8510±250 B.P., respectively (Connolly and Barker 2004). Tule reeds were also prehistorically used to make matting, including examples from Spirit Cave in western Nevada dated to 9460±60 B.P. (Fowler et al. 2000; Tuohy and Dansie 1997).

Fish and shellfish also served an important role throughout prehistory (Fowler 1990; Fowler and Liljeblad 1986). Indicators that people were taking these resources during the TP/EH include a fragment of netting from Fishbone Cave in central Nevada dated to 7830±350 B.P. (Orr 1956) and freshwater mollusk shells from Last Supper Cave in the High Rock Country of Nevada dated to 8790±350 B.P. (Grayson 1988; Layton and Davis 1978). Direct evidence of food, specifically fecal boluses from Spirit Cave dated to 9,400 B.P., indicate the consumption of lacustrine resources similar to those consumed ethnographically in the Great Basin, including small fish (Eiselt 1997; Tuohy and Dansie 1997; Wigand 1997).

Evidence around low elevation pluvial lakes is of course only part of the picture from this time period, as early sites from higher elevations and locations away from pluvial settings are becoming increasingly recognized (Bryan 1979; Burke et al. 2010; Kelly 2001; Layton 1970; Layton and Davis 1978; Goebel 2007; Fenner and Smith 2011). A recent study from an isolated high elevation basin in the Black Rock Range called Paiute Lake displays utilization of upland localities during the TP/EH and indicates the great mobility of peoples at that time (Burke et al. 2010; Fenner and Smith 2011).

Early Archaic. In the Great Basin, the Prearchaic period is followed by the Archaic period. The first sub-period, the Early Archaic, encompasses part of the early Holocene and the entire middle Holocene (8,000–5,000 B.P.). This time frame is generally characterized by a gradual increase in aridity and increased adaptation to the desert environment (Grayson 1993; Kelly 1997). Black mats that formed during the early Holocene are indicative of an increasingly irregular environment, but one still considerably moister than today (Quade et al. 1998). As the Holocene continued and entered the middle period, an expansive drought persisted and again changed how people used the landscape. Sites from this period usually consist of small surface scatters near well-watered localities that may represent temporary, seasonal camps. Large Side-notched projectile points are associated with this period (Grant and Wenzlau 2008; McGonagle and Waski 1978; Thomas 1981).

Middle Archaic. The subsequent Middle Archaic period, at the beginning of the Late Holocene (5,000–1,300 B.P.), records broadening activities associated with adaptations to the desert environment throughout the Great Basin (Bettinger 1999; Kelly 1997). The frequency of groundstone artifacts increased during this period, suggesting a greater reliance on plant foods. The replacement of the atlatl with the bow-and-arrow at the end of this period also increased hunting efficiency (Grayson 1993; Kelly 1997). Settlement patterns also indicate an increased reliance on rockshelters. Raw materials come from more locally available sources, suggesting a more restricted procurement area (G. Smith 2010). Once again, a strong reliance on wetland systems is seen, particularly in western Nevada (Napton and Heizer 1970). Diagnostic artifacts from this period include Gatecliff, Humboldt, and Elko series projectile points, as well as scrapers, rectangular knives, and choppers (Grant and Wenzlau 2008; McGonagle and Waski 1978; Thomas 1981).

Late Archaic. Regional cultural variation is considered a hallmark of the late Archaic period (1,300–700 B.P.). Settlement patterns in some parts of the Great Basin shifted to village-type occupations with temporary camps and processing stations situated around major habitation localities. However, low-density occupations located around permanent or seasonal bodies of water are also common (Grayson 1993; Kelly 1997). Lithic artifacts attributed to this cultural period include small Rosegate series projectile points (Thomas 1981). Raw materials come from a wider range of sources during this period, suggesting a less restricted procurement area than the Middle Archaic (G. Smith 2010). Other common technologies for this period include grinding slabs and handstones, stone and wooden pestles, ceramics, and ornamental and ritual objects (Grant and Wenzlau 2008; McGonagle and Waski 1978).

Proto-Historic. The Proto-Historic spans the period between 700 B.P. and European Contact at 80 B.P. This period saw increased trade and exchange (Self 1980) as well as the expansion of Numic-speaking populations across Nevada (Grayson 1993; Madsen and Berry 1975; Madsen and Rhode 1994). Identified site types include rockshelters, open-air camps, and brush wikiups. Desert Side-notched and Cottonwood series projectile points dominate lithic assemblages from this period and persist into the historic period (Grant and Wenzlau 2008; Kelly 1997; McGonagle and Waski 1978; Thomas 1981).

Pluvial Lakes Research

Before we can properly address how prehistoric people utilized their environments, we must first be able to reconstruct and understand those environments. In this study, Prearchaic groups and pluvial lakes are the primary focus. Various methods exist for reconstructing past environments, each with its own limits in accuracy, time frame, and resolution. These methods include analyses of ecological, atmospherical, geological, geomorphological, and geochemical data. As with most scientific inquiries, a cumulative, although discerning, view of prehistory from each of these methods ultimately creates the most holistic understanding of the environments possible.

Extensive records of human occupation around pluvial lakes exist in the literature and through physical remains; however, there continue to be gaps in the collective knowledge of Prearchaic groups. Persistent efforts to explain the interplay between hunter-gatherers and pluvial systems remain a worthy venture in the Great Basin and will continue to advance our knowledge of the past.

Hydrologic Chronology of the Quaternary Great Basin

Prior to the invention of radiometric dating, the dating of pluvial features was confined to relative age correlations (Benson et al. 1990; Benson and Thompson 1987a; Orme 2008), which used stratigraphy and geomorphology to identify the fluctuations of Quaternary lakes (Antevs 1945; Gilbert 1884, 1890; Russell 1885). This method is still in practice today (Dickerson 2006, 2009; Morrison 1965; Orme 2008; Reheis 1999) with analyses of cores and surface exposures conducted to determine the relations of beach gravel deposits, fan gravels, paleosols, tephras, and lacustrine deposits. However, most modern methods involve the correlation of absolutely dated materials in direct association with remnant pluvial features.

The study of Great Basin pluvial systems was well underway when archaeologists initially made the connection between these environments and prehistoric groups (Campbell et al. 1937). Pioneering researchers such as Gilbert (1884, 1890) and Russell (1885), who focused on the Bonneville and Lahontan basins, respectively, relied extensively on an understanding of geomorphological, stratigraphic, and geochemical processes. Without the luxury of absolute dating, they correlated far reaching sediments, expansion and contraction of glacial landscapes, chemical and precipitate behaviors, solar radiation, seasonal climate variability, and jet stream tracks. Despite considerable scientific advances during the latter half of the 20th century, many of these analyses have held up to later scrutiny and are still practiced in association with modern techniques (Benson 1981; Benson and Thompson 1987a; Orme 2008).

Although less widely used today, another method popular before radiometric dating consisted of salt-balance calculations. Considerably coarser-grained than radiocarbon dating, salt-balance records were primarily used to identify dramatic changes in the ratios of oxygen, chlorine, and other elements in water. This method has been most effective at displaying when lakes reached desiccation and less accurate at recording fluctuations, particularly relatively minor ones, which are significant because they altered the distribution of prehistoric resources (Benson 1978; Benson and Thompson 1987a; Broecker and Walton 1959; Rhode 2008).

Since the development of radiometric dating, geologists and archaeologists alike have had the tools to more accurately reconstruct hydrographic histories. Multiple radiometric methods have been used in the past, including U-series dating, Potassium-Argon dating, and most popular, radiocarbon (^{14}C) dating. The ^{14}C method dates carbon-bearing materials, which can be divided into deposits from above and deposits from below the surface of prehistoric lakes. These datable remains consist of soils, packrat midden macrofossils, gastropods, ostracodes, lake sediments, tufa, mollusk shells, oolites, marl, and wood. Each method holds its own level of uncertainty, particularly with dates of decay and absorption of new carbon. However, as the limitations of these techniques become better known (Benson et al. 1990; Benson and Thompson 1987b; J. Davis 1978; Sarna-Wojcicki and Davis 1991; Thompson et al. 1986), proper measures can be taken with cleaning procedures, correlation of similar remains, and a general awareness of these limitations to create reliable lake-level curves.

Hydrographic conditions, specifically highstands, fluctuations, and ultimate lake recessions, affected not only the environment, and thus the types of landscape that prehistoric people encountered, but also influenced where archaeological sites accumulated. As people were not likely present during the last glacial maximum, the hasty lake retreat and fluctuations during the TP/EH seen in basins across the region would have affected people's adaptations to the landscape over relatively brief periods of time (Benson et al. 1990; Benson and Thompson 1987b; Dansie and Jerrems 2004).

As I discuss in later chapters, reconstructing past hydrographic conditions and environments is an ongoing, evolving, and advancing effort. Greater understanding of the limitations of absolutely dating remains associated with pluvial lakes, increased reliability of radiometric dating, greater integration of geological methods, and further awareness of field and laboratory methods have significantly advanced archaeological insight into the spatial and temporal relationship between pluvial wetlands and human occupations during the Prearchaic Great Basin (Adams and Wesnousky 1998; Benson et al. 1990; Dansie and Jerrems 2004; Orme 2008).

Research Goals

The primary goal of this study is to describe and analyze changing environmental conditions and the observable responses of prehistoric groups in the Mud Lake basin, with the greatest emphasis placed on the TP/EH. To address the relationship between humans and their environment, I take into consideration climatological and cultural factors which influenced prehistoric land-use patterns. Both lines of evidence, environmental proxy data and relatively dated archaeological sites, are decidedly coarse-grained. However, these lines of evidence are the best that we currently have to work with, and when both are considered together, a greater understanding of the past may be achieved. Considering these factors, I formulated two research questions to develop a better understanding of the relationship between Prearchaic people and their environment at pluvial Mud Lake:

(1) Are the archaeological sites at Mud Lake associated with certain types of landforms?; and

(2) Are there environmental or climatological factors that may have influenced the distribution of archaeological sites at Mud Lake?

Chapter 2

METHODS

In this chapter, I outline the methods utilized before, during, and after fieldwork was conducted at Mud Lake. Before fieldwork, every effort was made to identify all previous fieldwork projects at Mud Lake. Field procedures and laboratory measures, which dealt with small amount of lithic analyses, are briefly outlined. More space is devoted to environmental studies, which consider climatologic proxies and models to gain a better understanding of the TP/EH paleoenvironments.

Previous Fieldwork at Mud Lake

Archaeological Fieldwork

For more than 40 years, considerable attention has been paid to Mud Lake by avocational archaeologists from the nearby town of Tonopah. The work done by these people continues to provide most of the data available for Mud Lake. Although great attention was paid to the gathering of data, a certain level of interpretation and consultation was necessary to integrate the archaeological data sets into one record.

The greatest detail regarding the previous investigations at Mud Lake comes from Gary D. Noyes, a long time resident of Tonopah and well-known avocational archaeologist. Introduced to collections from other central Nevada sites, Noyes began his exploration of Mud Lake on April 9, 1967. During the 10 years that followed, Noyes spent considerable time surveying at Mud Lake, consulting with professional archaeologists and gaining as much knowledge as possible on the earliest inhabitants of the Desert West.

Noyes collected numerous archaeological reports and books, resources not commonly available at the time. Through these records, Noyes acknowledged the importance of systematic site recording, artifact cataloguing, and learned of the widespread relationship between pluvial landforms and archaeological sites. Through close working relationships with Donald R. Tuohy, the Curator of Anthropology at the Nevada State Museum, and Fredrick C. V. Worman, an archaeologist for the NTTS, Noyes was encouraged to continue his systematic recordings.

While considerable advances have been made with regards to technology since the late 1960's, Noyes' field procedures were much as they should be today. Initially more defined by the existing dirt roads that lead to the Mud Lake playa and the remnant shorelines whose flat topped morphology made easy roads, Noyes' survey methods changed to a more random system after he discovered that others were collecting from sites. Weary of others detracting from his recording methods, Noyes was careful of the tracks he left, intentionally not creating paths to sites. Originally restricted to the western portion of the basin, out of respect for the lands other avocational archaeologists' utilized, Noyes started visiting the eastern side of the basin after 1969, after which his methods increased to their ultimately random nature.

Utilizing his experience with a theodolite while in the Air Force and as a chainman for the Nevada State Highway Department, Noyes' methods included initially identifying site boundaries and concentrations, recording exact provenience of artifacts, and producing detailed site maps, notes, complete tool class collections, and finally artifact cataloguing, analysis, and labeling. Important to emphasize here is the complete artifact collection and analysis that was conducted by Noyes, including all time periods of diagnostic projectile points, bifaces, scrapers, cores, gravers, utilized flakes, and groundstone. These methods facilitate a true analysis of human use of the Mud Lake basin through time as there is no clear bias towards any tool type or period.

In addition to Noyes, his close friends Phil W. Hutchinson, Noble Crew, and Bill and Kemma Lowe also spent considerable time at Mud Lake. Their collective knowledge has effectively been lost to time, as many have now passed away or moved elsewhere. As will be discussed in more detail later, sites recorded by other avocational archaeologists, particularly the Lowes, were reported to the Tonopah BLM in the 1970's; however, there are few data more specific than site location and general tool types present related to these sites. As a result, only the collections recorded by Noyes, which I was fortunate enough to have access to, are detailed in my study.

Based upon the collective work of these avocational archaeologists, who focused considerable amounts of attention on the obvious pluvial landforms, previous sites were almost exclusively recorded on the Pleistocene ridges and around the periphery of the playa. Many sites are located along the playa margin (n=7), and while they presently lie in areas designated as geologically active (Dickerson 2006), because discrete concentrations were identified by Noyes, all sites are believed to be in more-or-less their primary contexts, which is the case for all sites identified, both in the past and more recently. As will be seen, these patterns provide a record of human activity and environmental change at Mud Lake.

Geological Fieldwork

In stark contrast to the little academic archaeological work that has been conducted here, Mud Lake has been the focus of some notable geological fieldwork. While not numerous, publications by Mifflin and Wheat (1979) and Dickerson (2006, 2009) are invaluable to understanding the geological and hydrographic history of Mud Lake.

Mifflin and Wheat (1979) undertook the task of analyzing all basins in Nevada for evidence of pluvial lakes. Primarily relying on aerial photographs to identify pluvial features such as shorelines, Mifflin and Wheat confirmed their findings with field reconnaissance. Of the 81 basins in Nevada, Mifflin and Wheat determined that there was evidence of 53 pluvial lakes, all of which were present during the last highstand of Lake Lahontan between 14,000 and 13,000 B.P. (Adams and Wesnousky 1998; Benson 1981; Benson et al. 1990; Reheis 1999; Thompson et al. 1986). Equally important to identifying pluvial landscapes was the realization that some basins previously thought to have contained a pluvial lake in fact did not (e.g., the Sarcobatus basin [Mifflin and Wheat 1979]).

From numerous forms of quantitative data collected on each basin, a large data set was gathered as to the specifications of Nevada's pluvial systems. From this data set, Mifflin and Wheat created a mathematical formula for quantifying pluvial lake size with paleoclimatic conditions. With this formula, called the "Pluvial Hydrologic Index", Mifflin and Wheat determined that lake altitude and latitude account for 75% of the variation in lake size during the Pleistocene. Of these two parameters, latitude perhaps has greater influence on the Pluvial Hydrologic Index, as one degree of latitude change is equivalent to an altitude change of 500 ft. The strong influence that latitude has on pluvial basins has been empirically confirmed through other analyses, particular Pacific jet stream migrations (Benson 1981; Benson et al. 1990, 1995; Benson and Thompson 1987b).

Dickerson (2006, 2009) also initially consulted aerial photography and spent considerable time in the field identifying pluvial features. Dickerson was charged with examining the pluvial lake basins on NAFB land, and because half of Mud Lake lies on these lands, it was included in his study. As part of Dickerson's more field-oriented assessment, he utilized previously existing test pits as well as dug some of his own to reconstruct histories of Mud Lake.

Despite the fact that some of Dickerson's interpretations have been called into question (Adams, personal communication 2010), the most significant assertions that he made related to this project are the location and extent of remnant beach features, which, with few exceptions, were all field confirmed in 2009. As a considerable portion of Dickerson's publications are focused entirely on the Mud Lake basin, a greater discussion of his pluvial findings is found in Chapter 3.

Recent Fieldwork Procedures

Before fieldwork was initiated by the Sundance Archaeological Research Fund (SARF), basic survey guidelines were constructed using a topographic overlay map generated by Dickerson (2006, 2009) that depicts the present locations of beach ridges and areas of recent geologic activity (e.g., wind erosion, water erosion, wind deposition, water deposition) superimposed on the USGS *Mud Lake North Quadrangle* (1987). Using this map, 1-km^2 units were delineated using the Universal Transverse Mercator (UTM) grid system, and each unit was classified based upon a defining geologic feature (the *Lowengruhn* ridges at 1,591 to 1,595 m (5,220 to 5,232 ft), *above* the Lowengruhn Ridges, *below* the Lowengruhn Ridges, and ephemeral *channels*, (words in italics represent how each unit is referenced herein) and then numbered according to each of those features. It is important to note that while certain geologic and topographic features may have dominated a particular survey unit, most units contained two or three of these designations. These units later guided procedures utilized in the field and helped to organize the data collected.

Following Dickerson's (2006, 2009) assessment of the location of the remnant beach features, letter designations were assigned to each ridge system to aid discussion and identification of certain places on the landscape. Around the northern periphery of the Mud Lake basin, five linear ridges are designated "A" through "E", with A being the ridge closest to the playa and E being farthest away from the playa (Figure 2.1).

Field reconnaissance around Mud Lake was conducted over three field sessions between June 1 and July 13, 2009, by a SARF crew. Based upon the research goals for

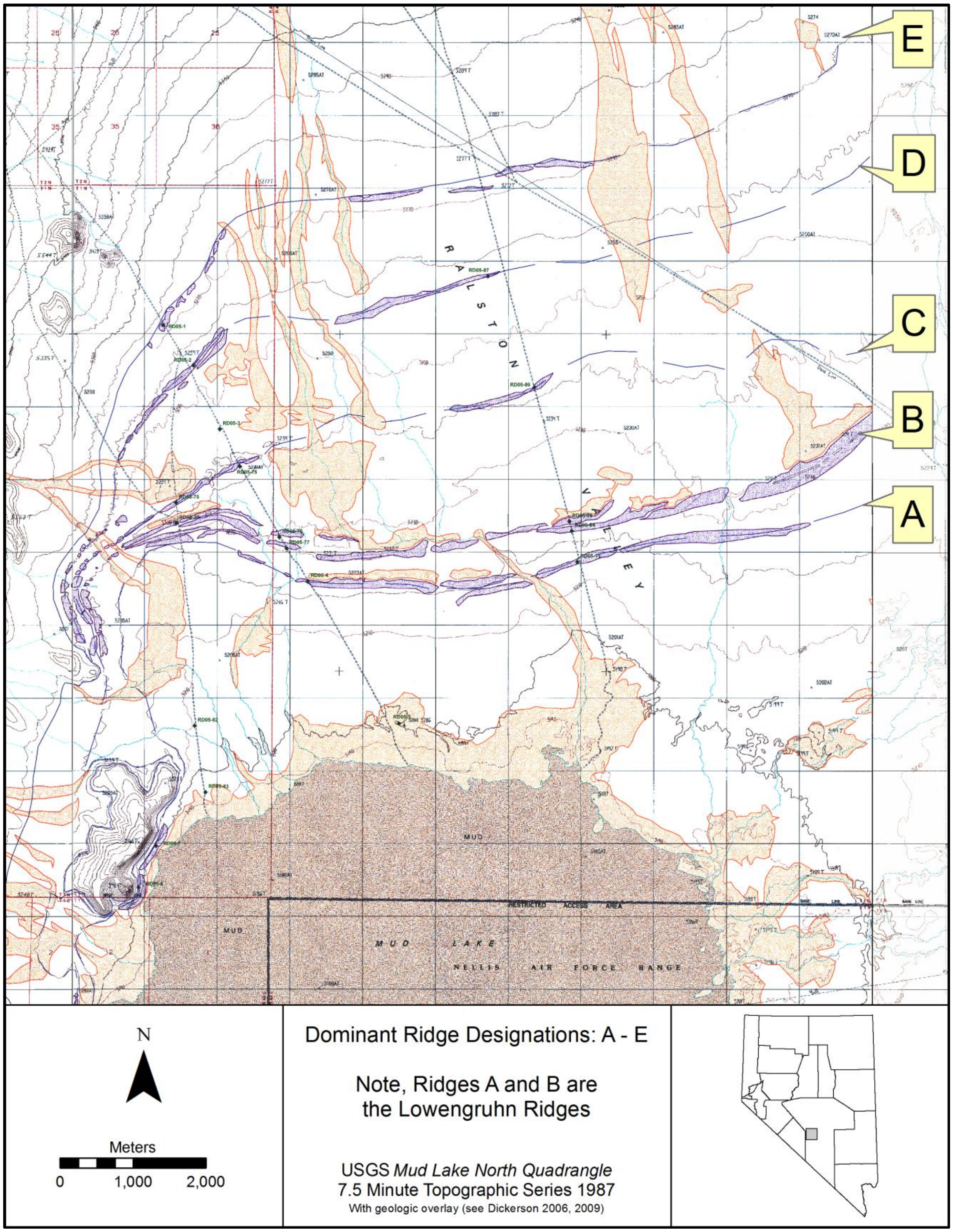

Figure 2.1. Geologic feature map of Mud Lake with dominant beach ridge designations.

this project, a stratified random sampling technique was initially employed. Based upon the findings of the first few units, we altered our strategy to a more targeted method. These findings led to more weight being placed upon units dominated by the Lowengruhn ridges, with continued interest on the other beach ridges, areas of geologic activity, and ephemeral channels following our research design.

Each 1-km^2 unit was surveyed using 30-m interval transects, guided with the use of a Trimble GeoXT GeoExplorer 2008 Series handheld GPS unit and compasses. Investigations were held to non-collection survey and mapping with no cultural resources displaced or collected unless otherwise directed by the BLM. Once cultural artifacts were located, close interval survey was conducted in the area to identify additional artifacts and designate site boundaries. Artifact scatters comprised of <12 individual flakes were recorded as "isolated finds" (IFs). Solitary tools with no other associated artifacts were also recorded as an IF. The boundaries (or UTM coordinates in the case of solitary artifacts) of all IFs were recorded with the GPS. Because our permit did not allow for the collection of artifacts, digital photographs, metric measurements, and brief descriptions of each tool were taken in the field.

Artifact concentrations totaling ≥12 flakes and/or formed tools were classified as archaeological sites and recorded as such. All information pertinent to the completion of Intermountain Antiquities Computer System (IMACS) site forms was documented. Site boundaries were recorded using a handheld GPS, as were the locations of all diagnostic projectile points and other tools (e.g., cores, scrapers, gravers, unifacial tools, etc.). Additionally, the limits of artifact concentrations within the site boundaries were recorded in the same manner.

Over the course of this project 10 units were surveyed, including six Lowengruhn, one above, one below, and two channel units. Regardless of topographic setting locations, all areas surveyed were dominated by Prearchaic artifacts, particularly those classified as GBSS and as BRCB points. The criteria used to classify these and other diagnostic point types is outlined below.

Laboratory Analysis

Once fieldwork was completed, analysis consisted of comparing projectile points observed in the field with diagnostic projectile point typologies and assessing the temporal spans of each point type, and, in turn, the ages of the sites on which they were found.

Projectile Points

Numerous works on projectile point typologies and cultural chronologies are available for the Great Basin. Determinations made by Beck and Jones (2009, 2010), Heizer and Hester (1978), Justice (2002), and Thomas (1981) were utilized for establishing broad chronologies and publications from individual type sites were used for more specific typing in order to classify all of the points found at Mud Lake. These lithic artifacts stand as the only datable cultural materials present at Mud Lake. As previously stated, exact ages and chronologies of each diagnostic tool type come from rare stratified sites, and this information permits the use of lithic cross dating to establish the approximate age of surface sites at Mud Lake and elsewhere.

At Mud Lake projectile points consist primarily of GBSS points, with numerous BRCB points and one GBF point also present. While these oldest projectile point types are most significant to this project, the presence (or absence) of later Archaic points also help to determine the ages of sites. All time periods of projectile points are present at Mud Lake with the exception of Large Side-notched projectile points, a hallmark of Early Archaic occupations. All projectile point types, a broad cultural sequence, local phase designations, and radiocarbon age ranges are displayed in Table 2.1. Sketches of GBSS points are identified in Figure 2.2. Descriptions of each projectile point type identified at Mud Lake are as follows:

Black Rock Concave Base Projectile Points. Originally defined by Clewlow (1968), BRCB points were likened to Clovis in that they are lanceolate in shape and concave based, but are unfluted. Edge grinding and basal thinning are also common markers of this point type. BRCB points are associated with a date range of 11,250 to 8,000 B.P. in the Great Basin (Basgall 1988; Beck and Jones 2009).

Great Basin Fluted Projectile Points. GBF points are "Clovis-like" fluted concave base projectile points. Lanceolate shape in profile, these projectiles display lateral edge grinding. They exhibit a considerable amount of morphological variation, commonly attributed to resharpening (Beck and Jones 1997), yet all display true flute attributes (Warren and Phagan 1988). GBF points are thought to date to the same time range as Clovis in the Plains, between 11,200 and 10,900 B.P., although they remain very poorly

Table 2.1. Cultural sequence represented at Mud Lake and in the Ralston Valley and corresponding projectile point chronology[1].

Cultural Sequence	**Regional Phase**	**Radiocarbon Date Range**	**Primary Diagnostic Artifacts**
Proto-Historic	Clifford	700–80 B.P.	Desert Side-notched and Cottonwood series projectile points
Late Archaic	Blue Eagle	1,300–700 B.P.	Rosegate series projectile points
Middle Archaic	Liberty	5,000–1,300 B.P.	Gatecliff, Humboldt, and Elko series projectile points
Early Archaic	Grant	7,000–5,000 B.P.	Large Side-notched and Gatecliff series projectile points
	Morey	8,000–7,000 B.P.	Large Side-notched projectile points
Prearchaic	Nyala	10,000–8,000 B.P.	Stemmed and fluted projectile points, crescents
	Tonopah	11,000–10,000 B.P.[2]	Fluted projectile points

[1] See McGonagle and Waski (1978) for the framework from which this table was made.
[2] Early dates for GBF and GBSS points are still a greatly debated topic in the Great Basin. See Beck and Jones (2010) for a recent discussion of this subject.

dated in the Great Basin (Beck and Jones 1997, 2009; Geobel et al. 2010; G. Haynes 2002; Haynes et al. 2007; Waters and Stafford 2007).

Great Basin Stemmed Series Points. The GBSS is a group of lanceolate shaped, sometimes shouldered, projectile points found throughout the Great Basin. Originally starting with two types in the Mojave Desert in 1937 (Lake Mojave and Silver Lake [Campbell et al. 1937]), as more similarly shaped artifacts were identified, the establishment of a unified typology became problematic. In 1977, this diagnostic name was assigned by Tuohy and Layton. Many variants of GBSS points exist and are discussed below, as nearly all of them are present at Mud Lake. Those stemmed projectile points not attributable to particular varieties were assigned to a catchall category of Indeterminate GBSS.

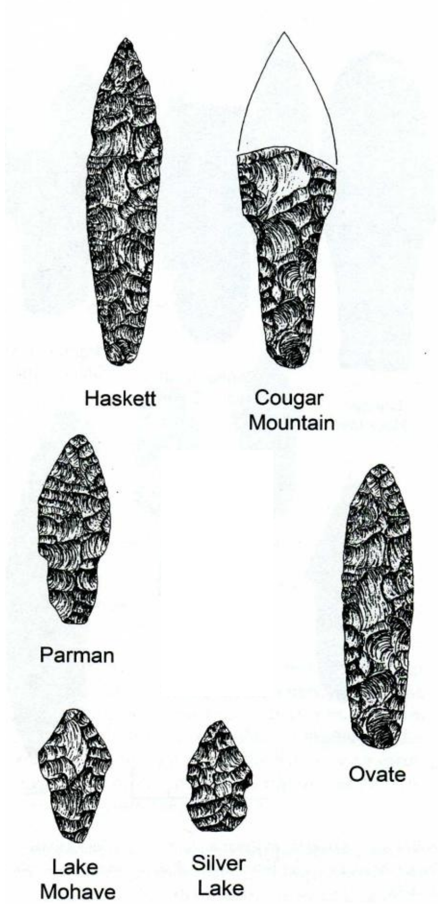

Figure 2.2. Examples of Great Basin Stemmed Series projectile point types identified at Mud Lake (Beck and Jones 2009:167).

Cougar Mountain Stemmed Projectile Points. Originally defined by Layton (1970), Cougar Mountain points are large lanceolate tools with sloping shoulders and long contracting stems. These points are often defined by considerable stem grinding, with little grinding present on their shoulders or bases. Cougar Mountain projectile points have been dated to between 9,920 and 7,080 B.P. (Beck and Jones 1997, 2010; Jones and Beck 1999).

Haskett Stemmed Projectile Points. Originally defined by Butler (1965), Haskett points are unshouldered and tapered in shape. Their broadest section is at their distal end, with the stem accounting for roughly 60% of the length of the point. The contracting stem is commonly ground with the base thin and slightly rounded. Haskett projectile points have been dated to between 11,200 and 7,240 B.P. in the Great Basin (Beck and Jones 1997, 2010; Jones and Beck 1999).

Lake Mojave Stemmed Projectile Points. As one of the first GBSS point types to be identified, Lake Mojave (also spelled Mohave) points were originally defined by Amsden (1937) as part of the celebrated Campbell expedition. These points are only slightly shouldered and have long tapering stems, which are often ground. Lake Mojave projectile points have been dated to between 11,140 and 7,815 B.P. in the Great Basin (Beck and Jones 1997, 2010; Jones and Beck 1999).

Ovate Stemmed Projectile Points. Originally defined by Beck and Jones (2009), Ovate points have been identified throughout the Great Basin for some time (Bedwell 1973; Connolly and Jenkins 1999) yet did not receive an individual classification until recently. Resembling several GBSS styles, Ovate points lack the clear distinction between stem and blade characteristic of Cougar Mountain points, the symmetry and detail characteristic of Haskett points, and it is not known if they represent the same form, function, or temporal span as Cascade points from the northern Great Basin or Columbia Plateau. Based upon the paucity of radiocarbon dates associated with this projectile point type, Ovate points are broadly dated to pre-Mazama eruptions in the northern Great Basin (Connolly and Jenkins 1999).

Parman Stemmed Projectile Points. Originally defined by Layton (1970, 1979), Parman points exhibit square to sloping shoulders, with stems that are often shorter than their broad blades, and display varied flaking patterns. Stems often display grinding, crushing, and steep retouching and are short compared to the blade. Parman projectile points have been dated to between 10,200 and 8,260 B.P. in the Great Basin (Beck and Jones 1997, 2010; Jones and Beck 1999).

Silver Lake Stemmed Projectile Points. Also identified by Amsden (1937), Silver Lake points are small non-tapering tools with pronounced shoulders. The stems of these tools generally comprise one-third to one-half of the length of the tool and display variation in flaking pattern, from fine pressure flaking to percussion. Silver Lake projectile points have been dated to 7,140 B.P. in the Great Basin (Beck and Jones 1997, 2010; Jones and Beck 1999).

Windust Stemmed Projectile Points. Originally defined by Leonardy and Rice (1970), Windust points have relatively short blades and square to sloping shoulders. The stems of these tools are relatively short and broad, and may not actually represent a GBSS tool based upon these qualifications (Beck and Jones 1997, 2009). For this project, I leave Windust among the GBSS based upon its overlapping time frame with other GBSS forms, between 10,740 and 7,080 B.P. (Beck and Jones 1997, 2010; Jones and Beck 1999), as well as its common association with remnant pluvial features.

Crescents. Found throughout the western United States in association with Prearchaic projectile points, crescents remain an enigma. Predominantly made of crypto-crystalline silicates (CCS), crescents have been observed in three “types”; quarter-moon; half-moon; and butterfly (Tadlock 1966:663). They are highly variable in size and shape, and are usually bifacially flaked. Many uses have been suggested for these tools, with the most prevalent theory being that they were hafted transversely and used for hunting waterfowl (Beck and Jones 2009; E. Davis 1978; B. Smith 2008; Tadlock 1966).

Crescents are associated predominantly with GBSS points but also with BRCB and GBF points (Beck and Jones 2009, 2010; Grayson 1993; Willig 1988). A small number of crescents have been found in buried contexts, from Lind Coulee, Daisy Cave, C. W. Harris, and Sunshine Locality, and have been radiocarbon dated between 10,320 and 8,085 B.P. (Beck and Jones 2009, 2010).

Gatecliff Contracting Stem Projectile Points. Originally defined by Clewlow (1967) under the Elko series and reorganized by Thomas (1981), these points are large and have contracting stems with little to no basal indention (having a basal indentation ratio of more than 0.97). Gatecliff Contracting Stem points are securely dated to the early Middle Archaic between 5,500 and 3,500 B.P. (Thomas 1981).

Gatecliff Split Stem Projectile Points. Originally defined by Heizer and Baumhoff (1961) as part of the Pinto Series and later reorganized by Thomas (1981), Gatecliff Split Stems are nearly identical in history, time frame, and morphology to Gatecliff Contracting Stem, save for their bifurcated stems (Thomas 1981).

Humboldt Concave-Base Projectile Points. Originally defined by Heizer and Clewlow (1968), Humboldt Concave-base points are lanceolate in profile and unnotched. Humboldt points are variable in size, but are generally ≥4 cm in length. Humboldt projectile points are not thought to be good time markers, as they span most of the late Holocene from 5,000 to 1,300 B.P. (Thomas 1981).

Elko Corner-notched Projectile Points. Originally defined by Heizer and Baumhoff (1961), these projectile points are large and corner-notched. Elko Corner-notched points are securely dated to the Middle Archaic, between 3,500 and 1,500 B.P. (Thomas 1981).

Elko Eared Projectile Points. Also originally defined by Heizer and Baumhoff (1961), Elko Eared points are nearly identical in history, time frame, and morphology to Elko Corner-notched points, save for a basal indention with a ratio of less than or equal to 0.93 (Thomas 1981).

Rosegate Corner-notched Projectile Points. The Rosegate series emerged from a reordering of projectile point typologies by Thomas (1981), merging the Rose Spring, as defined by Lanning (1963), and the Eastgate, as identified by Heizer and Baumhoff (1961). This merging was detailed by their nearly identical morphology and no discernable difference in their respective ages. Rosegate points are small, corner-notched points with expanding stems. They date to the Late Archaic between 1,300 and 700 B.P. (Thomas 1981).

Cottonwood Leaf-shaped Projectile Points. Originally identified by Riddell (1951) and defined by Lanning (1963), Cottonwood Leaf-shaped points are small, basally rounded, and unnotched. Cottonwood projectile points are dated to the Proto-Historic period post 700 B.P. (Thomas 1981).

Undiagnostic Projectile Points. Undiagnostic projectile points are fragments that possess features of projectile points (e.g., projectile point tips) but lack other basal indicators (e.g., stem, notching, edge-grinding) that would facilitate assignment to a particular type.

While there still exists a paucity of radiocarbon dates associated with Prearchaic projectile points, there is an ever expanding collection of absolutely dated sites. From all the dates available on GBSS points (Table 2.2), each projectile point type overlaps in age considerably, predominantly within the span of 11,500 to 7,500 B.P. (note that GBSS

Table 2.2. The radiocarbon ranges of GBSS projectile points (after Beck and Jones 1997, 2010; Jones and Beck 1999).

GBSS Type	Radiocarbon Age	N
Cougar Mountain	7,080–9,920	20
Haskett	7,240–11,200	12
Lake Mojave	7,815–11,140	18
Parman	8,260–10,200	6
Silver Lake	7,140	1
Windust	7,080–10,740	22

Ovate points were not been included in this consideration as they are as of now not reliably absolutely dated).

Environmental Analysis

The last phase of analysis, the environmental analysis, is arguably the most significant avenue to address my research goals, particularly the second question: are there environmental or climatological factors that influenced the distribution of archaeological sites at Mud Lake? Below, I outline the types of proxy data that I used to reconstruct environmental conditions at Mud Lake during the TP/EH.

Lake Fluctuation Comparisons. Certain features remaining from lake fluctuations can be directly dated using radiocarbon dating (Benson 1978, 1981; Benson et al. 1990, 1992; Benson and Thompson 1987a; Reheis 1999). While abundant in some areas, many smaller basins such as Mud Lake are either lacking these features or have not been sufficiently studied. Therefore, well documented records from other locations must serve as proxy records themselves. As the records from other pluvial systems are being used as independent proxy data here, these records act on a regional scale, but are the most specific to recreating the history of Mud Lake's fluctuations. Some of these records are outlined below.

Paleo-spring Complexes. Despite the large number of pluvial lakes present in the Great Basin, one did not reside in every single basin, particularly in the southern half of the region. Therefore, other means of observing environmental factors associated with water flow must be studied. Analyses of paleo-spring systems allow for such determinations. Many of these analyses are similar to lake fluctuations, including oxygen isotopes and ostracodes. An interesting departure from pluvial lake studies is the ability to examine sediment accumulations from unique events such as large floods (Quade et al. 1998, 2003). Similar to lake-level analysis, the proxy record generated from paleo-springs is inherently regional, given its sensitivity to broad climate patterns and groundwater influxes from surrounding areas.

Packrat Middens. Extremely common in its application in the Intermountain West, proxy data provided by packrat (*Neotoma*) middens come from the analysis of plant macrofossil remains preserved in the rodents' excrement. Preserved in dry caves, rockshelters, and overhangs in the Great Basin, many of these locations lie around the periphery of pluvial lake basins, and thus contain strong records for those settings (Nowak et al. 1994; Spaudling 1990; Thompson 1990; Wigand and Rhode 2002). Given that packrats will only collect organic materials from a 100-m radius of their nest, individual macrofossil proxy data are predominantly local records, although many reports on packrat middens place this information into regional contexts.

Pollen Analysis. In addition to being found in packrat settings, cores from modern and extinct lakes, cave fill, and coprolites provide prehistoric pollen for microfossil analysis (Overpeck et al. 1985; Wigand 1997; Wigand and Rhode 2002). Pollen also generally has a limited traveling distance, although some species (e.g., pine) are exceptions, and aid in generating geographical extents of flora. However, despite variable traveling distances, as long as they are properly accounted for, microfossil proxy data inherently creates a local record of past flora distributions. Again like macrofossil discussions, microfossil reports are often analyzed on a more regional scale.

Isotope and Trace Element Analysis. This category includes the study of stable and inorganic isotopes oxygen, carbon, strontium, uranium, and others. Either suspended in or trapped by water, isotopes are analyzed in numerous proxy data sets, particularly with glacial cores and groundwater records (Benson et al. 1997; Dansgaard et al. 1993; Reheis et al. 2003). Glaciers form when successive annual snow accumulations turn to ice. Water molecules deposited as snow carry distinct chemical signatures which can then be related to temperature and other aspects of past climate. Glacial ice also keeps a record of carbon dioxide, methane, nitrous oxide, and other airborne elements in the form of tiny air bubbles. Other particles such as dust, volcanic ash, and pollen that fell among the snow are also trapped by each successive ice layer, allowing for other trace element studies (Alley 2000; CLIMAP 1976; Dansgaard et al. 1993; GRIP 1993). Analysis of trace elements and oxygen isotopes in groundwater allows for the creation of prehistoric hydrologic pathways in order to date various deposits and track relative influxes of precipitation to a system (Benson and Klieforth 1989; Reheis et al. 2003). As a result of their broad application, water isotope proxy data are intrinsically regional or larger in scale. This is especially so with regard to the analysis of glacial ice, which records data at the global scale. Although groundwater analyses are also affected by inputs on the regional level, these signatures can often be teased apart.

Soil Formation. While a less common proxy data set for environmental reconstructions, geological analysis of soil formation processes creates a baseline for when other proxy data may be initiated. Five factors affect the level and amount of soil that develops: climate; organisms; relief; parent material; and time. The latter is generally believed to be the most significant factor in the development of distinct soil horizons (Birkeland 1999; Ritter et al. 2002; Waters 1992). Based upon the amount of time necessary for soil formation to occur, poorly developed soil horizons in pluvial lake or stream environments may provide a rough minimum age for associated landforms. These rough ages may in turn support or refute estimates of lake transgressions and regressions. Soil formation is an extremely local form of proxy as it is site specific.

Summary

Numerous data sets exist for the analysis of Mud Lake prehistoric conditions, both environmentally and archaeologically. Proxy climate data are available for Mud Lake at varying resolutions, from a global perspective to a local perspective. Each proxy record discussed above is integrated into the reconstruction of Mud Lake's environment, with glacial records receiving a relatively small emphasis, and a greater emphasis given to the pluvial lake fluctuations previously generated from larger and more well studied basins in western and southern Great Basin. The archaeological methods outlined in this chapter serve as a starting point for the greater proxy detail that will be given in the next. Together, these records create a picture of environmental and archaeological change at Mud Lake throughout prehistory.

Chapter 3

MATERIALS

In this chapter, I outline the various materials utilized during this study. These materials consist of temporally diagnostic artifacts (i.e., projectile points) present at Mud Lake, the local geological context, and the collection of pertinent environmental proxy data. All time periods of diagnostic artifacts are relevant and will be addressed here, although Prearchaic artifacts and their corresponding environmental conditions of the TP/EH are most significant to my study. Prearchaic artifacts from Mud Lake archaeological sites consist of those previously identified by avocational archaeologists as well as those sites recorded by SARF during the 2009 field season. Proxy data for Mud Lake consist of various environmental analyses, ranging from globally significant ice core and isotope data sets to locally constrained macrofossil and microfossil data for the western and southern Great Basin.

Geological Context of Mud Lake

The local geography of Mud Lake includes the Goldfield Hills immediately to the south and southwest and the San Antonio Mountains to the west. The modern Mud Lake playa surface lies at an elevation between 1,579 m (5,179 ft) and 1,581 m (5,187 ft) a.s.l. The presence of alluvial deposits overlying lacustrine deposits, beach gravel lag deposits found around the outside of the playa, and the presence of fossil stromatolites that form only in aquatic environments congruently indicate that the current Mud Lake playa was once a perennial lake. At its pluvial maximum, Mud Lake reached an elevation of 1,609 m (5,280 ft) a.s.l. (Mifflin and Wheat 1979:54), had a potential depth of 29-31 m (95-101 ft), and covered a total area of 335 km^2 (113 square miles) (Dickerson 2006:2, 21).

Much of the local surface geology is typical of lacustrine environments. At Mud Lake, lacustrine mud deposits are overlain by well-sorted and coarse-grained clastic materials, both of which suggest shore deposits. These deposits are capped by poorly-sorted sands and alluvial gravels. Dickerson (2006:20-26) utilized several test pits throughout the identified geologic zones along the northern periphery of the Mud Lake playa to characterize the local stratigraphy (Figure 3.1). The southernmost pit, located roughly 200 m (650 ft) north of the playa, records 1 m (3 ft) of lacustrine mud typical of Great Basin playa surfaces. Moving away from the playa, the stratigraphic profile includes 46-56 cm (18-22 in) of poorly-sorted gravels and coarse alluvial sands, the lower 10 cm (4 in) of which includes a higher proportion of sub-rounded pebbles and unsorted sands indicative of an immature beach gravel lag deposit. This gravel lag serves as an interface between the upper alluvial deposits and the underlying 61 cm (24 in) of finely laminated silt and clays representing lacustrine deposits. Further to the north, 10 cm (4 in) of alluvium overlies mixed deposits of sand and gravel with discontinuous gravel beds suggesting a stable beach environment. Lacustrine clays lie below the mixed deposits at a depth of 76 cm (30 in). Most distant from the playa surface, 20-25 cm (8-10 in) of unsorted, fine to coarse-grained sands and gravels cap a gravel lag deposit of sub-rounded pebbles which developed along the ancient lake shore. This stratigraphic profile indicates that as the shoreline retreated, younger beach gravel was deposited upon older

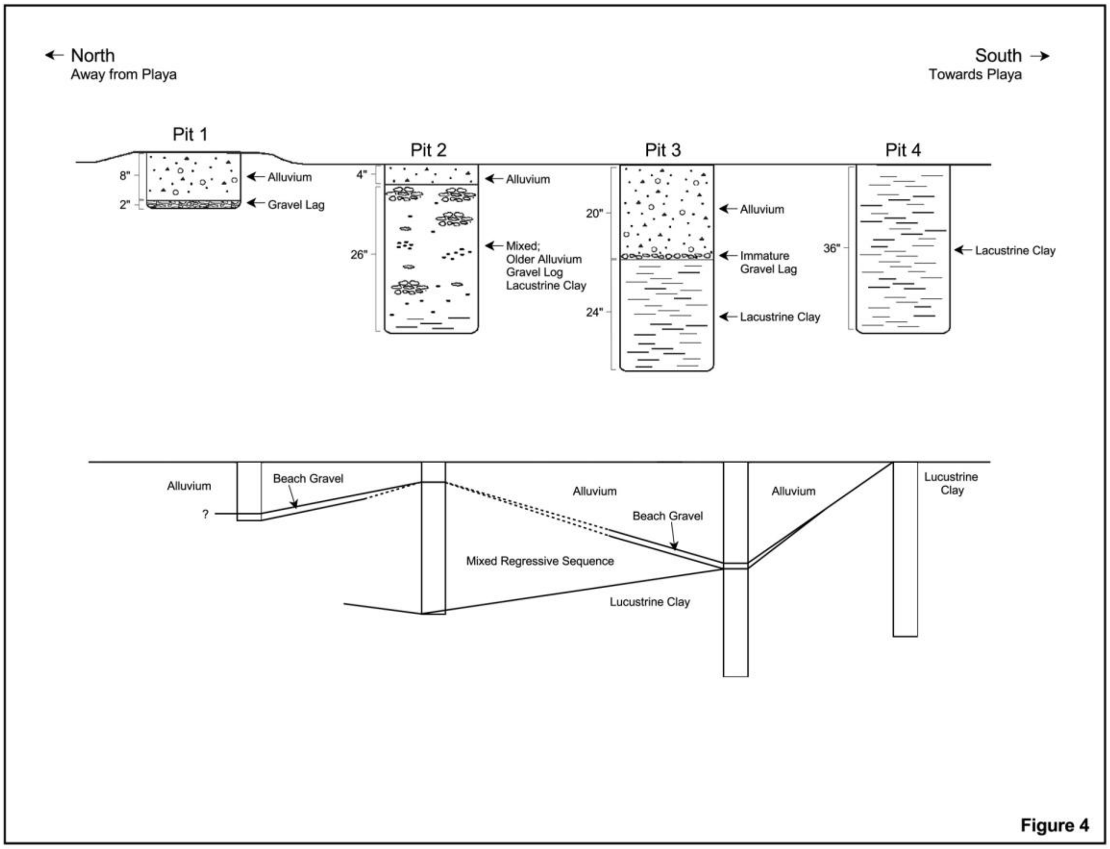

Figure 3.1. Profiles of test pits discussed in the text (Dickerson 2006:32).

silt and clay lake beds, leading to the advancement of alluvial fans and the subsequent burial of these beach gravels by more recent alluvium (Dickerson 2006:31-32).

A dominant feature on the local landscape and a primary focus of this investigation is a series of discontinuous linear ridges circumferentially arranged around the modern playa, which have effectively changed little since their formation during the Pleistocene (Adams, personal communication 2011). As many as eight parallel ridge formations occur around the playa (see Figures 1.4 and 1.5). These ridges rise from less than 1-3 m (2-10 ft) above the surrounding landscape, and are often capped by 12.5-25 cm (5-10 in) of gravel deposits (Dickerson 2006:8).

Overall, these formations record three periods of stable lake levels, punctuated by two periods of rapid recession. To the north of Mud Lake, the oldest period of stability is reflected in two ridge formations at an elevation of 1,609 m (5,275 ft) a.s.l. The middle period of stability is recognized through two ridges at 1,603 m (5,260 ft) a.s.l. The most recent period of stability actually reflects three shorter periods of stability with a series of complex beach ridge formations at 1,597 m (5,240 ft), 1,594 m (5,230 ft), and 1,591 m (5,220 ft) a.s.l. Most of these beach ridges are mirrored across the southern portion of Mud Lake, but at slightly more variable elevations due to Holocene uplift and a slight tilting of the entire basin to the north and east (Piety 1996).

Mud Lake Archaeological Sites

Previous Research

Archaeological sites identified by avocational archaeologists comprise the largest sample of sites at Mud Lake. The Nevada Cultural Resource Information System (NVCRIS) indicates that 24 previously-recorded sites are located within a one-mile radius of the project area (Figure 3.2 and Table 3.1). The majority of these previously recorded sites were reported to the BLM by Gary D. Noyes in 1975 after many years of personal identification and documentation, together with information from other avocational archaeologists, whose activities and methods were discussed in Chapter 2. Additionally, three more sites, not previously reported to the BLM, were systematically recorded by Noyes. As collections from these sites exist, they are included in this study, but because they do not have Smithsonian trinomials, these sites are identified using an alphabetical letter as Noyes originally recorded them.

Of these 27 total previously recorded sites, all but one are surface sites. The one known buried site, Lowe Shelter (CrNV-61-531), is the only professionally excavated site in the vicinity of Mud Lake. It was excavated by Donald R. Tuohy in 1970 (Self 1980; Tuohy 1978). Additionally, there is not a detailed artifact record for one of the surface sites. As these two localities are anomalies from all other Mud Lake sites, and do not provide the proper data to aid to the focus of this study, they are not considered in my study.

Of the 25 previously recorded surface sites, 16 (CrNV-61-530, CrNV-61-533, CrNV-61-534, CrNV-61-535, CrNV-61-537, CrNV-61-538, CrNV-61-539, CrNV-61-540, CrNV-61-543, CrNV-61-545, CrNV-61-546, CrNV-61-547, CrNV-61-548, Noyes P, Noyes Q, and Noyes X) contained diagnostic Prearchaic artifacts, including GBF projectile points, BRCB projectile points, GBSS projectile points, and crescents. While these are the most significant sites in this study, all sites containing diagnostic projectile points (with the addition of CrNV-61-532, n=17; Table 3.2) are relevant as they speak to when and how peoples utilized the landscape. All details regarding the location and archaeological contents of these 17 previously recorded sites come from Noyes. Five of these sites (CrNV-61-543, CrNV-61-545, CrNV-61-546, CrNV-61-547, CrNV-61-548) were predominantly recorded and collected by the Lowes, but as these other records were not available, I relied solely upon data gathered by Noyes. Additionally, the locations of each site, associations with geologic and pluvial landforms, elevation, and diagnostic artifacts of each are detailed to address my research goals. Assertions of artifact association with beach ridges or geologically active areas are taken from Dickerson (2006, 2009) when that fact was not made obvious during field reconnaissance.

CrNV-61-530 (26NY2112). CrNV-61-530 is located near the junction of the eastern road and the Mud Lake playa at an elevation of 1,581 m. A total of 131 artifacts were originally identified, including one GBSS Lake Mojave projectile point, one GBSS Silver Lake projectile point, six GBSS Ovate projectile points, one crescent, 14 Gatecliff Split Stem projectile points, two Elko Corner-notched projectile points, 11 indeterminate point fragments, 21 bifaces, three gravers, and 46 scrapers.

CrNV-61-532 (26NY2114). CrNV-61-532 is located at the junction of the central access road and the northern margin of the playa along a slight terrace at an elevation of 1,581 m. Four artifacts were identified, including two Gatecliff Split Stem projectile points and two scrapers.

CrNV-61-533 (26NY2115). CrNV-61-533 is located near the junction of the central access road and the northern margin of the playa along a slight terrace at an elevation of 1,581 m. A total of 36 artifacts were originally identified, including one GBSS Lake Mojave projectile point, two GBSS Silver Lake projectile points, seven Gatecliff Split Stem projectile points, two indeterminate point fragments, 10 bifaces, and 11 scrapers.

CrNV-61-534 (26NY2116). CrNV-61-534 is located at the junction of the central access road and the northern margin of the playa along a slight terrace at an elevation of 1,581 m. A total of 41 artifacts were originally identified, including one GBF projectile point, one GBSS Lake Mojave projectile point, two GBSS Ovate projectile points, one

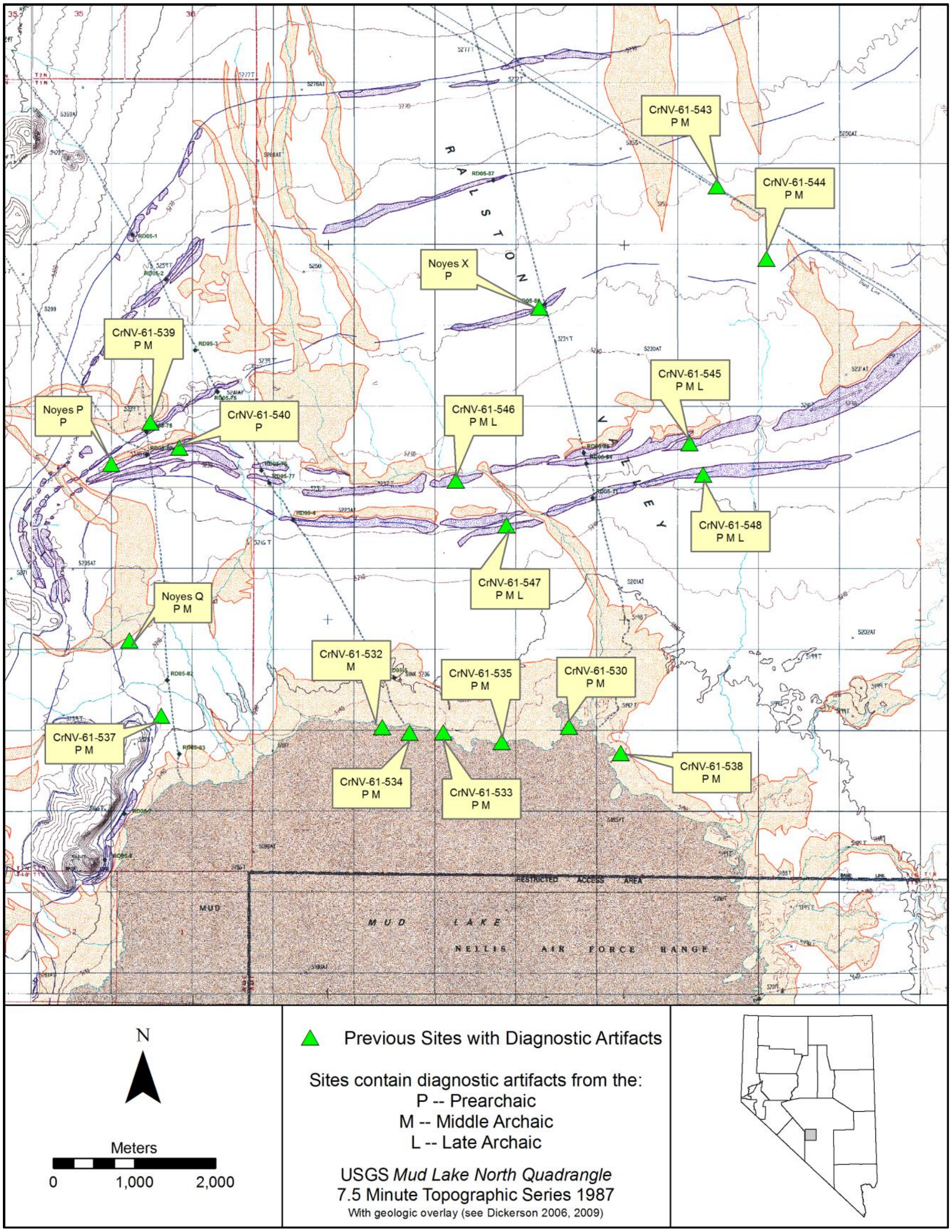

Figure 3.2. Previously identified sites containing temporally diagnostic projectile points in a one-mile radius of the Mud Lake project area.

Table 3.1. Previously identified surface sites within a one-mile radius of the Mud Lake project area which contain temporally diagnostic projectile points.

Agency / Noyes Site Number	**Cultural Affiliation**
CrNV-61-530 (26NY2112)	Prearchaic and Middle Archaic
CrNV-61-532 (26NY2114)	Middle Archaic
CrNV-61-533 (26NY2115)	Prearchaic and Middle Archaic
CrNV-61-534 (26NY2116)	Prearchaic and Middle Archaic
CrNV-61-535 (26NY2117)	Prearchaic and Middle Archaic
CrNV-61-537 (26NY2119)	Prearchaic and Middle Archaic
CrNV-61-538 (26NY2120)	Prearchaic and Middle Archaic
CrNV-61-539 (26NY2121)	Prearchaic and Middle Archaic
CrNV-61-540 (26NY2122)	Prearchaic
CrNV-61-543 (26NY2125)	Prearchaic and Middle Archaic
CrNV-61-545 (26NY2127)	Prearchaic, Middle and Late Archaic
CrNV-61-546 (26NY2128)	Prearchaic, Middle and Late Archaic
CrNV-61-547 (26NY2129)	Prearchaic, Middle and Late Archaic
CrNV-61-548 (26NY2130)	Prearchaic, Middle and Late Archaic
Noyes P	Prearchaic
Noyes Q	Prearchaic and Middle Archaic
Noyes X	Prearchaic

crescent, five Gatecliff Split Stem projectile points, seven indeterminate point fragments, one biface, one graver, and 16 scrapers.

CrNV-61-535 (26NY2117). CrNV-61-535 is located along the northern margin of the playa along a slight terrace along the playa margin at an elevation of 1,581 m. A total of 68 artifacts were originally identified, including one GBSS Cougar Mountain projectile point, one GBSS Lake Mojave projectile point, two GBSS Silver Lake projectile points, 10 indeterminate GBSS projectile points, 20 Gatecliff Split Stem projectile points, eight indeterminate point fragments, one biface, one graver, and 22 scrapers.

CrNV-61-537 (26NY2119). CrNV-61-537 is located northwest of the Mud Lake playa at the base of a steep ridge in close proximity to the western access road at an elevation of 1,591 m. A total of 212 artifacts were originally identified, including two

BRCB projectile points, four GBSS Lake Mojave projectile points, 43 GBSS Silver Lake projectile points, three GBSS Windust projectile points, two GBSS Ovate projectile points, seven indeterminate GBSS projectile points, one crescent, five Gatecliff Split Stem projectile points, 38 indeterminate point fragments, 25 bifaces, three cores, one graver, and 64 scrapers.

CrNV-61-538 (26NY2120). CrNV-61-538 is located along the eastern periphery of the Mud Lake playa east of the eastern access road at an elevation of 1,581 m. A total of 39 artifacts were originally identified, including one indeterminate GBSS projectile point, one crescent, one Gatecliff Split Stem projectile point, one indeterminate point fragment, five bifaces, and 28 scrapers.

CrNV-61-539 (26NY2121). CrNV-61-539 is located near the western access road to the Mud Lake playa where the Lowengruhn ridges, Ridges A and B, align closely with Ridge C, at an elevation of 1,597 m. A total of 76 artifacts were originally identified, including one BRCB projectile point, eight GBSS Silver Lake projectile points, three indeterminate GBSS projectile points, one Gatecliff Split Stem projectile point, nine indeterminate point fragments, six bifaces, one core, four gravers, and 34 scrapers.

CrNV-61-540 (26NY2122). CrNV-61-540 is located along Ridge B near the western access road to the Mud Lake playa at an elevation of 1,595 m. A total of three artifacts were originally identified, including two GBSS Lake Mojave projectile points and one GBSS Silver Lake projectile point.

CrNV-61-543 (26NY2125). CrNV-61-543 is located between Ridges C and D at the intersection of the power lines and the western access road at an elevation of 1,600 m.

A total of 76 artifacts were originally identified, including four BRCB projectile points, one GBSS Cougar Mountain projectile point, four GBSS Lake Mojave projectile points, one GBSS Silver Lake projectile point, one GBSS Ovate projectile point, three indeterminate GBSS projectile points, one Gatecliff Split Stem projectile point, two gravers, and two scrapers.

CrNV-61-545 (26NY2127). CrNV-61-545 is located on Ridge B at an elevation of 1,595 m. A total of 23 artifacts were originally identified, including one BRCB projectile point, two GBSS Lake Mojave projectile points, two GBSS Silver Lake projectile points, one GBSS Ovate projectile point, two indeterminate GBSS projectile points, once crescent, one Gatecliff Split Stem projectile point, one Elko Eared projectile point, two Rosegate Corner-notched projectile points, five indeterminate point fragments, one biface, two gravers, and two scrapers.

CrNV-61-546 (26NY2128). CrNV-61-546 is located on Ridge B at an elevation of 1,595 m. A total of 21 artifacts were originally identified, including one BRCB projectile point, one GBSS Lake Mojave projectile point, one GBSS Silver Lake projectile point, two GBSS Ovate projectile points, three indeterminate GBSS projectile points, one Gatecliff Split Stem projectile point, one Elko Eared projectile point, one Rosegate Corner-notched projectile point, five indeterminate point fragments, two bifaces, one graver, and two scrapers.

CrNV-61-547 (26NY2129). CrNV-61-547 is located on Ridge A at an elevation of 1,591 m. A total of 27 artifacts were originally identified, including two BRCB projectile points, two GBSS Lake Mojave projectile points, two GBSS Silver Lake projectile points, two GBSS Ovate projectile points, four indeterminate GBSS projectile points, one crescent, two Gatecliff Split Stem projectile points, one Elko Corner-notched projectile point, one Rosegate Corner-notched projectile point, five indeterminate point fragments, two bifaces, one graver, and two scrapers.

CrNV-61-548 (26NY2130). CrNV-61-548 is located on Ridge A at an elevation of 1,592 m. A total of 35 artifacts were originally identified, including two GBF projectile points, two BRCB projectile points, one GBSS Cougar Mountain projectile point, two GBSS Lake Mojave projectile points, two GBSS Silver Lake projectile points, three GBSS Ovate projectile points, three indeterminate GBSS projectile points, one crescent, one Gatecliff Split Stem projectile point, one Elko Eared projectile point, two Rosegate Corner-notched projectile points, eight indeterminate point fragments, one biface, one graver, and two scrapers.

Noyes P. While not reported to the BLM, this site was well documented by Noyes. Noyes P is located on the northern periphery of the Mud Lake basin along the crests and between Ridges A and B at an elevation of 1,597 m. A total of 40 artifacts were originally identified, including two GBF projectile points, one BRCB projectile point, two GBSS Silver Lake projectile points, two GBSS Ovate projectile points, four indeterminate GBSS projectile points, nine indeterminate point fragments, two bifaces, one core, one graver, and 15 scrapers.

Noyes Q. While not reported to the BLM, this site was also well documented by Noyes. Noyes Q is located on the northern periphery of the Mud Lake basin on a slight terrace between Ridge A and the playa at an elevation of 1,591 m. A total of 98 artifacts were originally identified, including four BRCB projectile points, nine GBSS Silver Lake projectile points, one GBSS Ovate projectile point, four indeterminate GBSS projectile

Table 3.2. Frequencies of tools present at Previously Recorded sites. "-" denotes absence of artifact class at a site. Gatecliff = Gatecliff Split Stem; Elko = Elko Corner-notched and Elko Eared; Rosegate = Rosegate Corner-notched; Indeterminate = all indeterminate projectile point fragments. See Chapter 2 for a discussion of these tools types.

	Diagnostic Artifacts							Other Artifacts				
Site Number	**GBF**	**GBSS**	**BRCB**	**Crescents**	**Gatecliff**	**Elko**	**Rosegate**	**Biface**	**Cores**	**Graver**	**Indeterminate**	**Scraper**
CrNV-61-530	-	8	-	1	14	2	-	21	-	3	11	46
CrNV-61-532	-	-	-	-	2	-	-	-	-	-	-	2
CrNV-61-533	-	3	-	-	7	-	-	10	-	-	2	11
CrNV-61-534	1	3	-	1	5	-	-	3	-	1	7	16
CrNV-61-535	-	14	-	-	20	-	-	1	-	1	8	22
CrNV-61-537	-	59	2	1	5	-	-	25	3	1	38	64
CrNV-61-538	-	1	-	1	1	-	-	5	-	-	1	28
CrNV-61-539	-	11	1	-	1	-	-	6	1	4	9	34
CrNV-61-540	-	3	-	-	-	-	-	-	-	-	-	-
CrNV-61-543	-	11	4	-	1	-	-	-	-	2	-	2
CrNV-61-545	-	7	1	1	1	1	2	1	-	2	5	2
CrNV-61-546	-	7	1	-	1	1	1	2	-	1	5	2
CrNV-61-547	-	10	2	1	2	1	1	2	-	1	5	2
CrNV-61-548	2	11	2	1	1	1	2	1	-	1	8	2
Noyes P	2	9	-	-	-	-	-	2	1	1	9	15
Noyes Q	-	14	4	3	1	-	-	4	1	8	21	29
Noyes X	2	9	1	1	-	-	-	1	-	1	1	4
Totals	**7**	**180**	**18**	**11**	**62**	**6**	**6**	**84**	**6**	**27**	**130**	**281**

points, three crescents, one Gatecliff Split Stem projectile point, 21 indeterminate point fragments, four bifaces, one core, eight gravers, and 29 scrapers.

Noyes X. While not reported to the BLM, this site too was well documented by Noyes. Noyes X is located on the northern periphery of the Mud Lake basin on a segment of Ridge C that has not been truncated by the encroaching alluvial fan, at an elevation of 1,597 m. A total of 22 artifacts were originally identified, including two GBF projectile points, one BRCB projectile point, one GBSS Lake Mojave projectile point, three GBSS Silver Lake projectile points, five indeterminate GBSS projectile points, one crescent, one indeterminate point fragment, one biface, one graver, and four scrapers.

Recent Research

During the 2009 field season at Mud Lake, 24 archaeological sites were recorded. Of all sites recorded during that project, 19 contained diagnostic artifacts, including Prearchaic points (CrNV-61-14910, CrNV-61-14911, CrNV-61-14913, CrNV-61-14914, CrNV-61-14915, CrNV-61-14916, CrNV-61-14917, CrNV-61-14919, CrNV-61-14920, CrNV-61-14921, CrNV-61-14922, CrNV-61-14923, CrNV-61-14924, CrNV-61-14927, CrNV-61-14928, CrNV-61-14929, CrNV-61-14930, CrNV-61-14931, and CrNV-61-14932; see Figure 3.3 and Table 3.3). Several of these sites (n=5) were re-recorded sites previously identified by Noyes and the Lowes (CrNV-61-537, CrNV-61-540, CrNV-61-543, CrNV-61-545, CrNV-61-548), but per the request of the BLM they were assigned new trinomials (CrNV-61-14915, CrNV-61-14929, CrNV-61-14930, CrNV-61-14932, and CrNV-61-14933) to distinguish between the new survey project and those recorded by the local avocational archaeologists. Additionally, the three sites previously lacking trinomials (Noyes P, Noyes Q, Noyes X) were recorded by SARF, for a total of eight re-recorded sites (Table 3.4).

When combined, the sites recorded by avocational archaeologists and SARF total 46 sites in the Mud Lake study area, 30 of which contain diagnostic artifacts. Of those, all but one contain Prearchaic components (n=29; Table 3.5). In addition to the archaeological sites, 14 diagnostic IFs (15 total projectile point fragments) were found by

Table 3.3. New archaeological sites at Mud Lake which contain temporally diagnostic projectile points.

Agency Number	**State Number**	**Cultural Affiliation**
CrNV-61-14910	26NY14000	Prearchaic
CrNV-61-14911	26NY14001	Prearchaic
CrNV-61-14913	26NY14003	Prearchaic
CrNV-61-14914	26NY14004	Prearchaic and Middle Archaic
CrNV-61-14915	26NY14005	Prearchaic
CrNV-61-14916	26NY14006	Prearchaic and Middle Archaic
CrNV-61-14917	26NY14007	Prearchaic and Proto-Historic
CrNV-61-14919	26NY14009	Prearchaic and Middle Archaic
CrNV-61-14920	26NY14010	Prearchaic
CrNV-61-14921	26NY14011	Prearchaic
CrNV-61-14922	26NY14012	Prearchaic
CrNV-61-14923	26NY14013	Prearchaic
CrNV-61-14924	26NY14014	Prearchaic
CrNV-61-14927	26NY14017	Prearchaic
CrNV-61-14928	26NY14018	Prearchaic and Middle Archaic
CrNV-61-14929	26NY14019	Prearchaic
CrNV-61-14930	26NY14020	Prearchaic
CrNV-61-14931	26NY14021	Prearchaic
CrNV-61-14932	26NY14022	Prearchaic

SARF, including nine containing Prearchaic artifacts (Table 3.6). Again, associated geologic and pluvial contexts, elevation, and temporal descriptions for each diagnostic locality are detailed for the sake of addressing my research goals.

CrNV-61-14910 (26NY14000). CrNV-61-14910 is a small lithic scatter located on the northern periphery of the Mud Lake basin between Ridges B and C at an elevation of 1,595 m. The relatively dense vegetation consists of sagebrush, hopsage, rabbitbrush, and prince's plume. Artifacts are sparsely distributed across the site (1 flake/m^2) with one small concentration of 10 flakes observed. Debitage (n=50) consists entirely of obsidian, from at least two sources based upon color and transparency. One tool, a GBSS Lake Mojave projectile point (FS-1) was observed on site, and thus dates the site to the Prearchaic period.

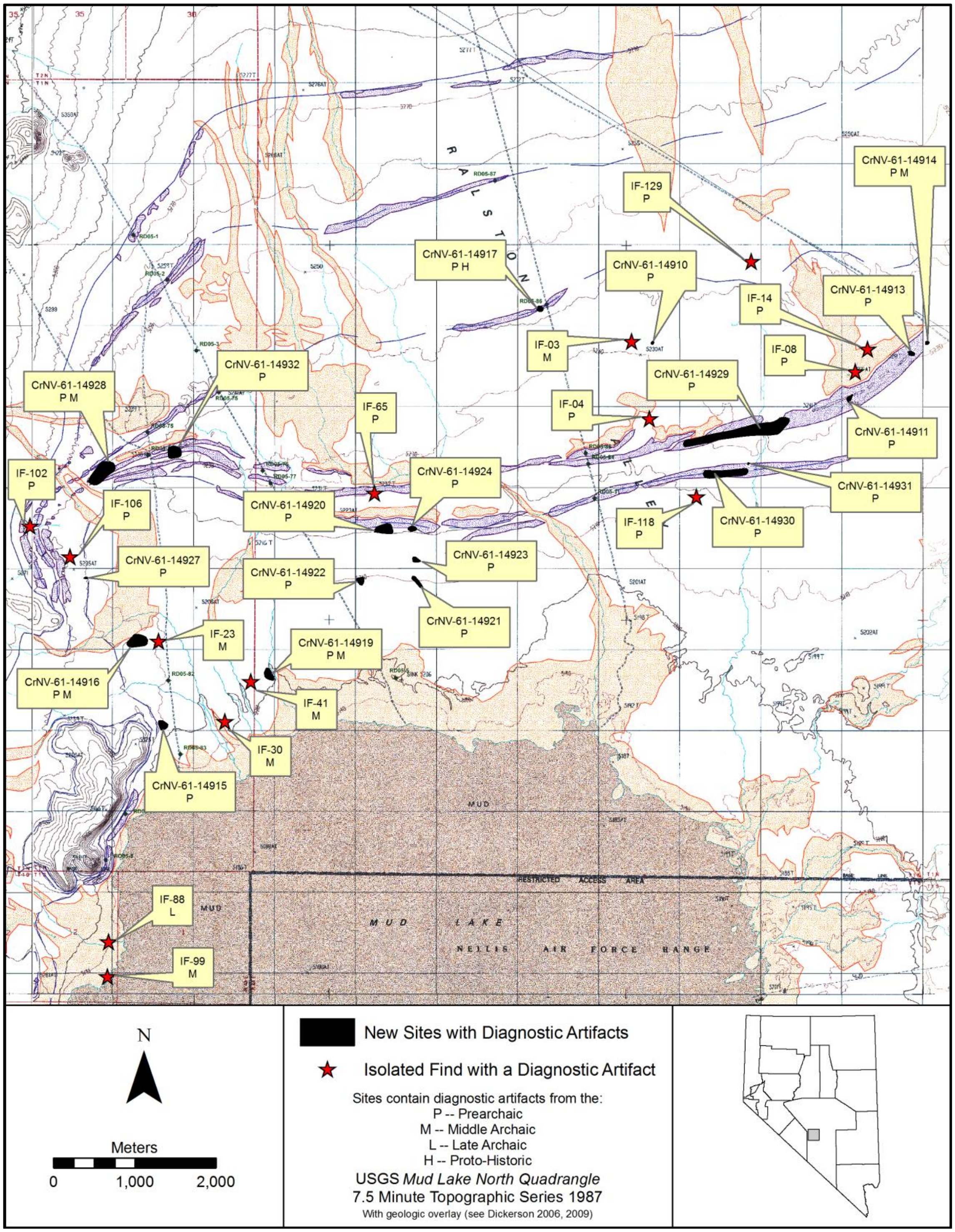

Figure 3.3. New archaeological sites and IFs at Mud Lake that contain temporally diagnostic projectile points.

Table 3.4. Correlation of the previously recorded sites by avocational archaeologists to their new trinomials as recorded by SARF.

Previous Site Identifier	New Trinomial
CrNV-61-537	CrNV-61-14915
CrNV-61-540	CrNV-61-14932
CrNV-61-543	CrNV-61-14933 [1]
CrNV-61-545	CrNV-61-14929
CrNV-61-548	CrNV-61-14930
Noyes P	CrNV-61-14928
Noyes Q	CrNV-61-14916
Noyes X	CrNV-61-14917

[1] SARF site CrNV-61-14933 was recorded as not containing any temporally diagnostic tools and as a result is not discussed in this section of new archaeological sites.

CrNV-61-14911 (26NY14001). CrNV-61-14911 is a small lithic scatter located on the northwestern periphery of the Mud Lake basin on Ridge B at an elevation of 1,595 m. The sparse vegetation consists of sagebrush, hopsage, and rabbitbrush. Debitage (n=50) consists primarily of obsidian with CCS and fine-grained volcanic rock (FGVR) also present, and is low in density (1 flake/m^2). The five tools identified on site consist of two semi-translucent obsidian bifaces (FS-1 and FS-2), a FGVR indeterminate GBSS projectile point fragment (FS-3), and two obsidian utilized flakes (FS-4 and FS-5). Based upon the presence of the diagnostic projectile point, this site dates to the Prearchaic period.

CrNV-61-14913 (26NY14003). CrNV-61-14913 is a small lithic scatter located on the northwestern periphery of the Mud Lake basin on Ridge B at an elevation of 1,595 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, and various bunch grasses including blue bunch wheat grass. Debitage (n=80) consists primarily of obsidian and CCS with FGVR also present, and is moderately dense (3 flakes/m^2). The six tools identified on site consist of a translucent obsidian biface (FS-1), a red CCS biface (FS-2),

Table 3.5. All sites with diagnostic artifacts at Mud Lake.

Agency Number	Cultural Affiliation
CrNV-61-530	Prearchaic and Middle Archaic
CrNV-61-532	Middle Archaic
CrNV-61-533	Prearchaic and Middle Archaic
CrNV-61-534	Prearchaic and Middle Archaic
CrNV-61-535	Prearchaic and Middle Archaic
CrNV-61-536	Prearchaic and Middle Archaic
CrNV-61-537/CrNV-61-14915	Prearchaic and Middle Archaic
CrNV-61-538	Prearchaic and Middle Archaic
CrNV-61-539	Prearchaic and Middle Archaic
CrNV-61-540/CrNV-61-14932	Prearchaic
CrNV-61-543/CrNV-61-14933	Prearchaic and Middle Archaic
CrNV-61-545/CrNV-61-14929	Prearchaic, Middle and Late Archaic
CrNV-61-546	Prearchaic, Middle and Late Archaic
CrNV-61-547	Prearchaic, Middle and Late Archaic
CrNV-61-548/CrNV-61-14930	Prearchaic, Middle and Late Archaic
CrNV-61-14910	Prearchaic
CrNV-61-14911	Prearchaic
CrNV-61-14913	Prearchaic
CrNV-61-14914	Prearchaic and Middle Archaic
CrNV-61-14916	Prearchaic and Middle Archaic
CrNV-61-14917	Prearchaic and Proto-Historic
CrNV-61-14919	Prearchaic and Middle Archaic
CrNV-61-14920	Prearchaic
CrNV-61-14921	Prearchaic
CrNV-61-14922	Prearchaic
CrNV-61-14923	Prearchaic
CrNV-61-14924	Prearchaic
CrNV-61-14927	Prearchaic
CrNV-61-14928	Prearchaic and Middle Archaic
CrNV-61-14931	Prearchaic
IF-03	Middle Archaic
IF-04	Prearchaic
IF-08	Prearchaic
IF-14	Prearchaic
IF-23	Middle Archaic
IF-30	Middle Archaic
IF-41	Middle Archaic
IF-65	Prearchaic
IF-88	Late Archaic
IF-99	Middle Archaic
IF-102	Prearchaic
IF-106	Prearchaic
IF-118	Prearchaic
IF-129	Prearchaic

a translucent obsidian indeterminate medial GBSS projectile point fragment (FS-3), a banded, semi-translucent obsidian GBF projectile point (FS-4), a FGVR uniface (FS-5), and an obsidian utilized flake (FS-6). Upon request from the Tonopah Field Office, the GBF projectile point was collected. Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14914 (26NY14004). CrNV-61-14914 is a small lithic scatter located on the northwestern periphery of the Mud Lake basin on Ridge B at an elevation of 1,595 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, and various bunch grasses including blue bunch wheat grass. Debitage (n=50) consists primarily of CCS and FGVR with obsidian also present, and is relatively dense (6 flakes/m^2). The two tools identified on site consist of an olive-green CCS Elko Corner-notched projectile point (FS-1) and a black obsidian indeterminate GBSS projectile point fragment (FS-2). Based upon the presence of diagnostic projectile points, this site dates to both the Prearchaic and Middle Archaic time periods.

CrNV-61-14915 (26NY14005). CrNV-61-14915 is a lithic scatter located on the northern periphery of the Mud Lake basin along a narrow toe extending east from a volcanic ridge, at an elevation of 1,591 m. The site has been truncated by a slight ephemeral wash extending from the northern to the southeastern portion of the site. The vegetation consists of sagebrush and hopsage, and is considerably less dense along the talus slope. Debitage (n=100) consists primarily of obsidian and CCS with FGVR also present, and is moderately dense (3 flakes/m^2). The 11 tools identified on site consist of three CCS bifaces (FS-1, FS-2, and FS-5), two obsidian bifaces (FS-3 and FS-4), two black obsidian GBSS Silver Lake projectile points (FS-6 and FS-7), a FGVR indeterminate GBSS stem fragment (FS-8), a white/pink CCS indeterminate point fragment (FS-9), a white/brown CCS scraper (FS-10), and a white/orange CCS uniface (FS-11). In addition, four cores, two CCS, one quartzite, and one FGVR, were also identified. Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14916 (26NY14006). CrNV-61-14916 is a large lithic scatter located on the northern periphery of the Mud Lake basin on a slight terrace between Ridge A and the playa at an elevation of 1,591 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, and various bunch grasses including blue bunch wheat grass. Debitage (n=500) consists primarily of obsidian and CCS, and is relatively dense (7 flakes/m^2). Numerous small concentrations exist, with higher proportions of obsidian identified in the east side of the site and higher proportions of CCS to the west. The nine tools identified on site consist of two obsidian bifaces (FS-1 and FS-2), a white/gray CCS BRCB projectile point (FS-3), a semi-transparent obsidian BRCB projectile point (FS-4), a black obsidian Elko Corner-notched projectile point (FS-5), an opaque obsidian GBSS Parman projectile point (FS-6), a FGVR GBSS Silver Lake projectile point (FS-7), a black obsidian GBSS Silver Lake projectile point (FS-8), and a red/pink banded CCS scraper (FS-9). In addition, three white/orange CCS cores were also identified. Based upon the presence of diagnostic projectile points, this site dates to both the Prearchaic and Middle Archaic periods.

CrNV-61-14917 (26NY14007). CrNV-61-14917 is a small lithic scatter located on the northern periphery of the Mud Lake basin on a segment of Ridge C that has not been truncated by the encroaching alluvial fan, at an elevation of 1,597 m. The relatively dense vegetation consists of sagebrush, hopsage, rabbitbrush, and prince's plume. Debitage (n=35) consists primarily of CCS with obsidian also present, and is low in density (1 flake/m^2). The nine tools identified on site consist of a semi-translucent obsidian biface (FS-1), a white quartz Cottonwood Leaf-shape projectile point (FS-2), a gray/green CCS graver (FS-3), a semi-translucent obsidian indeterminate GBSS projectile point fragment (FS-4), a FGVR indeterminate projectile point fragment (FS-5), and a white/gray CCS scraper (FS-6). In addition, one white/orange CCS core was also identified. Based upon the presence of diagnostic projectile points, this site dates to both the Prearchaic and Proto-historic periods.

CrNV-61-14919 (26NY14009). CrNV-61-14919 is a large, sparse lithic scatter located on the northwestern periphery of the Mud Lake basin at the confluence of several meandering ephemeral washes at the edge of the playa, south of a low beach terrace which slopes to the north at an elevation of 1,586 m. The sparse vegetation consists of sagebrush, hopsage, and rabbitbrush. Debitage (n=100) consists primarily of obsidian and CCS with FGVR also present, and is low in density (2 flakes/m^2). The 10 tools identified on site consist of four obsidian bifaces (FS-1–FS-4), an opaque obsidian Gatecliff Split Stem projectile point (FS-5), a black obsidian GBSS Windust projectile point (FS-6), a granite groundstone fragment (FS-7), three fragments of granite fire cracked rock (FS-8), an opaque obsidian indeterminate projectile point fragment (FS-9), and a dark red CCS scraper (FS-10). In addition, three cores, one CCS, one quartzite, and one obsidian, were also identified. Based upon the presence of diagnostic projectile points, this site dates to both the Prearchaic and Middle Archaic periods.

CrNV-61-14920 (26NY14010). CrNV-61-14920 is a large lithic scatter located on the northern periphery of the Mud Lake basin along the crest of Ridge A at an elevation of 1,591 m. The relatively dense vegetation consists of sagebrush, hopsage, rabbitbrush, and prince's plume. Debitage (n=150) consists primarily of CCS with basalt, obsidian, and FGVR also present, and is moderately dense (3 flakes/m^2). The 13 tools identified on site consist of three CCS bifaces (FS-1, FS-4, and FS-5), three obsidian bifaces (FS-2, FS-3, and FS-6), a light pink CCS graver (FS-7), a black obsidian GBSS Lake Mojave projectile point (FS-8), four obsidian GBSS Silver Lake projectile points (FS-9–FS-12), and a FGVR indeterminate GBSS projectile point fragment (FS-13). Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14921 (26NY14011). CrNV-61-14921 is a small lithic scatter located on the northern periphery of the Mud Lake basin between Ridge A and the playa at an elevation of 1,588 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=50) consists primarily of obsidian with CCS also present, and is moderately dense (3 flakes/m^2). The five tools identified on site consist of two black obsidian GBSS Windust projectile points (FS-1 and FS-2), two CCS scrapers (FS-3 and FS-4), and a white CCS uniface (FS-5). In addition, one CCS core was also identified. Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14922 (26NY14012). CrNV-61-14922 is a small lithic scatter located on the northern periphery of the Mud Lake basin between Ridge A and the playa at an elevation of 1,588 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=150) consists primarily of obsidian and CCS with FGVR also present, and is low in density (2 flakes/m^2). The four tools identified on site consist of two opaque obsidian bifaces (FS-1 and FS-2), a black obsidian GBSS Windust projectile point (FS-3), and a dark red banded CCS GBSS Windust projectile point (FS-4). In addition, one CCS core was also identified. Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14923 (26NY14013). CrNV-61-14923 is a small lithic scatter located on the northern periphery of the Mud Lake basin between Ridge A and the playa at an elevation of 1,589 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=100) consists primarily of obsidian with CCS also present, and is low in density (2 flakes/m^2). The one tool identified on site consists of a pink/orange GBSS Windust projectile point (FS-1), and thus dates the site to the Prearchaic period.

CrNV-61-14924 (26NY14014). CrNV-61-14924 is a small lithic scatter located on the northern periphery of the Mud Lake basin along the crest of Ridge A at an elevation of 1,591 m. The relatively dense vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=200) consists of nearly all obsidian with CCS present but rare, and is low in density (2 flakes/m^2). The five tools identified on site consist of two obsidian bifaces (FS-1 and FS-2), two obsidian indeterminate GBSS projectile point fragments (FS-3 and FS-4), and an opaque obsidian indeterminate projectile point fragment (FS-5). Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14927 (26NY14017). CrNV-61-14927 is a small lithic scatter located on the northwestern periphery of the Mud Lake basin on a colluvial bench south of a deeply incised channel covered with desert pavement of volcanic cobbles and pebbles at an elevation of 1,591 m. The sparse vegetation consists of sagebrush and hopsage. Debitage (n=15) consists of obsidian and CCS, and is low in density (1 flake/m^2). The five tools identified on site consist of a white/orange/gray CCS biface (FS-1), a white/orange/gray CCS GBSS Cougar Mountain projectile point (FS-2), a black obsidian indeterminate GBSS projectile point fragment (FS-3), a white/orange/gray CCS indeterminate projectile point tip fragment (FS-4), and a white/orange/gray CCS scraper (FS-5). Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14928 (26NY14018). CrNV-61-14928 is a large, sparse lithic scatter located on the northern periphery of the Mud Lake basin along the crests and between Ridges A and B at an elevation of 1,597 m. The sparse vegetation consists of sagebrush and hopsage. Debitage (n=500) consists of obsidian and CCS with FGVR also present, and is relatively dense (8 flakes/m^2). The 23 tools identified on site consist of nine obsidian bifaces (FS-1, FS-2–FS-10), a FGVR biface (FS-2), a semi-translucent obsidian GBSS Parman projectile point (FS-11), a tan/gray CCS GBSS Parman projectile point (FS-12), a black obsidian indeterminate GBSS projectile point fragment (FS-13), a FGVR indeterminate GBSS projectile point fragments (FS-14), a gray/black CCS Humboldt Concave Base projectile point (FS-15), two obsidian indeterminate projectile point fragments (FS-16 and FS-17), five CCS scrapers (FS-18–FS-20, FS-22, and FS-23), and a black obsidian scraper (FS-21). Based upon the presence of diagnostic projectile points, this site dates to both the Prearchaic and Middle Archaic periods.

CrNV-61-14929 (26NY14019). CrNV-61-14929 is a large and dense lithic scatter located on the northern periphery of the Mud Lake basin along the crest and down both the northern and southern slopes of Ridge B at an elevation of 1,594 m. Along the eastern portion of the site a segment of the ridge has been truncated by an ephemeral wash, beyond which the site continues for a short distance towards its eastern boundary. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=1,300) consists of obsidian and CCS with FGVR also present, and is very dense (12 flakes/m^2). The 79 tools identified consist of 15 CCS bifaces (FS-1, FS-3, FS-16, FS-17, FS-19, FS-27, FS-28, FS-29, FS-31, FS-37, FS-39, FS-41, FS-43, FS-46, and FS-48), 24 obsidian bifaces (FS-2, FS-4, FS-5, FS-7, FS-10, FS-12, FS-13, FS-15, FS-18, FS-20–FS-23, FS-25, FS-30, FS-32–FS-36, FS-38, FS-40, FS-45, and FS-47), nine FGVR bifaces (FS-6, FS-8, FS-9, FS-11, FS-14, FS-24, FS-26, FS-42, and FS-44), a dark red CCS BRCB projectile point (FS-49), two CCS gravers (FS-50 and FS-51), a white/pink CCS GBSS Cougar Mountain projectile point (FS-52), a brown/orange CCS GBSS Lake Mojave projectile point (FS-53), an opaque obsidian GBSS Silver Lake projectile point (FS-54), two FGVR indeterminate GBSS projectile point fragments (FS-55 and FS-59), three obsidian indeterminate GBSS projectile point fragments (FS-56–FS-58), four CCS indeterminate projectile point fragments (FS-60–FS-61 and FS-64–FS-65), an obsidian indeterminate projectile point fragment (FS-62), a FGVR indeterminate projectile point fragment (FS-63), 13 CCS scrapers (FS-66–FS-73 and FS-75–FS-79), and a FGVR scraper (FS-74).

Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14930 (26NY14020). CrNV-61-14930 is a large lithic scatter located on the northern periphery of the Mud Lake basin along the crest and down both the northern and southern slopes of Ridge A at an elevation of 1,592 m. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=250) consists of obsidian and CCS with FGVR and basalt also present, and is relatively dense (8 flakes/m^2). The 21 tools identified on site consist of three CCS bifaces (FS-1, FS-5, and FS-9), seven obsidian bifaces (FS-2–FS-4, FS-6, FS-7, FS-10, and FS-11), three FGVR bifaces (FS-8, FS-12, and FS-13), a pink/gray/brown CCS graver (FS-14), a light pink/orange GBSS Cougar Mountain projectile point (FS-15), two CCS indeterminate GBSS projectile point fragments (FS-16 and FS-21), an obsidian indeterminate GBSS projectile point fragment (FS-17), and three FGVR indeterminate GBSS projectile point fragments (FS-18–FS-20). Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14931 (26NY14021). CrNV-61-14931 is a small lithic scatter located on the northern periphery of the Mud Lake basin within the low area between Ridges A and B, at an elevation of 1,593 m. The site is bounded by an ephemeral wash roughly 50 m to the east. The sparse vegetation consists of sagebrush, hopsage, rabbitbrush, prince's plume, and various bunch grasses including blue bunch wheat grass. Debitage (n=15) consists of CCS with obsidian and basalt also present, and is low in density (1 flake/m^2). The three tools identified on site consist of two CCS bifaces (FS-1 and FS-2) and an

Table 3.6. Frequencies of tools present at newly recorded sites. "-" denotes absence of artifact class at a site. Gatecliff = Gatecliff Contracting Stem and Gatecliff Split Stem; Elko = Elko Corner-notched and Elko Eared; Cottonwood = Cottonwood Triangular; Indeterminate = all indeterminate projectile point fragments. See Chapter 2 for a discussion of these tools types.

	Diagnostic Artifacts							**Other Artifacts**							
Agency Site Number	**GBSS**	**BRCB**	**GBF**	**Gatecliff**	**Humboldt**	**Elko**	**Cottonwood**	**Biface**	**Cores**	**Graver**	**Groundstone**	**Indeterminate**	**Scraper**	**Uniface**	**Total**
CrNV-61-14910	1	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
CrNV-61-14911	1	-	-	-	-	-	-	2	-	-	-	-	-	-	**5**
CrNV-61-14913	1	-	1	-	-	-	-	2	-	-	-	-	-	1	**6**
CrNV-61-14914	1	-	-	-	-	1	-	-	-	-	-	-	-	-	**2**
CrNV-61-14915	3	-	-	-	-	-	-	5	4	-	-	1	1	1	**15**
CrNV-61-14916	3	2	-	-	-	1	-	2	3	-	-	-	1	-	**12**
CrNV-61-14917	1	-	-	-	-	-	1	1	1	1	-	1	1	-	**8**
CrNV-61-14919	1	-	-	1	-	-	-	4	3	-	2	1	1	-	**13**
CrNV-61-14920	6	-	-	-	-	-	-	6	-	1	-	-	-	-	**13**
CrNV-61-14921	2	-	-	-	-	-	-	2	1	-	-	-	1	-	**6**
CrNV-61-14922	2	-	-	-	-	-	-	2	-	-	-	-	-	-	**4**
CrNV-61-14923	1	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
CrNV-61-14924	2	-	-	-	-	-	-	2	-	-	-	1	-	-	**5**
CrNV-61-14927	2	-	-	-	-	-	-	1	-	-	-	1	1	-	**5**
CrNV-61-14928	4	-	-	-	1	-	-	10	-	-	-	2	6	-	**23**
CrNV-61-14929	8	1	-	-	-	-	-	48	-	2	-	6	14	-	**79**
CrNV-61-14930	7	-	-	-	-	-	-	13	-	1	-	-	-	-	**21**
CrNV-61-14931	-	1	-	-	-	-	-	2	-	-	-	-	-	-	**3**
CrNV-61-14932	2	-	-	-	-	-	-	2	-	-	-	1	-	-	**5**
Total	**48**	**4**	**1**	**1**	**1**	**2**	**1**	**105**	**12**	**5**	**2**	**14**	**26**	**2**	**227**

orange/brown banded CCS BRCB projectile point (FS-3). Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

CrNV-61-14932 (26NY14022). CrNV-61-14932 is a small lithic scatter located on the northern periphery of the Mud Lake basin along the crest and down both the northern and southern slopes of Ridge B at an elevation of 1,595 m. The sparse vegetation consists of sagebrush, hopsage, and prince's plume. Debitage (n=150) consists of CCS with obsidian and FGVR also present, and is low in density (1 flake/m^2).

The five tools identified on site consist of a black obsidian biface (FS-1), an orange/brown CCS biface (FS-2), a black obsidian GBSS Parman projectile point (FS-3), a semi-translucent, banded obsidian GBSS Silver Lake projectile point (FS-4), and an orange/brown CCS indeterminate projectile point fragment (FS-5). Based upon the presence of diagnostic projectile points, this site dates to the Prearchaic period.

While archaeological sites may be more indicative of prehistoric occupation duration and intensity, the presence of temporally diagnostic artifacts in an isolated context are also capable of indicating what landforms were available through time and as such are discussed below. This information is summarized in Table 3.7.

IF-03. IF-03 is an obsidian Elko Corner-notched projectile point that lies between Ridge B and Ridge C at an elevation of 1,592 m.

IF-04. IF-04 is a FGVR Great Basin Lake Mojave projectile point stem fragment that lies between Ridge B and Ridge C at an elevation of 1,592 m.

IF-08. IF-08 is a FGVR indeterminate Great Basin projectile point stem fragment that lies in the geologically active area between Ridge B and Ridge C at an elevation of 1,592 m.

IF-14. IF-14 is a FGVR indeterminate Great Basin projectile point stem fragment that lies in the geologically active area between Ridge B and Ridge C at an elevation of 1,595 m.

IF-23. IF-23 is a complete pink and white CCS Humboldt Concave Base projectile point that lies between Ridge A and the playa at an elevation of 1,588 m.

IF-30. IF-30 is a FGVR Gatecliff Contracting Stem projectile point fragment that lies between Ridge A and the playa at an elevation of 1,585 m.

Table 3.7. Frequencies of tools identified at IF localities discussed in text.

IF Number	**GBSS**	**Gatecliff**	**Humboldt**	**Elko**	**Rosegate**	**Total**
IF-03	-	-	-	1	-	**1**
IF-04	1	-	-	-	-	**1**
IF-08	1	-	-	-	-	**1**
IF-14	1	-	-	-	-	**1**
IF-23	-	-	1	-	-	**1**
IF-30	-	1	-	-	-	**1**
IF-41	-	-	-	1	-	**1**
IF-65	1	-	-	-	-	**1**
IF-88	-	-	-	-	1	**1**
IF-99	-	1	-	-	-	**1**
IF-102	1	-	-	-	-	**1**
IF-106	1	-	-	-	-	**1**
IF-118	2	-	-	-	-	**1**
IF-129	1	-	-	-	-	**1**
Total	**9**	**1**	**2**	**2**	**1**	**15**

IF-41. IF-41 is an obsidian Elko Eared projectile point that lies between Ridge A and the playa at an elevation of 1,586 m.

IF-65. IF-65 is an obsidian Great Basin Parman projectile point that lies on Ridge B at an elevation of 1,594 m.

IF-88. IF-88 is an obsidian Rosegate Corner-notched projectile point that lies between Ridge A and the playa at an elevation of 1,582 m.

IF-99. IF-99 is an obsidian Gatecliff Split Stem projectile point that lies between Ridge A and the playa at an elevation of 1,581 m.

IF-102. IF-102 is an obsidian indeterminate Great Basin projectile point stem fragment that lies between Ridge C and Ridge D at an elevation of 1,603 m.

IF-106. IF-106 is an obsidian indeterminate Great Basin projectile point stem fragment that lies between Ridge A and Ridge B at an elevation of 1,595 m.

IF-118. IF-118 is two obsidian indeterminate Great Basin projectile point fragments that lie between Ridge A and the playa at an elevation of 1,590 m.

IF-129. IF-129 is a complete obsidian Great Basin Cougar Mountain projectile point that lies between Ridge A and Ridge B at an elevation of 1,598 m.

Environmental Proxy Records

Before we can properly address how prehistoric peoples utilized and adapted to their environments, we must first be able to reconstruct and understand the environments they encountered. While many aspects of environment analysis were introduced in Chapter 1 and exact methodologies outlined in Chapter 2, this section requires a cursory discussion of the climatological records available for the TP/EH as they relate to Mud Lake. Each method of analysis contains its own restrictions and variability, so a broader and more holistic approach is used here to gain the greatest understanding of how the environment influenced prehistoric land-use patterns. For all corresponding data, I am primarily interested in the TP/EH, the anticipated overlap between human occupation and the presence of pluvial Mud Lake. This time period spans almost completely the Sehoo lacustral between 35,000 and 8,000 B.P. (Morrison 1965, 1991).

Global Climate

Analyses under this classification are the broadest in scope; these analyses deal with records that document global-scale climate changes. Coarse-grained in that they are not capable of recording subtle or brief changes, these data sets have far reaching and significant relevance to all manner of climate analysis.

Glacial ice cores from Greenland dominated the record of ice-cores utilized in this study. These records include the Greenland Ice-core Project (GRIP), Greenland Ice Sheet Project 2 (GISP2), and North Greenland Ice Core Project (NGRIP), and DYE-3 (Benson et al. 1997; Dansgaard et al. 1989, 1993; GRIP Members 1993; Grootes et al. 1993; Vinther et al. 2009). These ice records lose on average a small portion of the core from the near-surface (Dansgaard et al. 1993), but as this project is interested in the more distant past, this fact does not adversely affect the analysis.

Because this form of analysis is the most coarse-grained, the glacial records are primarily utilized to make connections to other more local proxy data, specifically to the timing of the Younger Dryas (Alley 2000; Dansgaard et al. 1989) and the fluctuations of Owens Lake (Bacon et al. 2006; Benson et al. 1996, 1997).

Regional Climate

Analyses under this classification deal with records of either regional climate change (e.g., paleo-spring records) or report regional variations (e.g., macro- and microfossil remains). Such types of proxy data vary between regions, but this variation allows for correlation throughout the Great Basin as well as among other proxy records.

This study relied most heavily upon regional records from the southern Great Basin; this is largely a factor of what records are available. Of great relevance to this study, numerous environmental projects with data sets from all regional forms of analyses have been conducted near the NTTS (Benson and Klieforth 1989; Quade 1986; Quade et al. 1995, 2003; Rose and Davisson 2003; Spaudling 1985; Thompson et al. 1999).

As previously mentioned, paleo-spring records are predominantly represented in southern Nevada where pluvial lakes are largely absent (Nelson et al. 2001; Quade et al. 1995, 1998). These proxy data are often collected concurrently with isotopic data, specifically for groundwater analyses, which in many cases also allow for direct ^{14}C dating (Benson and Klieforth 1989; Quade et al. 2003).

Dated packrat middens are also a good source of environmental dates and many well-studied middens are located in the south-central Great Basin (Spaulding 1990; Thompson 1990; Thompson et al. 1999). With the exception of a few packrat-only analyses (Betancourt et al. 1990), most samples are lumped in with other records (e.g., pollen), primarily to reconstruct climate on a regional scale (Wigand and Rhode 2002), and are almost always integrated into pluvial lake fluctuations (Benson et al. 1990; Benson and Thompson 1987a; Thompson et al. 1986).

Microfossils can often be found in a different range of environments than macrofossils as they are usually found embedded in sediments, ranging from perennially wet locations like lakes and springs to open-air hearths and archaeosediments. Many analyses include a synthesis of both macro- and microfossil remains, and as a result the pollen data used for this study are derived from sites in southern Nevada (Spaulding 1985; Wigand and Rhode 2002). Additional data come from lake core records in the western and northwestern Great Basin (O. Davis 1999; Minckley et al. 2007).

Local Climate

As the most geographically specific form of climate analysis, considerations of Great Basin pluvial systems constitute some of the most relevant studies to pluvial Mud Lake, as numerous lines of proxy evidence help to create lake fluctuation records. In addition, a brief consideration of soil formation around the pluvial systems of south-central Nevada is included.

For this study, I focused most greatly upon pluvial Lakes Lahontan, Russell, and Manly. Particularly important about these lakes is the relative internal consistency they display and that each lake, spaced throughout the Great Basin, holds an important constant for Mud Lake's fluctuations; Lake Lahontan and its subbasins Pyramid and Walker are the most well studied basins in Nevada, Lake Russell is also a small basin like Mud Lake and lies at the same latitude, and Lake Manly is similarly located in the southern Great Basin with relatively comparable modern climates (Adams and Wesnousky 1998; Benson et al. 1990, 1995, 1996; Benson and Thompson 1987b; O. Davis 1999; Li et al. 1996; Lowenstein 2002; Negrini and Davis 1992; Thompson et al. 1986; Yang 1989).

Based upon the long span of time for soil to form, poorly developed soil horizons in pluvial lake or stream environments have the ability to provide a rough minimum age for the occupied landforms. Soils within the pluvial basins of the NTTS are generally not well-developed (Grant and Wenzlau 2008:87), nor are they apparent in the profiles or discussions from Mud Lake (Dickerson 2006:32). As a result, these pluvial landscapes are estimated to be relatively young in age as soils have not had sufficient time to develop, and are thus likely post-Lahontan in age.

Summary

The analysis of Mud Lake's archaeological and environmental contexts provides a unique opportunity to understand human interaction with the environment within a small, closed system. Vital to this synthesis are archaeological and climatic evidence dated to the TP/EH. Teasing these apart from later records is no simple task. To ensure that materials from this oldest period of human occupation are present and utilized in this research project requires implicit dating methods for all data. While this condition is more readily achieved for the climate component through environmental proxy data, the dating of the archaeological remains continues to be a problem with surficial sites in the Great Basin. Lacking known sub-surface deposits and organic material for absolute dating, other methods must be utilized to date archaeological sites and their materials, specifically the lithic cross-dating and proxy record comparisons utilized in this study.

At Mud Lake a wide variety of archaeological localities from the Prearchaic to the Proto-historic periods are represented. The vast majority of all diagnostic artifacts

(86.1%) identified during the 2009 field season are Prearchaic in age, and all sites with diagnostic artifacts contain a Prearchaic component, even though a few sites are palimpsests (n=5) representing multiple occupations spanning may millennia.

Prearchaic artifacts are overwhelmingly represented by GBSS points, with a few BRCB points and one GBF point also documented. Other projectile types represented at Mud Lake date to the Middle Archaic, including Gatecliff, Humboldt, and Elko series projectile points, the Late Archaic, including Rosegate series projectile points, and the Proto-Historic, including Cottonwood series projectile points. The association of Prearchaic diagnostic artifacts to later Archaic points cannot be ignored. I believe that these later archaeological expressions were brief in duration and low in intensity, something which will be complimented with the later environmental assessment in Chapter 5.

Chapter 4

RESULTS

In this chapter, I present the findings from the recent archaeological and climatological investigations at pluvial Mud Lake. The results continue to be divided between the cultural and spatial data and the environmental records and proxy data as a means of highlighting their unique components. Results emphasize the temporal data, derived from the lithic cross-dating of diagnostic projectile points and the landscape data, with attention paid to pluvial features and elevation. Lastly, the environmental data are presented, which brings together all methods of climate reconstruction.

The Archaeological Record

The location of all archaeological remains, the previously recorded sites by Noyes and the recently recorded localities by SARF, are shown in Figure 4.1. This figure includes the five re-recorded sites (see Table 3.4 for a summary) where the assemblages have effectively been merged.

While the overall goal of this study is to analyze Prearchaic artifacts, all later diagnostic artifacts also must be taken into consideration as they reflect changes in land-use over time. A number of surface sites are palimpsests of multiple cultural periods. This phenomenon occurs more frequently with the previously recorded surface sites than

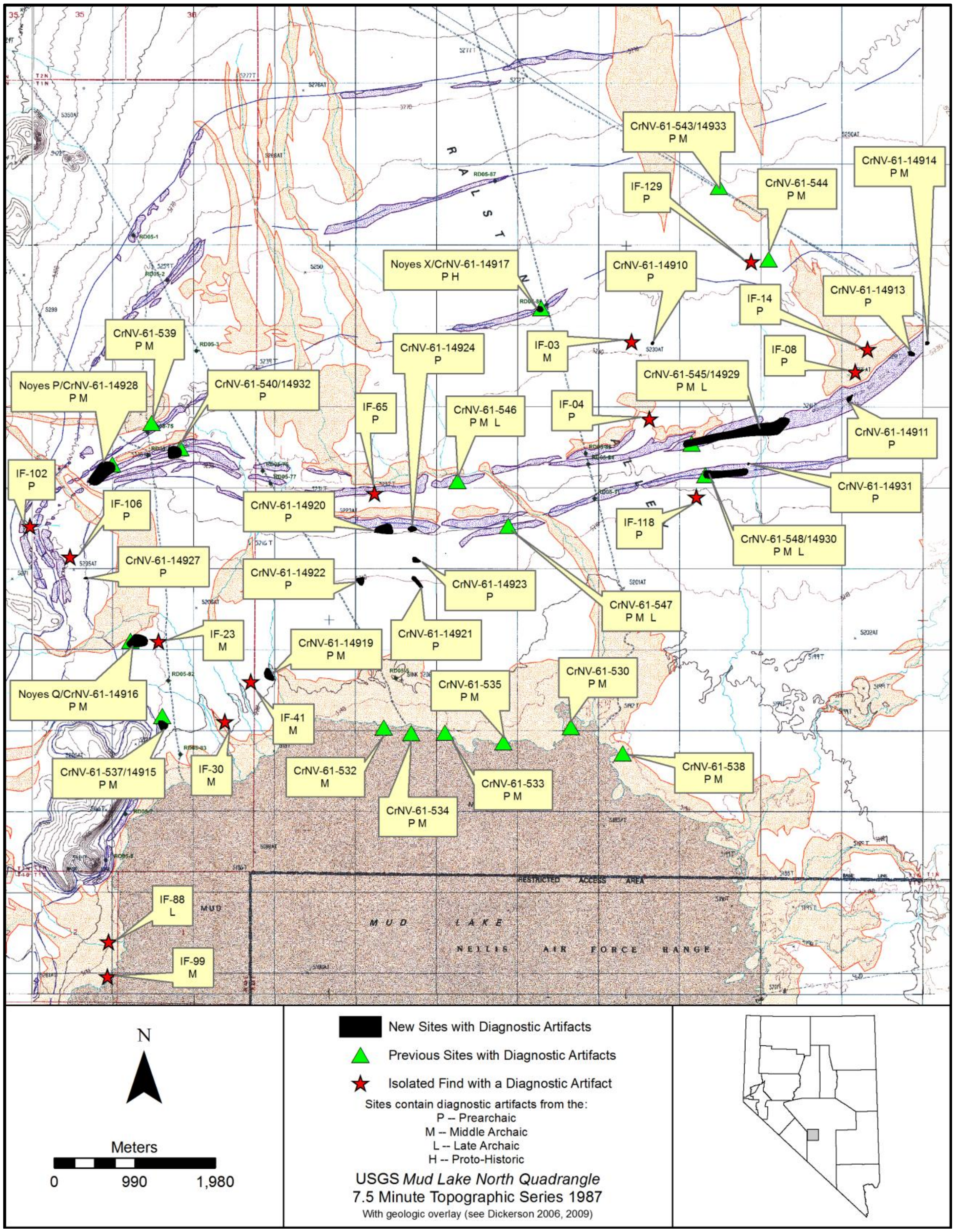

Figure 4.1. Map displaying all temporally diagnostic archaeological localities known at Mud Lake.

in those recorded during this study (14 of 17, 82.3%, vs. 5 of 19, 26.3%, respectively), and may be a result of many factors, including but not limited to the long history of modern collection at Mud Lake, displacement of earlier artifacts by later prehistoric groups, reuse of previously occupied landforms, or a result of variable survey methods. When considered collectively, just over half (17 of 31, 54.8%) of Mud Lake's surface sites are palimpsests (Tables 4.1–4.3).

Mud Lake Site Ages

The archaeological localities at Mud Lake, including sites and IFs, can be broken down into four periods – Prearchaic, Middle Archaic, Late Archaic, and Proto-Historic – based upon the diagnostic tools they contain. Large Side-notched projectile points, a hallmark of Early Archaic lithic assemblages, are absent from sites at Mud Lake. As previously stated, the temporal classification of these artifacts is currently the best, albeit coarse-grained, method of dating open-air sites at Mud Lake and elsewhere. Figure 4.2 and Table 4.1 display the relative frequencies of all dated artifacts from each locality type.

Prearchaic Localities. This locality type constitutes the largest percentage of the assemblage, with 29 sites and 8 IFs comprising 84.1% of all localities containing temporally diagnostic artifacts. Prearchaic points also make up an overwhelming majority of all diagnostic artifacts recorded (n=278, 76.6%). Many Prearchaic sites are palimpsests (n=18, 60%). While this last statistic may add some ambiguity to the make-up of these sites, their occurrence is in no way uncommon in the Great Basin, especially

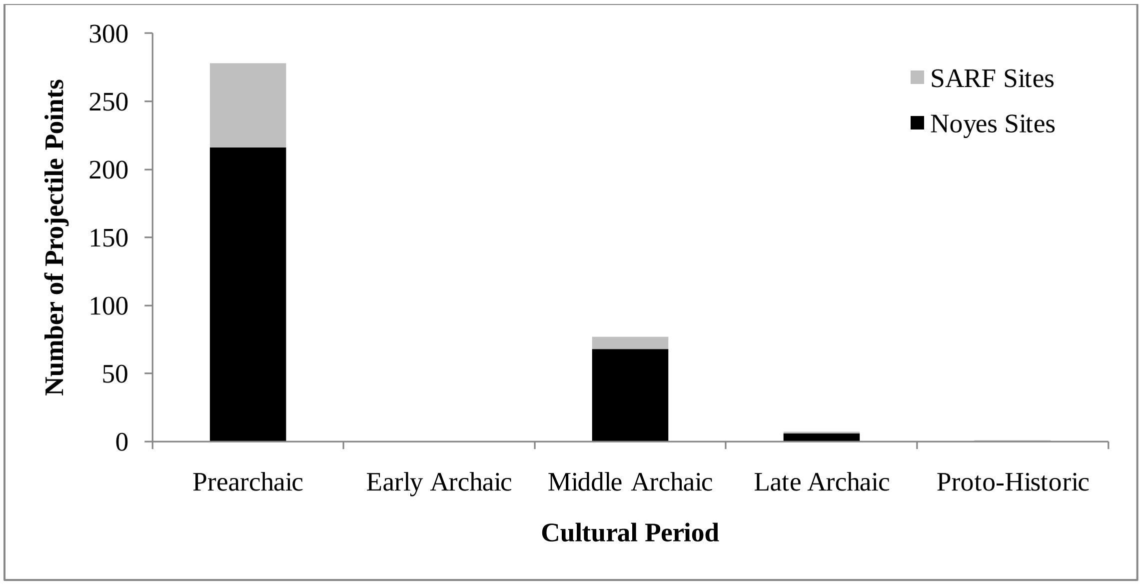

Figure 4.2. Frequencies of diagnostic points at Mud Lake. Black designates points previously identified by Noyes; grey designates points identified by SARF.

in lacustrine landscapes (Jones and Beck 1999). Additionally, Prearchaic sites make up the largest number of single component sites, with 11 of the 12 such sites (91.7%) that have been identified at Mud Lake.

Middle Archaic Localities. After the Prearchaic, the Middle Archaic displays the next largest proportion of diagnostic projectile points identified at Mud Lake (n=77, 21.2%), and constitutes 52.2% of all localities (including 18 sites and five IFs), with most sites (n=17, 94.4%) occurring as palimpsests.

Late Archaic Localities. Rosegate points – diagnostic of Late Archaic occupations – represent a very small portion (n=7, 1.9%) of all projectile points identified at Mud Lake. All sites containing Late Archaic cultural remains (n=4) are palimpsests, with one IF also identified.

Proto-Historic Localities. Cottonwood points – representing Proto-Historic occupations – are hardly represented (n=1, 0.3%) at Mud Lake.

Table 4.1. Totals and relative percentages for all temporally diagnostic artifacts recorded at Mud Lake.

	Noyes Sites	SARF Sites	Total Artifacts
Prearchaic	216 (74.5)	62 (84.9)	278 (76.6)
Early Archaic	--	--	--
Middle Archaic	68 (23.4)	9 (12.3)	77 (21.2)
Late Archaic	6 (2.1)	1 (1.4)	7 (1.9)
Proto-Historic	--	1 (1.4)	1 (0.3)
Total	**290 (79.9)**	**73 (20.1)**	**363 (100)**

Mud Lake Site Locations

Before I can assess how people utilized Mud Lake during the TP/EH and how these patterns changed through time, I must organize the data according to variation in the landscape. As previously discussed, in advance of the pedestrian survey conducted by SARF, the northern periphery of the Mud Lake basin was broken up into separate sections in relation to the Lowengruhn Ridges. These same designations are capable of aiding in our assessment of diachronic shifts in prehistoric land-use, and as such, are broken down in this manner here. Again, the Lowengruhn Ridges are one designation and range in elevation from 1591 to 1595 m a.s.l. The other designations relate to their location compared to the Lowengruhn Ridges: those with elevations higher than the Lowengruhn Ridges and those with elevations lower than the Lowengruhn Ridges.

Sites below the Lowengruhn Ridges (< 1591 m). Prearchaic, Middle Archaic, and Late Archaic localities are present at this elevation, with 11 sites and six IFs identified (Table 4.2). Seven of the 11 sites are palimpsests (63.6%), all of which contain Prearchaic artifacts. The remaining four sites are comprised of three temporally discrete

Table 4.2. All localities with temporal diagnostic points that lie below the elevation of the Lowengruhn Ridges (< 1591 m).

Agency / IF Number	Elevation	Cultural Affiliation
CrNV-61-530	1581 m	Prearchaic and Middle Archaic
CrNV-61-532	1581 m	Middle Archaic
CrNV-61-533	1581 m	Prearchaic and Middle Archaic
CrNV-61-534	1581 m	Prearchaic and Middle Archaic
CrNV-61-535	1581 m	Prearchaic and Middle Archaic
CrNV-61-536	1581 m	Prearchaic and Middle Archaic
CrNV-61-538	1581 m	Prearchaic and Middle Archaic
IF-99	1581 m	Middle Archaic
IF-88	1582 m	Late Archaic
IF-30	1585 m	Middle Archaic
CrNV-61-14919	1586 m	Prearchaic and Middle Archaic
IF-41	1586 m	Middle Archaic
CrNV-61-14921	1588 m	Prearchaic
CrNV-61-14922	1588 m	Prearchaic
IF-23	1588 m	Middle Archaic
CrNV-61-14923	1589 m	Prearchaic
IF-118	1590 m	Prearchaic

Prearchaic sites (27.3%) and one temporally discrete Middle Archaic site (9.1%). Of note is that the three discrete Prearchaic sites and one palimpsest site make up four of the five occurrences of Windust projectile points within the basin. This phenomenon is potentially telling with regards to both the low elevations of these sites as well as the history of this tool, which is often disassociated from GBSS (Beck and Jones 1997) and may date to the later TP/EH (Beck and Jones 2009; Jones et al. 2003), at which point environmental conditions may have been considerably different than earlier periods. Additionally, this designation displays the greatest density of Archaic artifacts and temporally discrete Archaic localities, with the single Middle Archaic site, four Middle Archaic IFs, and the only Late Archaic IF identified.

<u>Sites along the Lowengruhn Ridges (1591–1595 m)</u>. Prearchaic, Middle Archaic, and Late Archaic localities are present at this elevation, with 15 sites and six IFs present (Table 4.3). This elevation group contains the largest number of localities within the project area, especially Prearchaic sites. Seven of the 15 sites are palimpsests (46.7%), all of which contain Prearchaic artifacts. The remaining eight sites are temporally discrete Prearchaic sites. Of the six IFs, five are Prearchaic and one is Middle Archaic. These observations indicate that the Lowengruhn Ridges are the most likely area within the Mud Lake study area to contain Prearchaic artifacts – a fact that only confirms what has been known by Tonopah avocational archaeologists for decades.

<u>Sites above the Lowengruhn Ridges (> 1595 m)</u>. Prearchaic, Middle Archaic, and Proto-Historic localities are present at this elevation, with four sites and two IFs present, all of which contain Prearchaic artifacts (Table 4.4). All four sites are palimpsests, and both IFs are Prearchaic in age. This elevation designation is the most variable, with the greatest percentage of palimpsests and a paucity of single component sites. Additionally, the only Proto-Historic artifact present was identified at this elevation.

The Environmental Record

Environmental data are pertinent to describing the history of the Mud Lake basin. Analyses have been broken down into three broad categories, depending upon the type and specificity of the data evaluated. From the general to the more detailed, multiple

Table 4.3. All localities with temporal diagnostic points that lie at the elevation of the Lowengruhn Ridges (1591–1595 m).

Agency / IF Number	**Elevation**	**Cultural Affiliation**
CrNV-61-537/CrNV-61-14915	1591 m	Prearchaic and Middle Archaic
CrNV-61-547	1591 m	Prearchaic, Middle and Late Archaic
CrNV-61-14916	1591 m	Prearchaic and Middle Archaic
CrNV-61-14920	1591 m	Prearchaic
CrNV-61-14924	1591 m	Prearchaic
CrNV-61-14927	1591 m	Prearchaic
CrNV-61-548/CrNV-61-14930	1592 m	Prearchaic, Middle and Late Archaic
IF-03	1592 m	Middle Archaic
IF-04	1592 m	Prearchaic
IF-08	1592 m	Prearchaic
CrNV-61-14931	1593 m	Prearchaic
IF-65	1594 m	Prearchaic
CrNV-61-540/CrNV-61-14932	1595 m	Prearchaic
CrNV-61-545/CrNV-61-14929	1595 m	Prearchaic, Middle and Late Archaic
CrNV-61-546	1595 m	Prearchaic, Middle and Late Archaic
CrNV-61-14910	1595 m	Prearchaic
CrNV-61-14911	1595 m	Prearchaic
CrNV-61-14913	1595 m	Prearchaic
CrNV-61-14914	1595 m	Prearchaic and Middle Archaic
IF-14	1595 m	Prearchaic
IF-106	1595 m	Prearchaic

Table 4.4. All localities with temporal diagnostic points that lie above the elevation of the Lowengruhn Ridges (> 1595 m).

Agency / IF Number	**Elevation**	**Cultural Affiliation**
CrNV-61-539	1597 m	Prearchaic and Middle Archaic
CrNV-61-14917	1597 m	Prearchaic and Proto-Historic
CrNV-61-14928	1597 m	Prearchaic and Middle Archaic
IF-129	1598 m	Prearchaic
CrNV-61-543/CrNV-61-14933	1600 m	Prearchaic and Middle Archaic
IF-102	1603 m	Prearchaic

lines of evidence are considered to create the most holistic and supportable image of the environment encountered by the first inhabitants of Mud Lake and how the landscape changed during the Holocene.

Global Evidence

Glacial Ice-core Data. As the broadest line of evidence used in this study, analysis of glacial ice can only provide evidence for climate phenomena for Mud Lake at the global context. Grootes et al. (1993) compared the relative frequencies of oxygen isotopes in the GISP2 and the GRIP cores and showed that they were identical in major details, particularly the Dansgaard-Oeschger events, and provides inter-regional support for this form of proxy data. Pertinent to the TP/EH in the Great Basin was the globally recognized Younger Dryas (10,900 to 9,800 B.P.). The GISP2 core recorded a 7˚ C decrease in temperature and nearly a doubling in the precipitation accumulation during this period (Alley 2000; Alley et al. 1993). Additionally, the GISP2 core captured the end of the Younger Dryas, thereby displaying the fine temporal resolution of that record (Alley 2000; Alley et al. 1993; Dansgaard et al. 1989). In this ice-core, the termination of the Younger Dryas was observed at between 10,200 and 10,000 B.P. slightly earlier than it is seen in the Great Basin, and may stand as a point of reference to calibrate the great distance between Nevada and Greenland. In addition, correlations have been made between the GISP2 and the Great Basin's Owens Lake (Bacon et al. 1996; Benson et al. 1996, 1997). Here, changes in oxygen isotopes express synchronous oscillations, with dry periods in Owens Lake corresponding with cold periods in the GISP2 core.

Regional Evidence

Packrat Analysis. Dated middens in the southern Great Basin are heavily weighted towards the TP/EH (Thompson 1990:208; Thompson et al. 1999:4) with many locations reflecting the entire transition. As a result, they provide a large and valuable data set to compare against other proxy data. Many plant communities were displaced vertically during the terminal Pleistocene, facilitated by cooler and moister conditions. For example, at Yucca Mountain midden records led Thompson et al. (1999) to conclude that the period from 14,000 to 11,500 B.P. was 5.5˚ C cooler with 2.6 times the precipitation of modern conditions. While variable throughout the Great Basin, plant communities diversified during the TP/EH, as plants established during the colder conditions of the last glacial maximum were still present but started to be overtaken by pioneering communities of Holocene species (Nowak et al. 1994). Common in the western Great Basin during the Pleistocene, Utah Juniper was forced out of valley floors to its modern elevation by 9,500 B.P. (Wigand and Rhode 2002). In the southern Great Basin, subalpine woodlands of limber pine were replaced by juniper semi-arid woodlands and desert scrub overtook the valleys (Spaulding 1985; Wigand 1995). Additionally, increased summer rainfall and monsoonal activity around 9,000 B.P. facilitated the introduction of other species such as the netleaf hackberry and allowed them to reside at lower elevations than their modern limits (Spaulding 1990; Wigand and Rhode 2002).

Pollen Analysis. Pollen analyses from the TP/EH are often synthesized with data from packrat middens and lake-level histories, although stand-alone records do exist. Predominantly gathered via cores from perennially wet locations such as lakes and springs, few localities exist in the southern Great Basin while many records have been developed for the western and northwestern Great Basin (O. Davis 1999; Minckley et al. 2007; Wigand and Rhode 2002). Cores from the northwestern Great Basin indicate that open forests and grasslands present at 9,000 B.P. persisted at high elevations until 5,000 B.P., long after such changes had occurred in the southern Great Basin (Minckley et al. 2007; Wigand and Rhode 2002). Springs in southern Nevada record increased summer rainfall and corresponding vegetation associated with monsoonal activity (Spaulding 1985) and may have played an integral part of the creation of black mats (Quade et al. 1998).

Jet Stream Fluctuations. Originally proposed by Antevs in 1948, it has long been hypothesized that the Pacific jet stream entering the western Unites States during glacial times was deflected southward by the Laurentide ice sheet. Considering that increased precipitation, lower maximum temperatures, and reduced effective evaporation – three main factors in calculate pluvial lake levels (Mifflin and Wheat 1979; Street-Perrott and Harrison 1985) – are directly tied to their relative position to the jet stream core, there is little doubt about the role of the jet stream in pluvial lake histories. The jet stream moved north as the Laurentide ice sheet receded, and its timing and placement through the Great Basin can be seen in fluctuations of the pluvial lakes (Benson 1978; Benson et al. 1992, 1996, 1997; Thompson et al. 1986).

Pluvial Evidence

Evidence from Lake Lahontan. Lake Lahontan is the best documented western Great Basin pluvial lake. Lahontan once covered 21,860 km^2 and resided between 38-42˚ latitude. The highstand of Lahontan is well dated to between 15,000 and 13,000 B.P. and displays a near immediate lake recession (Adams and Wesnousky 1998; Benson 1981; Benson et al. 1990, 1992; Morrison 1965; Reheis 1999; Thompson et al. 1986). These dates, as well as the dates for other pluvial lakes, are calculated through multiple lines of evidence, particularly radiocarbon dating of tufas, packrat middens, and lake sediments. As a result, they are capable of bringing together all lines of proxy data into a more complete picture of prehistoric conditions. The rise and fall of Lahontan was rapid and punctuated, although not always continuous between sub-basins due to several overflow channels in western Nevada (Adams 2010; Adams et al. 2008; Benson et al. 1990). Through the analysis of other pluvial lakes within the Great Basin, Lahontan's history is relatively synchronous for other western lakes, although it is clear that factors such as glaciation and jet stream location have a profound effect on the timing and intensity of such oscillations (Bacon et al. 2006; Benson et al. 1990, 1992, 1996).

Evidence from Lake Russell. Lake Russell occurred in a small basin in the western Great Basin that still contains Mono Lake today. Russell was relatively small, covered an area of 790 km^2, and resided at roughly 37˚ latitude. Despite its proximity to the glaciated Sierra Nevada during the TP/EH, Lake Russell contains a record similar to other Great Basin lakes, particularly Lahontan, and even shared a similar highstand at 13,000 B.P. (Benson et al. 1990, 1998). Lake Russell also experienced lake fluctuations much like Lahontan, including during the Younger Dryas, although radiocarbon dates for this time period are lacking. Lake Russell receded beyond the historical level of Mono Lake around 8,000 B.P. and continued to be relatively low during the Holocene, although the lake never completely desiccated (Benson et al. 1990; Negrini and Davis 1992).

Evidence from the Mojave Desert. The Mojave Desert contains a system of large and small pluvial lakes, most of which are interconnected by the Mojave River and overflow channels (Enzel et al. 2003). One well studied system is Lake Mojave, which resided between 34-36˚ latitude. The lower of two pluvial beach ridge complexes there produced a radiocarbon date of 16,270±310 B.P. (Enzel et al. 2003; Wells et al. 2003). The higher and older of these ridge complexes is not dated, as its highest stand is constrained by an overflow outlet to the Amargosa River and Death Valley, but it has been estimated that this highstand would have occurred at 18,000 B.P. (Enzel et al. 2003). Lake sediments from Death Valley, obtained from coring and correlated to Lake Mojave shore features, indicate that another highstand occurred between 13,700 and 11,400 B.P. Core samples from the Silver Lake basin, one of the basins that Lake Mojave filled during the Quaternary, indicate that the lake was likely still present during the TP/EH, and did not disappear until between 9,100 and 8,300 B.P. (Wells et al. 2003). Additionally, lacustrine conditions and a marsh in the vicinity of Lake Manix along the Mojave River may have exists as late as 9,000 B.P. (Reynolds and Reynolds 1985). Lake Manly, one of larger pluvial lakes in the Mojave system, may have experienced similar fluctuations based upon analyses of and associated geomorphology. These fluctuations include a highstand around 13,000 B.P., followed by major recessions before 12,000 B.P., a slight rebound during the Younger Dryas, and terminating by the end of the

Oxygen Isotope Stage 2, around 10,000 B.P. (Hooke 1972; Knott et al. 2002; Lowenstein 2002).

Paleo-spring Evidence. Paleo-spring analysis is an increasingly common practice in the southern Great Basin due to a general lack of pluvial lakes and an abundance of sediments from smaller spring and wetland areas. These were fed by a higher groundwater table during the terminal Pleistocene (Quade et al. 2003; Rose and Davisson 2003; Spaulding and Graumlich 1986). From sediments taken from cores, analysis can be conducted for isotopic information, radiocarbon dates, and pollen assessment. Cores taken from southern Nevada indicate that a wet phase occurred between 14,500 and 12,300 B.P. as indicated by the active discharge at Cactus Spring (Quade et al. 1995, 2003). Oxygen isotope values from this period indicate that water was lost through springs and seeps by overflow rather than through evaporation. The subsequent wet period, which was considerably dryer than the last, dates between 11,600 and 9,800 B.P. and is associated with the black mats created during the Younger Dryas present at numerous archaeological sites in the western United States (C. V. Haynes 2008; Quade et al. 1998, 2003).

Groundwater Isotopes. Numerous groundwater studies have been conducted near Mud Lake to monitor nuclear material around the NTTS. Many of these studies have also focused on the more distanct past and analyzed isotopes from the late Pleistocene. In studying ratios of isotopes it has been determined through lower relative frequencies of heavy oxygen isotopes that groundwater recharge rates were quite high during the late Pleistocene, and that a considerable amount of water was added to the system (Rose and Davisson 2003). Although exact dates have been difficult to obtain in this area due to the large amount of mixing with later Holocene-aged groundwater, this phenomenon is entirely consistent with the wetter climate seen during this time as a result of increased precipitation, decrease evaporation, and cooler temperatures (Quade et al. 1995, 2003; Spaulding and Graumlich 1986).

Summary

Integrating these variable environmental data sets together to form a cohesive picture of Mud Lake during the TP/EH is not easy. Each line of proxy data contains its own variability, biases, and sensitivity in recording a changing environment. The older dates on the most recent highstand of Lake Mojave are a result of the progression of the jet stream from its more southern position during full glaciation to its present location much further north. Also, lake levels observed to be relatively stable through much of the later Pleistocene began to fluctuate more frequently as the jet stream receded to the north. Other factors such as glaciers and catchment area also affect the relative moisture of areas, but latitude has arguably the greatest effect (Mifflin and Wheat 1979). Proxy data from paleo-spring and pollen records confirm the timing of warming and drying northward through the Great Basin.

Chapter 5

DISCUSSION

In this chapter, I synthesize the archaeological and environmental records from Mud Lake and use these data to address the questions outlined in Chapter 1:

(1) Are the archaeological sites at Mud Lake associated with certain types of landforms?; and

(2) Are there environmental or climatological factors that may have influenced the distribution of archaeological sites at Mud Lake?

In the sections that follow, I tackle each question individually, provide additional lines of evidence supporting the prehistoric use of the study area, and integrate the evidence for a complete look at Mud Lake during the TP/EH.

Landscape Use in the Mud Lake Basin

Earlier in this thesis, I asked if the archaeological record of Mud Lake is in any way associated with certain landforms or if it is instead uniformly distributed across the landscape. Here, the distributions of sites at Mud Lake, with a consideration of how those distributions changed through time, are analyzed by both location and density. Additionally, the composition of the Mud Lake record is compared with other Great Basin locations to consider Mud Lake from a regional perspective. For these analyses, elevation is used as a proxy for lake-level fluctuations as well as to understand pluvial landform utilization. Figure 5.1 and 5.2 display archaeological sites by elevation and make certain topographic features clear: the playa margin lies at an elevation of 1,581 m, Ridge A lies between 1,591 and 1,592 m, Ridge B lies at 1,595 m, and Ridge C lies at 1,597 m.

Comparing Prearchaic and Archaic Assemblages

The descriptive statistics presented in Chapter 4 includes how common Prearchaic artifacts are in the Mud Lake basin (see Figure 4.2 and Table 4.1). Comprising more than 75% of the diagnostic artifacts recorded at Mud Lake, Prearchaic tools (n=278) overshadow Archaic points (n=85). This fact has been well known for decades by avocational archaeologists (Noyes, personal communication); however, to more completely address the research questions, other manners of considering the data are necessary.

Taking into consideration the perceived variation in landscape usage between Prearchaic and later Archaic groups, all tool types were analyzed using a standardized frequency, for both location frequencies and artifact frequencies. This method makes all values of a single sample a relative frequency of the largest value, effectively normalizing the significant variation seen between Prearchaic and Archaic assemblages by removing the scalar effect of sample size (i.e., 278 diagnostic artifacts from the TP/EH compared with 85 diagnostic artifacts from the remainder of the Holocene). Because there were no Early Archaic artifacts identified and only a small component of Middle Archaic (n=77), Late Archaic (n=7), and Proto-Historic (n=1) artifacts, I lumped all Archaic points together to create a more robust sample.

When standardized, frequency distributions show some interesting trends; particularly, how similar Prearchaic and Archaic sites are (Figure 5.1). By a narrow margin, Archaic localities have a higher frequency below the elevation of the Lowengruhn Ridges (< 1,591 m) and along the playa margin (1,581 m) while Prearchaic localities have a higher frequency at elevations associated with the Lowengruhn Ridges (1,591–1,595 m). This relatively consistent distribution of sites on certain landforms may be a function of several factors, including possible sampling bias, the reoccupation of previous sites for sources of toolstone, or simply because the beach ridges are distinct topographic features. The repeated occupation of sites for resource acquisition is found in areas with desirable resources and areas dense with discarded lithic materials may be revisited to scavenge raw materials (Jones and Beck 1999:87; Potts 1991:166), especially in toolstone-poor areas (e.g., Mud Lake). Additionally, the same areas of Mud Lake may have been continually reoccupied because the ridges are natural places on the landscape which, based upon their slightly elevated position over the surrounding landscape and flat-topped formation, may have made suitable camp sites. It is impossible to determine which individual factor(s) caused the similarity in location frequency. However, based upon the many years that Noyes spent surveying all over the Mud Lake basin, I believe that sampling bias can at least be down-played as a cause for the consistency in Prearchaic and Archaic site distributions.

To consider how Prearchaic and Archaic land-use patterns may have differed, I also standardized diagnostic projectile point frequencies by elevation (Figure 5.2). From

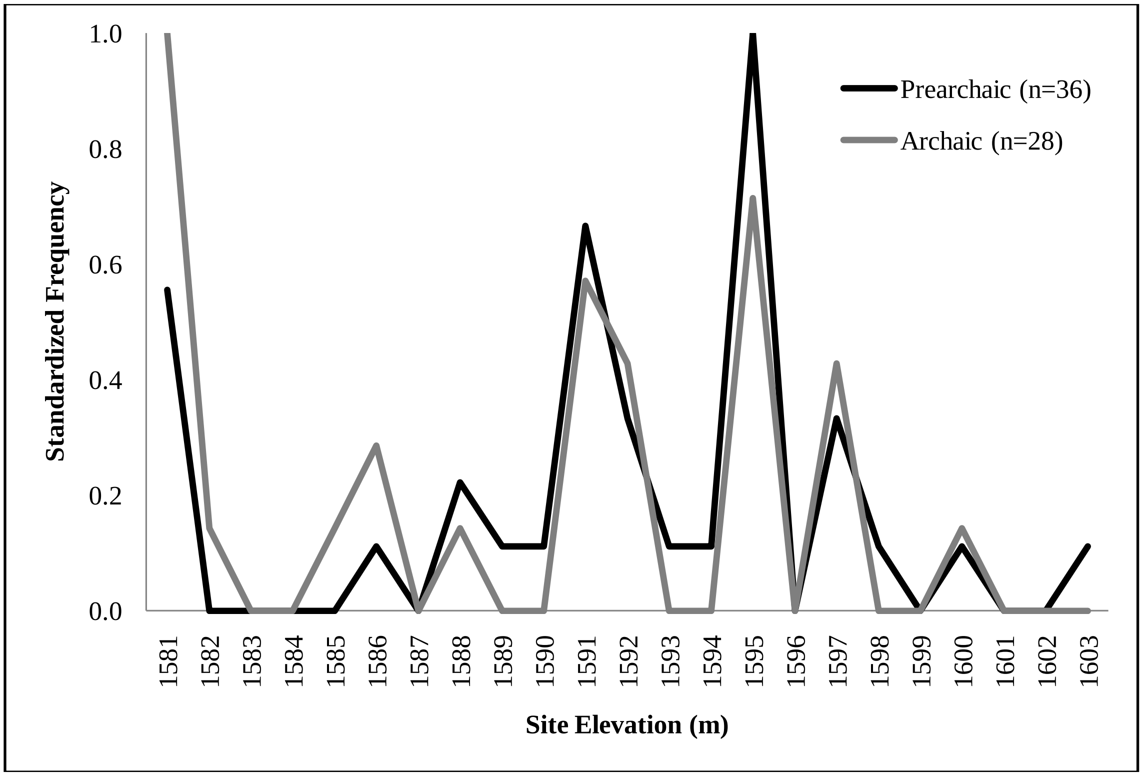

Figure 5.1. Standardized frequencies of Prearchaic and Archaic Localities by elevation.

this perspective trends are much more apparent by time and elevation. While points from both periods cluster on the playa margin (1,581 m) and Ridges A (1,591 m) through C (1,597 m), which can easily be observed on site distribution maps (see Figure 4.1), Prearchaic points occur most commonly on ridges while Archaic points occur most commonly on the playa margin. This difference strongly suggests different land-use foci.

Causes of these differences in land-use intensity must be considered. The substantial difference in artifact density between the Prearchaic and the later Archaic periods can be considered as a product of various human mechanisms. Systems that produce these patterns may include the utilization of Mud Lake by disparate group size, differences in occupation span, different rates of reoccupation, or a combination of these.

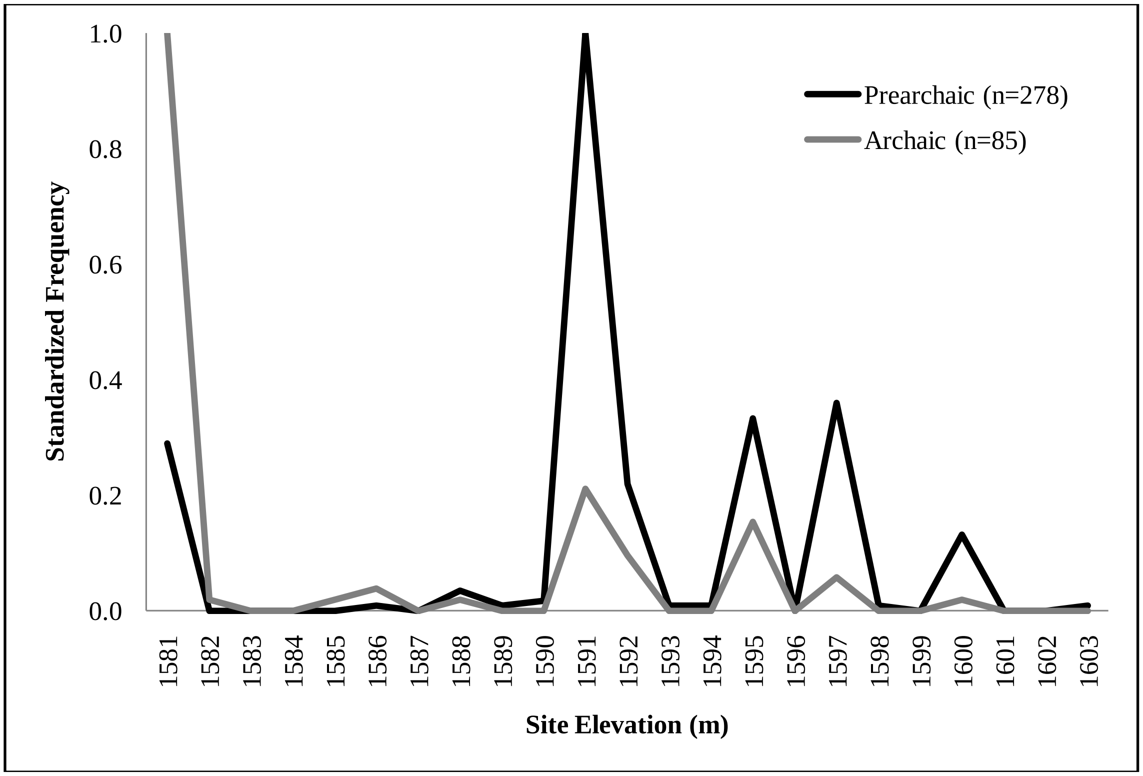

Figure 5.2. Standardized frequencies of Prearchaic and Archaic diagnostic point by elevation.

Regardless of the cause(s), it is plain to see a change in landscape utilization through time: Prearchaic artifacts are clustered along the pluvial shorelines. Ridge C (at 1,597 m) is believed to be older than the human occupation of the New World (Dickerson 2006), so the Prearchaic occupations of that landform may reflect the possibility that beach ridges made good camping spots. However, the occupations of Ridges A and B are interpreted as being directly associated with the pluvial Mud Lake shorelines at those elevations during the TP/EH. This seems especially likely given the greater frequency of Prearchaic projectile points on the lowest ridge.

Patterns of Archaic point frequencies display some continued use of the remnant ridges, but at a considerably lower rate. Archaic point frequencies are highest along the playa margin (1,581 m). Under modern conditions, the playa will occasionally fill with a small amount of water, indicating its likelihood throughout the Holocene. However, durations of stability would have been necessary for marsh resources to establish themselves around the playa. Additionally, groups may have simply passed through the basin on their way to other locations with no consideration in camping locations, in which case elevation would have less bearing on site and isolate locations.

Comparing Mud Lake to Other Great Basin Localities

Taking the results of the analyses of Mud Lake land-use through time to another level, we can compare this assemblage with other records around the Great Basin when the observed difference in intensity through time becomes even more pronounced (Figure 5.3). Taken from localities similar in geography and environment, the comparative assemblages come from the Reese River Valley in central Nevada, a tributary of the Humboldt River which contained fluvial resources prehistorically (Thomas 1971), Monitor Valley in central Nevada, which in addition to being one of the closest datasets to Mud Lake was an important locality throughout prehistory (Thomas 1988), and Owens Valley in eastern California, which, as previously discussed, has existed as a significant lacustrine system from the TP/EH into historic times when it only desiccated as a result of human involvement (Bettinger 1975, 1999). Again, a standardized frequency is used to compare the four assemblages.

Similar among these four data sets is the low representation of Early Archaic projectile points, an overwhelming increase in frequency into the Middle Archaic, and,

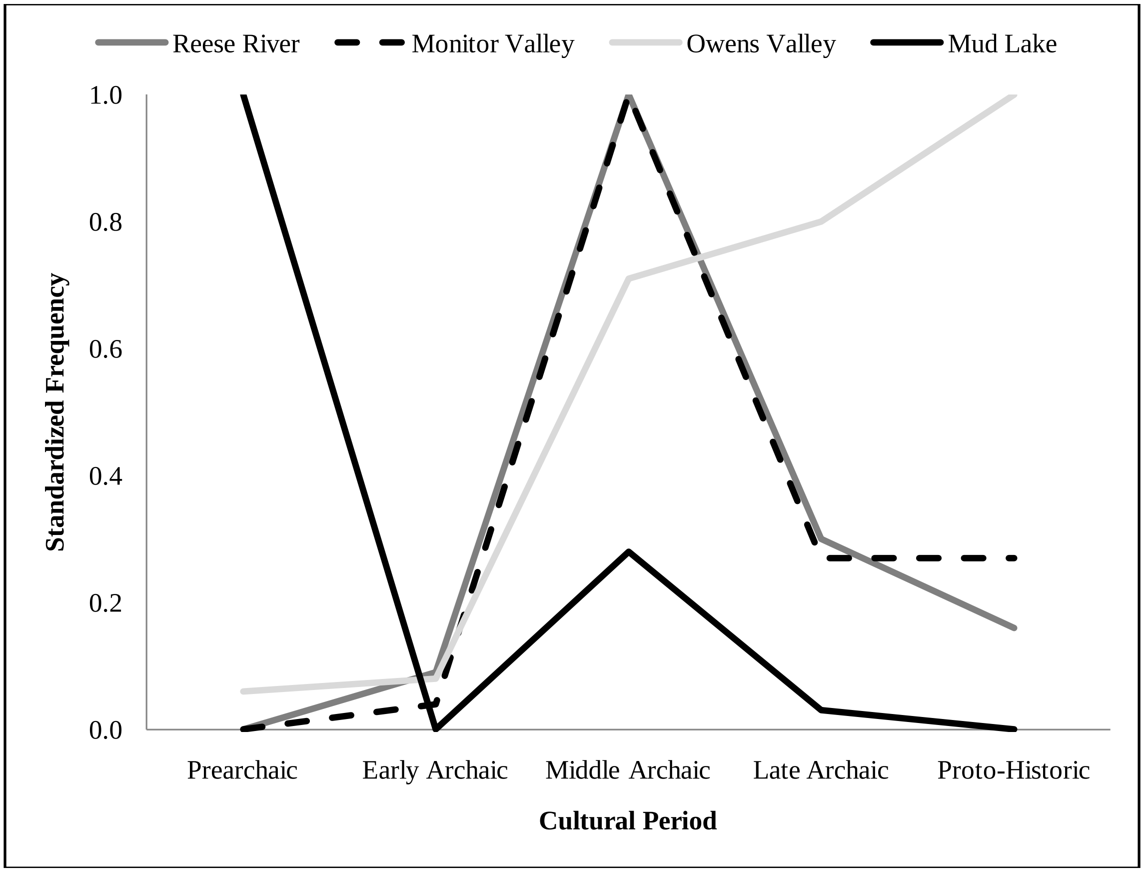

Figure 5.3. Standardized frequencies of diagnostic points from Great Basin localities.

with the exception of Owens Valley, a decrease through the Late Archaic into the Proto-Historic periods. Absent from this generalization was the Prearchaic period; this is because of the drastic difference seen in this time period. The Prearchaic record is virtually non-existent in these other locations but dominates the Mud Lake record.

Moving beyond the sheer number of Prearchaic artifacts present at Mud Lake, these determinations would not mean much if large Prearchaic assemblages were the archaeological norm. As Figure 5.3 displays, Mud Lake is far removed from other Great Basin assemblages. Prearchaic assemblages of this size, much like those from the Sunshine Locality (Beck and Jones 2009) and nearby Lake Tonopah (Kelly 1979;

Pendleton 1978), are the exception. As Beck and Jones (1997; Jones and Beck 1999) point out, the rarity of large assemblage Prearchaic sites is may indicate that a higher value or importance was placed on Prearchaic projectiles compared to those from later periods. As a result, the former may have been discarded less frequently than the latter. Prearchaic localities are often made up of a few points or point fragments and a few other formal tools, specifically scrapers (Jones and Beck 1999). With this observation in mind, Jones and Beck (1999:87) state that it is "not unrealistic to suppose that two stemmed points may herald a very significant TP/EH occupation". If this was the case, the sites at Mud Lake represent very significant TP/EH occupations.

Synthesizing the Archaeological and Environmental Records

Here, I address the second research question: are the distribution of archaeological sites related to the environmental history of the area? The numerous lines of data presented in previous chapters are drawn together to make the most complete picture possible of prehistoric Mud Lake.

The Terminal Pleistocene/Early Holocene

All proxy data utilized in this study indicate a cool, wet Pleistocene, a slight warming into the terminal Pleistocene punctuated by the drastically cooler conditions of the Younger Dryas, and a return to gradual warming throughout the remainder of the early Holocene. The exact timing of these events are variable throughout the Great

Basin, with the majority of this variability coming from relative latitude and association with the Pacific jet stream or proximity to continental glaciers (Benson et al. 1990, 1992, 1995, 1996, 1997; Benson and Thompson 1987a).

Evaluating the highstands of some of the more prominent lakes in the western Great Basin – Lake Lahontan, Lake Russell, and Lake Manly – can give an estimate of lake fluctuations which likely also occurred at Mud Lake. Lake Lahontan is useful because it is the most well-studied basin in Nevada, Lake Russell is useful as it is a small basin like Mud Lake at the same latitude, and Lake Manly is useful because it is similarly located in the southern Great Basin with a comparable modern climate.

Each basin records a pluvial highstand between roughly 14,000 and 13,000 B.P. A considerable recession occurred from these highstands until about 11,500 B.P. when stabilizations or minor increases in lake levels were seen associated with the Younger Dryas until 10,000–9,500 B.P., followed by a recession that was complete for Lakes Lahontan and Manly and to the historical level of Mono Lake for Lake Russell (Adams 2003; Adams and Wesnousky 1998; Benson 1981; Benson et al. 1990, 1992; Enzel et al. 2003; Morrison 1965; Reheis 1999; Wells et al. 2003). The desiccation of Lake Manly has been placed at just after 10,000 B.P., although there were likely still wetlands present until 9,000 B.P. (Wells et al. 2003). The other basins remained filled with shallow water throughout much of the Holocene, but were at relatively low levels between 9,720 and 8,800 B.P. as evidenced by Lahontan's position below 1,177 m – the elevation at which it spills into Pyramid Lake, a period of slow sedimentation in Walker Lake indicating no flow from Lahontan, and Lake Russell leaving little record during this time (Adams and

Wesnousky 1998; Benson et al. 1990, 1995; Benson and Thompson 1987b; O. Davis 1999; Li et al. 1996; Lowenstein 2002; Thompson et al. 1986; Yang 1989).

Supporting evidence for this brief and rough climatological timeline come from evidence in the areas of macrofossil and microfossil analysis. Plant communities slowly reacted to the warming of the Holocene. Important developments include Utah Juniper's establishment at modern levels ca. 9,500 B.P. in the western Great Basin (Wigand and Rhode 2002). In the southern Great Basin, subalpine woodlands were replaced by the semi-arid woodlands of juniper and desert scrub ca. 10,000 B.P. (Spaulding 1985, 1990; Wigand 1995). Additionally, increased summer rainfall and monsoonal activity is seen ca. 9,000 B.P. in the introduction of other species (Spaulding 1990; Wigand and Rhode 2002).

Regardless of exact timings of each of these events, their magnitude, or duration, it seems clear that roughly halfway through the TP/EH (perhaps 9,000 B.P.) conditions were dry enough that Mud Lake was likely desiccated. The Younger Dryas was the last major influx of water seen in the relatively drier areas of the southern Great Basin, and with no localized source of additional moisture (e.g., a spring), Mud Lake likely desiccated soon after this time.

The near certainty that Mud Lake was not a functioning marsh system throughout the entire TP/EH in no way detracts from the significance of the large and dense archaeological record attributed to this time period; I believe this makes Mud Lake an even more interesting place if it was only utilized for half of its 4,000 year range . As can be seen from the later early Holocene record, it would not be optimal for groups to be intensively camping on the remnant beach ridges once the water and associated resources were gone. If Mud Lake was desiccated around 9,000 B.P., the 278 Prearchaic points were most likely discarded between 11,500 and 9,000 B.P.

A hasty, or at least constant, retreat of Mud Lake during the TP/EH is also supported by the location of Prearchaic sites. While some areas in the western Great Basin have been afforded precise elevation control over Prearchaic sites (e.g., the Lahontan basin [Adams et al. 2008]), the record at Mud Lake displays early sites at all elevations from the heavily utilized Lowengruhn ridges down to the playas' edge. Most of these sites do not display the heavy utilization that the beach ridges do, but they are present nonetheless and are more visible in the frequency of Prearchaic localities (Figure 5.1) than artifact densities (Figure 5.2). I interpret this site distribution as groups following the water's edge, as well as its resources, as water levels gradually receded down to the modern playa.

Change Through the Holocene

While not the primary focus of this study, a discussion of how the patterns outlined in the previous section changed throughout the Holocene is necessary to emphasize the unique conditions at Mud Lake during the TP/EH. Moving from the early Holocene into the middle Holocene, all climatic indicators are punctuated by the drastically drier conditions of the Middle Holocene Drought. In addition to the persistent long-term drought, there occurred a regular patterning of more intense droughts and relatively moist conditions (Benson et al. 2002; Mensing et al. 2004) further adding to the difficult conditions of this harsh period. This period is associated with the remainder of the Early Archaic and associated cultural expressions, particularly Large Side-notched points. The complete lack of this tool type in the Mud Lake basin is likely the archaeological expression of this drought. There appears to be a very low rate of mobility during this time period (Grayson 1993; G. Smith 2010) and groups may have settled in around reliable sources of water, which Mud Lake was not.

During the late Holocene, conditions became much as they are today. As groups changed their mobility strategies as a response to the changing climate, it has been shown that people became more sedentary and generally more limited in their mobility patterns (Kelly 1992; G. Smith 2010) although there is considerable variation between groups in terms of logistical and residential mobility (Bettinger 1978; Binford 1977). The Middle Archaic (5,000–1,300 B.P.) is the longest cultural time period since the Prearchaic and that fact alone could account for the larger representation of diagnostic artifacts (Gatecliff, Humboldt, and Elko points) from that period at Mud Lake. The Late Archaic displays even greater sedentism and carries on into the Proto-Historic (Grayson, 1993; Kelly 1997). As this time period was much as it is today, and there does not appear to exist any relevant flora or fauna in any significant quantity today (Fenner et al. 2010), there were likely no important resources that late Holocene groups would have utilized in the basin at any frequency.

A Destination in the Great Basin

In addition of the evidence already presented, which displays the relationship between hunter-gatherer choices, landscape, and the paleoenvironment in the Mud Lake basin, there exist other lines of evidence which highlight the importance of that area during the TP/EH. These paint Mud Lake as a desirable location during the TP/EH, a "destination" if you will. Specifically, a recent study was conducted analyzing the variability in obsidian source types among a collection of south-central Nevadan GBSS, GBF, and BRCB points (Fenner et al. 2011). While this study displayed no statistical difference between sources utilized between these tool types (and perhaps cultures), it did generate a large and varied group of toolstone sources (Figure 5.4). Of the 82 tools sourced from Mud Lake, 16 distinct chemical sources from Nevada and California are represented. These frequencies display a large percentage of a few sources nearest to Mud Lake (Montezuma Range [38.2 km], and Obsidian Butte Varieties 3 and 5 [43.3 km]) with other close sources hardly represented (Goldfield Hills [40.9 km]) and those quite distant very well represented in the sample (Mount Hicks [159.8 km]). This phenomenon may be a result of various human behaviors, including those analyzed through source provenance models (Jones and Beck 2010; Jones et al. 2003; G. Smith 2010) or preferential use of certain raw material sources (Earl 2010), although sampling bias likely has an effect on these observed trends. With the large collections available for Mud Lake and other pluvial lakes in the area (e.g., Lake Tonopah), this is an area of research that should be explored in future studies.

Additionally, a rudimentary model of foraging territories can be proposed, with lithic raw material sources and lacustrine localities imbedded into a subsistence model. From Mud Lake, three modestly sized foraging territories can be drawn to other, local pluvial lakes and encompass all lithic sources observed in the study (Fenner et al. 2011). A foraging territory to the west would encompass the productive Lake Tonopah and end

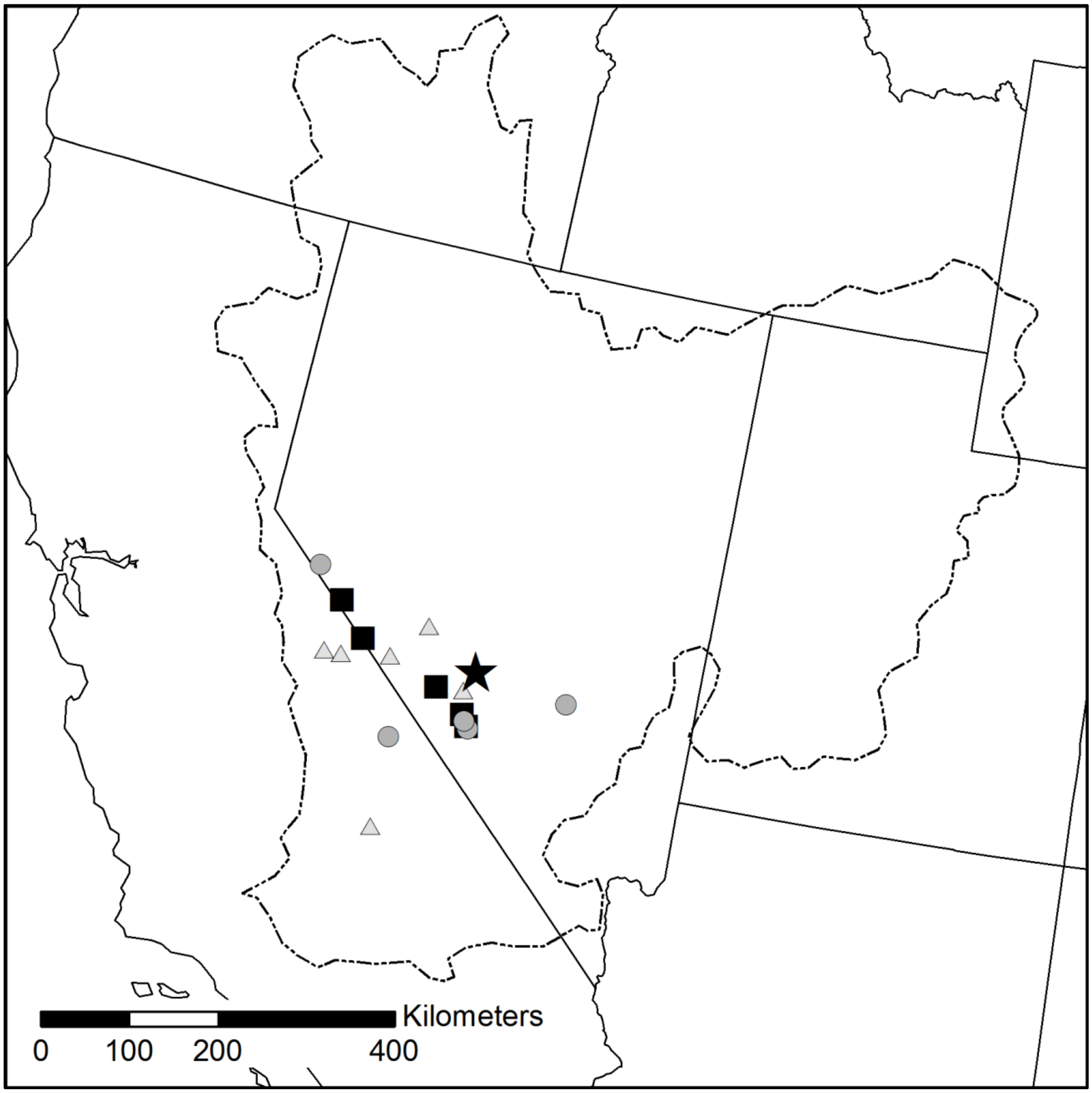

Figure 5.4. Obsidian sources represented among Prearchaic points from Mud Lake. Square = 7-16 artifacts (8-20%) from each source; Circle = 2-5 artifacts (2-6%) from each source; Triangle = 1 artifact (1%) from each source.

at Lake Russell, a foraging territory to the south would end at Owens Lake with the Mojave Desert in close proximity, and a foraging territory to the east would end at Railroad Lake, the only lake larger than Mud Lake in south-central Nevada (Figure 5.5). Taking the location and timing of wetland recourses into account may help answer

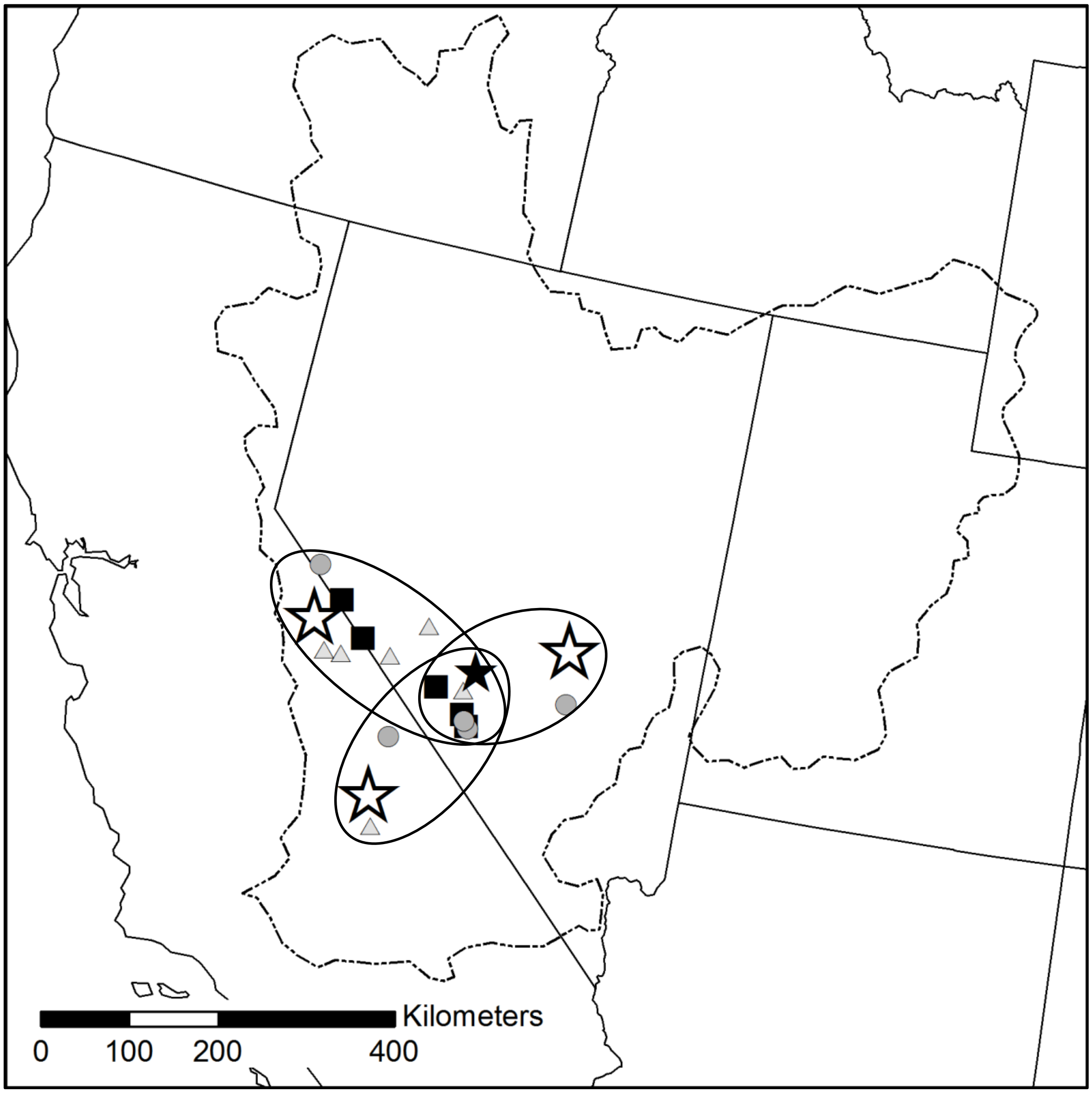

Figure 5.5. Obsidian sources represented among Prearchaic points from Mud Lake with possible lithic conveyance zones imbedded with lacustrine resources. Stars represent pluvial lakes of the TP/EH.

questions currently proposed in the study of lithic conveyance zones (Jones and Beck 2009; Jones et al. 2003).

As part of a larger discussion about when we should expect to find evidence for the earliest inhabitants in the New World, and consequently in the Great Basin, Beck and

Jones (2001) surmised that the initially peopling of the Great Basin may have occurred in the most southern region. Considering a changing climate, once people chose to move inland, they very quickly would have encountered the Cascades and the Sierra Nevada to their east. Knowing that landmasses with far less relief have affected people's movement throughout the Great Basin (Jones et al. 2003), they proposed that groups may have chosen to enter through the Mojave where the topographic relief is less difficult to travel through.

Mud Lake belongs to Mifflin and Wheat's (1979) geographical classification of Southcentral Nevada (SCN), and among this group Mud Lake was the second largest pluvial lake. Taking only elevation into consideration, Mud Lake was the largest in southern Nevada, with no other pluvial lakes of similar size until much further south into the Mojave Desert. Being the largest pluvial system in its vicinity, and given that the southern Great Basin may have been the original entrance to the region, the lack of similar resources could have made Mud Lake an important destination upon coming into the Great Basin.

Summary

The distribution of sites and artifacts at Mud Lake, both by raw counts and standardized frequencies, shows a significant emphasis on the occupation of beach ridges during the TP/EH. Additionally, the extensive Prearchaic record at Mud Lake sets itself apart from other well-studied prehistoric locations throughout the Great Basin. Changes in land-use at Mud Lake are seen ultimately as a result of human responses to environmental change during the early Holocene. With the disappearance of the lake and marsh system, so too went the groups who utilized the basin. The connection between humans, the environment, and the choices groups made about how they used the landscape is clear to see at Mud Lake.

Chapter 6

CONCLUSION

In this study, I have evaluated the relationship between prehistoric groups and the changing paleoclimatic conditions that were imposed upon them. With an emphasis on the TP/EH and its distinction from later time periods, this relationship is exemplified in patterns of land-use around Mud Lake. In order to delve deeper into the relationship between humans and environment at Mud Lake, I considered numerous paleoclimatological and cultural elements which had an intimate effect on prehistoric land-use. Considering these factors, research questions were formulated to advance our understanding of the relationship between Prearchaic people and their environments at pluvial Mud Lake. These research questions asked:

(1) Are the archaeological sites at Mud Lake associated with certain types of landforms?; and

(2) Are there environmental or climatological factors that may have influenced the distribution of archaeological sites at Mud Lake?

The data used to answer these questions were presented in Chapters 3 and 4 and synthesized in Chapter 5, providing a complete view of Mud Lake during the TP/EH, both archaeologically and environmentally. Major aspects of these findings are reiterated below, with a consideration of future research avenues that might be explored.

Summary of Findings

Through the course of this thesis, a few broad findings are clear regarding Mud Lake: (1) the Prearchaic record is dense and localized; (2) there was a pluvial lake present in the basin during the TP/EH; and (3) the location of the lake influenced how people used the landscape.

Between the Noyes collection and those artifacts identified by SARF, 44 archaeological localities have been identified at Mud Lake, including 30 sites and 14 IFs. Of these, all but seven localities (one site and six IFs) contain Prearchaic artifacts. Additionally, from this large collection of artifacts, Prearchaic tools (n=278) account for 76.6% of all diagnostic items. The next largest temporal group is from the Middle Archaic (n=77, 21.2%). The remaining artifacts consist of Late Archaic points (n=7, 1.9%) and Proto-Historic points (n=1, 0.3%). No Early Archaic artifacts have been identified at Mud Lake. These raw numbers alone display how heavily weighted the Mud Lake record is towards TP/EH occupations.

The majority of all localities, regardless of their temporal affiliations, are associated with the Lowengruhn Ridges A and B, with other concentrations seen on Ridge C and along the playa margin (see Figure 5.1). When taking into account the temporal variability of localities and the number of artifacts they contain, specifically Prearchaic points against Archaic points, a significant distribution becomes clear – Prearchaic points are overwhelmingly located on the pluvial ridges and Archaic points are located along the playa margin (see Figure 5.2).

A database of TP/EH environmental conditions for the Mud Lake basin was generated using an extensive collection of proxy data, specifically pluvial records from Lakes Lahontan, Russell, and Manley, paleo-spring records, packrat middens, and pollen data. The synthesis of these records indicates a wet and cool Pleistocene, with pluvial highstands between 14,000 and 13,000 B.P. From these highstands, increased warming lead to major pluvial lake recessions until about 11,500 B.P., at which point the effects of the cool Younger Dryas impacted the Great Basin, particularly through the stabilization or advance of lake levels. Again, recessions are seen through the area after 10,000 or 9,500 B.P., signaling the end of the Younger Dryas. After this point, a steady although gradual warming affected the western Great Basin.

There are no indicators in the proxy record or from Mud Lake itself to suggest any events outside those outlined above affected the project area. Given the record of warming, a short-lived period of cooling, and a return to warming throughout the TP/EH, Mud Lake likely closely followed the trends identified in other pluvial systems. Based upon the warming and drying of pluvial wetlands after the Younger Dryas, I proposed that Mud Lake was likely dry by 9,000 B.P. This date is just over half way through the time period proposed for GBSS points (11,500–7,500 B.P.), the dominant Prearchaic artifact type at Mud Lake.

Both lines of evidence, the environmental proxy data and relatively dated archaeological sites, are decidedly coarse-grained. However, these lines of evidence are currently the best and most reliable methods available to researchers. When both are taken into consideration together and synthesized, a greater understanding of the past may be achieved collectively than by relying upon either line of evidence alone.

Among the contributions made by this study, analyzing the archaeological remains from the northern Mud Lake basin allows for the first time a complete consideration of the entire prehistory of the area, not merely mentioning Mud Lake simply as the location of a single unique artifact or two. This area can now be more accurately represented in the literature, facilitating future work in the basin. The place of Mud Lake, with its substantial accumulation of Prearchaic artifacts, lies within Great Basin research as another unknown piece of the prehistoric puzzle, with the greatest amount of data provided on TP/EH but also with implications for land-use patterns throughout the Holocene. Continued research at Mud Lake, in similarly small or unstudied basins, and around pluvial systems in general remains a necessary venture in the Great Basin.

Continuing Research

Academic investigations at Mud Lake are in their infancy. While archaeological inquires have been conducted there since at least the 1960's, the available record has until recently been underreported. Now that a sizable record of the archaeological remains at Mud Lake has been developed, future work in this area has a solid foundation. Certainly, more work can and should be put forth at Mud Lake, with the geology and geomorphology being an open and inviting avenue of continuing research, partially with regards to the remnant beach features.

Addressing specific ideas proposed within this thesis, future research may speak to why similar land-use patterns are seen between the Prearchaic and later Archaic localities (Figure 5.1). Proposed in Chapter 5, this phenomenon may be explained by Archaic groups reoccupying sites as a means of scavenging previously discarded lithic tool stone. This possibility would be difficult to observe strictly though the analysis of formal tools, as the scavenged tool stone, now fashioned into an Archaic artifact, would most likely be carried away from the site with its maker. In this regard, more thorough lithic analyses would need to be conducted, including investigation of all debitage stages which may provide the best clue for lithic scavenging.

Another possibility includes the reoccupation of sites for other types of resources, particularly subsistence resources. Exact resources would be extremely difficult to map through time without the preservation of organic cultural remains, although climate reconstructions may allow for broad environmental assessments. Following this reasoning, wetland resources were no longer available to hunter-gatherer groups after 9,000 B.P., although fauna resources may have continued to be present in the Mud Lake basin throughout the Holocene. While not presently identified as a possibility, analysis of organic subsistence remains of any type would significantly further theories of what Archaic groups were doing in the vicinity after the recession of pluvial Mud Lake.

The last proposed reason for the similarity in land-use patterns between Prearchaic and Archaic localities is harder to empirically test and validate – whether the beach ridges were naturally pleasant places to camp. Rising 1–3m above the surrounding landscape, the concentric ridges closest to the playa of Mud Lake are flat topped and relatively sparse in vegetation. These factors alone may have enticed prehistoric groups, but without any indication of more permanent habitation locations, this proposition remains only a logical notion.

As a small system in south-central Nevada, Mud Lake is capable of contributing to the greater understanding of Great Basin pluvial lake and wetland utilization. The larger, and often consequently more frequently studied, basins in the region are well known archaeologically and geologically – two things that cannot be said about Mud Lake – yet these small glimpses into prehistory are just as crucial a piece to the ultimate picture of how groups made use of and moved around the Great Basin. Continued efforts in these small basins may provide equally unique archaeological records and further advance our understanding of the TP/EH.

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APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-530	Noyes	GBSS–Lake Mojave point	--
CrNV-61-530	Noyes	GBSS–Silver Lake point	--
CrNV-61-530	Noyes	GBSS–Ovate point	--
CrNV-61-530	Noyes	GBSS–Ovate point	--
CrNV-61-530	Noyes	GBSS–Ovate point	--
CrNV-61-530	Noyes	GBSS–Ovate point	--
CrNV-61-530	Noyes	GBSS–Ovate point	--
CrNV-61-530	Noyes	GBSS–Ovate point	--
CrNV-61-530	Noyes	Crescent	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Gatecliff Split Stem point	--
CrNV-61-530	Noyes	Elko Corner-notched point	--
CrNV-61-530	Noyes	Elko Corner-notched point	--
CrNV-61-532	Noyes	Gatecliff Split Stem point	--
CrNV-61-532	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	GBSS–Lake Mojave point	--
CrNV-61-533	Noyes	GBSS–Silver Lake point	--
CrNV-61-533	Noyes	GBSS–Silver Lake point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-533	Noyes	Gatecliff Split Stem point	--
CrNV-61-534	Noyes	GBF point	--
CrNV-61-534	Noyes	GBSS–Lake Mojave point	--
CrNV-61-534	Noyes	GBSS–Ovate point	--
CrNV-61-534	Noyes	GBSS–Ovate point	--
CrNV-61-534	Noyes	Crescent	--

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-534	Noyes	Gatecliff Split Stem point	--
CrNV-61-534	Noyes	Gatecliff Split Stem point	--
CrNV-61-534	Noyes	Gatecliff Split Stem point	--
CrNV-61-534	Noyes	Gatecliff Split Stem point	--
CrNV-61-534	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	GBSS–Cougar Mountain point	--
CrNV-61-535	Noyes	GBSS–Lake Mojave point	--
CrNV-61-535	Noyes	GBSS–Silver Lake point	--
CrNV-61-535	Noyes	GBSS–Silver Lake point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	GBSS–Indeterminate point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
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CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-535	Noyes	Gatecliff Split Stem point	--
CrNV-61-537	Noyes	BRCB point	--
CrNV-61-537	Noyes	BRCB point	--
CrNV-61-537	Noyes	GBSS–Lake Mojave point	--

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	**FS #**	**Artifact**	**Raw Material**
CrNV-61-537	Noyes	GBSS–Lake Mojave point	--
CrNV-61-537	Noyes	GBSS–Lake Mojave point	--
CrNV-61-537	Noyes	GBSS–Lake Mojave point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
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CrNV-61-537	Noyes	GBSS–Silver Lake point	--
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CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
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CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Silver Lake point	--
CrNV-61-537	Noyes	GBSS–Windust point	--
CrNV-61-537	Noyes	GBSS–Windust point	--
CrNV-61-537	Noyes	GBSS–Windust point	--
CrNV-61-537	Noyes	GBSS–Ovate point	--
CrNV-61-537	Noyes	GBSS–Ovate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	GBSS–Indeterminate point	--
CrNV-61-537	Noyes	Crescent	--
CrNV-61-537	Noyes	Gatecliff Split Stem point	--
CrNV-61-537	Noyes	Gatecliff Split Stem point	--
CrNV-61-537	Noyes	Gatecliff Split Stem point	--
CrNV-61-537	Noyes	Gatecliff Split Stem point	--
CrNV-61-537	Noyes	Gatecliff Split Stem point	--
CrNV-61-538	Noyes	GBSS–Ovate point	--
CrNV-61-538	Noyes	Crescent	--
CrNV-61-538	Noyes	Gatecliff Split Stem point	--
CrNV-61-539	Noyes	BRCB point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Silver Lake point	--
CrNV-61-539	Noyes	GBSS–Indeterminate point	--
CrNV-61-539	Noyes	GBSS–Indeterminate point	--
CrNV-61-539	Noyes	GBSS–Indeterminate point	--
CrNV-61-539	Noyes	Gatecliff Split Stem point	--
CrNV-61-540	Noyes	GBSS–Lake Mojave point	--
CrNV-61-540	Noyes	GBSS–Lake Mojave point	--
CrNV-61-540	Noyes	GBSS–Silver Lake point	--
CrNV-61-543	Noyes	BRCB point	--

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-543	Noyes	BRCB point	--
CrNV-61-543	Noyes	BRCB point	--
CrNV-61-543	Noyes	BRCB point	--
CrNV-61-543	Noyes	GBSS–Cougar Mountain point	--
CrNV-61-543	Noyes	GBSS–Lake Mojave point	--
CrNV-61-543	Noyes	GBSS–Lake Mojave point	--
CrNV-61-543	Noyes	GBSS–Lake Mojave point	--
CrNV-61-543	Noyes	GBSS–Lake Mojave point	--
CrNV-61-543	Noyes	GBSS–Silver Lake point	--
CrNV-61-543	Noyes	GBSS–Silver Lake point	--
CrNV-61-543	Noyes	GBSS–Ovate point	--
CrNV-61-543	Noyes	GBSS–Indeterminate point	--
CrNV-61-543	Noyes	GBSS–Indeterminate point	--
CrNV-61-543	Noyes	GBSS–Indeterminate point	--
CrNV-61-543	Noyes	Gatecliff Split Stem point	--
CrNV-61-545	Noyes	BRCB point	--
CrNV-61-545	Noyes	GBSS–Lake Mojave point	--
CrNV-61-545	Noyes	GBSS–Lake Mojave point	--
CrNV-61-545	Noyes	GBSS–Silver Lake point	--
CrNV-61-545	Noyes	GBSS–Silver Lake point	--
CrNV-61-545	Noyes	GBSS–Ovate point	--
CrNV-61-545	Noyes	GBSS–Indeterminate point	--
CrNV-61-545	Noyes	GBSS–Indeterminate point	--
CrNV-61-545	Noyes	Crescents	--
CrNV-61-545	Noyes	Gatecliff Split Stem point	--
CrNV-61-545	Noyes	Elko Eared point	--
CrNV-61-545	Noyes	Rosegate Corner-notched point	--
CrNV-61-545	Noyes	Rosegate Corner-notched point	--
CrNV-61-546	Noyes	BRCB point	--
CrNV-61-546	Noyes	GBSS–Lake Mojave point	--
CrNV-61-546	Noyes	GBSS–Silver Lake point	--
CrNV-61-546	Noyes	GBSS–Ovate point	--
CrNV-61-546	Noyes	GBSS–Ovate point	--
CrNV-61-546	Noyes	GBSS–Indeterminate point	--
CrNV-61-546	Noyes	GBSS–Indeterminate point	--
CrNV-61-546	Noyes	GBSS–Indeterminate point	--
CrNV-61-546	Noyes	Gatecliff Split Stem point	--
CrNV-61-546	Noyes	Elko Eared point	--
CrNV-61-546	Noyes	Rosegate Corner-notched point	--
CrNV-61-547	Noyes	BRCB point	--
CrNV-61-547	Noyes	BRCB point	--
CrNV-61-547	Noyes	GBSS–Lake Mojave point	--

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-547	Noyes	GBSS–Lake Mojave point	--
CrNV-61-547	Noyes	GBSS–Silver Lake point	--
CrNV-61-547	Noyes	GBSS–Silver Lake point	--
CrNV-61-547	Noyes	GBSS–Ovate point	--
CrNV-61-547	Noyes	GBSS–Ovate point	--
CrNV-61-547	Noyes	GBSS–Indeterminate point	--
CrNV-61-547	Noyes	GBSS–Indeterminate point	--
CrNV-61-547	Noyes	GBSS–Indeterminate point	--
CrNV-61-547	Noyes	GBSS–Indeterminate point	--
CrNV-61-547	Noyes	Crescent	--
CrNV-61-547	Noyes	Gatecliff Split Stem point	--
CrNV-61-547	Noyes	Gatecliff Split Stem point	--
CrNV-61-547	Noyes	Elko Corner-notched point	--
CrNV-61-547	Noyes	Rosegate Corner-notched point	--
CrNV-61-548	Noyes	GBF point	--
CrNV-61-548	Noyes	GBF point	--
CrNV-61-548	Noyes	BRCB point	--
CrNV-61-548	Noyes	BRCB point	--
CrNV-61-548	Noyes	GBSS–Cougar Mountain point	--
CrNV-61-548	Noyes	GBSS–Lake Mojave point	--
CrNV-61-548	Noyes	GBSS–Lake Mojave point	--
CrNV-61-548	Noyes	GBSS–Silver Lake point	--
CrNV-61-548	Noyes	GBSS–Silver Lake point	--
CrNV-61-548	Noyes	GBSS–Ovate point	--
CrNV-61-548	Noyes	GBSS–Ovate point	--
CrNV-61-548	Noyes	GBSS–Ovate point	--
CrNV-61-548	Noyes	GBSS–Indeterminate point	--
CrNV-61-548	Noyes	GBSS–Indeterminate point	--
CrNV-61-548	Noyes	GBSS–Indeterminate point	--
CrNV-61-548	Noyes	Crescent	--
CrNV-61-548	Noyes	Gatecliff Split Stem point	--
CrNV-61-548	Noyes	Elko Eared point	--
CrNV-61-548	Noyes	Rosegate Corner-notched point	--
CrNV-61-548	Noyes	Rosegate Corner-notched point	--
CrNV-61-14910	FS-1	GBSS–Lake Mojave point	FGVR
CrNV-61-14911	FS-3	GBSS–Indeterminate point	FGVR
CrNV-61-14913	FS-3	GBSS–Indeterminate point	OBS
CrNV-61-14913	FS-4	GBF point	OBS
CrNV-61-14914	FS-1	Elko Corner-notched point	CCS
CrNV-61-14914	FS-2	GBSS–Indeterminate point	OBS
CrNV-61-14915	FS-6	GBSS–Silver Lake point	OBS
CrNV-61-14915	FS-7	GBSS–Silver Lake point	OBS

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-14915	FS-8	GBSS–Indeterminate point	FGVR
CrNV-61-14916	Noyes	BRCB point	--
CrNV-61-14916	Noyes	BRCB point	--
CrNV-61-14916	Noyes	BRCB point	--
CrNV-61-14916	Noyes	BRCB point	--
CrNV-61-14916	FS-3	BRCB point	CCS
CrNV-61-14916	FS-4	BRCB point	OBS
CrNV-61-14916	FS-6	GBSS–Parman point	OBS
CrNV-61-14916	FS-7	GBSS–Silver Lake point	FGVR
CrNV-61-14916	FS-8	GBSS–Silver Lake point	OBS
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Silver Lake point	--
CrNV-61-14916	Noyes	GBSS–Ovate point	--
CrNV-61-14916	Noyes	GBSS–Indeterminate point	--
CrNV-61-14916	Noyes	GBSS–Indeterminate point	--
CrNV-61-14916	Noyes	GBSS–Indeterminate point	--
CrNV-61-14916	Noyes	GBSS–Indeterminate point	--
CrNV-61-14916	Noyes	Crescent	--
CrNV-61-14916	Noyes	Crescent	--
CrNV-61-14916	Noyes	Crescent	--
CrNV-61-14916	Noyes	Gatecliff Split Stem point	--
CrNV-61-14916	FS-5	Elko Corner-notched point	OBS
CrNV-61-14917	Noyes	GBF point	--
CrNV-61-14917	Noyes	GBF point	--
CrNV-61-14917	Noyes	BRCB point	--
CrNV-61-14917	Noyes	GBSS–Lake Mojave point	--
CrNV-61-14917	Noyes	GBSS–Silver Lake point	--
CrNV-61-14917	Noyes	GBSS–Silver Lake point	--
CrNV-61-14917	Noyes	GBSS–Silver Lake point	--
CrNV-61-14917	Noyes	GBSS–Indeterminate point	--
CrNV-61-14917	Noyes	GBSS–Indeterminate point	--
CrNV-61-14917	Noyes	GBSS–Indeterminate point	--
CrNV-61-14917	Noyes	GBSS–Indeterminate point	--
CrNV-61-14917	Noyes	GBSS–Indeterminate point	--
CrNV-61-14917	FS-4	GBSS–Indeterminate point	OBS

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-14917	Noyes	Crescent	--
CrNV-61-14917	FS-2	Cottonwood Leaf-shape point	Quartzite
CrNV-61-14919	FS-5	Gatecliff Split Stem point	OBS
CrNV-61-14919	FS-6	GBSS–Windust point	OBS
CrNV-61-14920	FS-8	GBSS–Lake Mojave point	OBS
CrNV-61-14920	FS-9	GBSS–Silver Lake point	OBS
CrNV-61-14920	FS-10	GBSS–Silver Lake point	OBS
CrNV-61-14920	FS-11	GBSS–Silver Lake point	OBS
CrNV-61-14920	FS-12	GBSS–Silver Lake point	OBS
CrNV-61-14920	FS-13	GBSS–Indeterminate point	FGVR
CrNV-61-14921	FS-1	GBSS–Windust point	OBS
CrNV-61-14921	FS-2	GBSS–Windust point	OBS
CrNV-61-14922	FS-3	GBSS–Windust point	OBS
CrNV-61-14922	FS-4	GBSS–Windust point	CCS
CrNV-61-14923	FS-1	GBSS–Windust point	CCS
CrNV-61-14924	FS-3	GBSS–Indeterminate point	OBS
CrNV-61-14924	FS-4	GBSS–Indeterminate point	OBS
CrNV-61-14927	FS-2	GBSS–Cougar Mountain point	CCS
CrNV-61-14927	FS-3	GBSS–Indeterminate point	OBS
CrNV-61-14928	Noyes	GBF point	--
CrNV-61-14928	Noyes	BRCB point	--
CrNV-61-14928	Noyes	BRCB point	--
CrNV-61-14928	FS-11	GBSS–Parman point	OBS
CrNV-61-14928	FS-12	GBSS–Parman point	CCS
CrNV-61-14928	Noyes	GBSS–Silver Lake point	--
CrNV-61-14928	Noyes	GBSS–Silver Lake point	--
CrNV-61-14928	Noyes	GBSS–Ovate point	--
CrNV-61-14928	Noyes	GBSS–Ovate point	--
CrNV-61-14928	Noyes	GBSS–Indeterminate point	--
CrNV-61-14928	Noyes	GBSS–Indeterminate point	--
CrNV-61-14928	Noyes	GBSS–Indeterminate point	--
CrNV-61-14928	Noyes	GBSS–Indeterminate point	--
CrNV-61-14928	FS-13	GBSS–Indeterminate point	OBS
CrNV-61-14928	FS-14	GBSS–Indeterminate point	FGVR
CrNV-61-14928	FS-15	Humboldt Concave Base point	CCS
CrNV-61-14929	FS-52	GBSS–Cougar Mountain point	FGVR
CrNV-61-14929	FS-53	GBSS–Lake Mojave point	CCS
CrNV-61-14929	FS-54	GBSS–Silver Lake point	OBS
CrNV-61-14929	FS-55	GBSS–Indeterminate point	FGVR
CrNV-61-14929	FS-56	GBSS–Indeterminate point	OBS
CrNV-61-14929	FS-57	GBSS–Indeterminate point	OBS
CrNV-61-14929	FS-58	GBSS–Indeterminate point	OBS

APPENDIX A: CATALOGUE ALL OF TEMPORALLY DIAGNOSTIC ARTIFACTS

Site / IF	FS #	Artifact	Raw Material
CrNV-61-14929	FS-59	GBSS–Indeterminate point	FGVR
CrNV-61-14930	FS-15	GBSS–Cougar Mountain point	CCS
CrNV-61-14930	FS-16	GBSS–Indeterminate point	CCS
CrNV-61-14930	FS-17	GBSS–Indeterminate point	OBS
CrNV-61-14930	FS-18	GBSS–Indeterminate point	FGVR
CrNV-61-14930	FS-19	GBSS–Indeterminate point	FGVR
CrNV-61-14930	FS-20	GBSS–Indeterminate point	FGVR
CrNV-61-14930	FS-21	GBSS–Indeterminate point	CCS
CrNV-61-14931	FS-3	BRCB point	CCS
CrNV-61-14932	FS-3	GBSS–Parman point	OBS
CrNV-61-14932	FS-4	GBSS–Silver Lake point	OBS
IF-03	FS-1	Elko Corner-notched point	OBS
IF-04	FS-1	GBSS–Lake Mojave point	FGVR
IF-08	FS-1	GBSS–Indeterminate point	FGVR
IF-14	FS-1	GBSS–Indeterminate point	FGVR
IF-23	FS-1	Humboldt Concave Base point	CCS
IF-30	FS-1	Gatecliff Contracting Stem point	FGVR
IF-41	FS-1	Elko Eared point	OBS
IF-65	FS-1	GBSS–Parman point	OBS
IF-88	FS-1	Rosegate Corner-notched point	OBS
IF-99	FS-1	Gatecliff Split Stem point	OBS
IF-102	FS-1	GBSS–Indeterminate point	OBS
IF-106	FS-1	GBSS–Indeterminate point	OBS
IF-118	FS-1	GBSS–Indeterminate point	OBS
IF-118	FS-2	GBSS–Indeterminate point	OBS
IF-129	FS-2	GBSS–Cougar Mountain point	OBS

“--" indicates no lithic raw material was provided for the Noyes Collection.