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RENO

**The Wizards Beach Men:  
A Study in Contrasts from Pyramid Lake, Nevada**

A thesis submitted in partial fulfillment of the requirements  
for the degree of Master of Arts in Anthropology

By

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## THE GRADUATE SCHOOL

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prepared under our supervision by

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## **ABSTRACT**

This thesis compares and contrasts two sets of human skeletal remains of different chronometric ages found on Nevada's Pyramid Lake shoreline in 1968. The remains were found when drought lowered the shoreline of the lake, resulting in exposure by erosive wave action. No artifacts were found associated with the remains, so there are no direct indications of the two men's subsistence and lifeways in the Early and Middle Holocene. This thesis describes how the lives of these two individuals and their possible manner of death differed under disparate climatic conditions. Differences are seen in their skeletal morphology, pathologies, and degree of dental wear during periods of changing climate in the Great Basin.

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## **DEDICATION**

This thesis is dedicated to the two Wizards Beach Men, it has been an honor to learn about you and your lives far beyond what initially looked like a straightforward project.

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## Chapter 1: Introduction

This thesis compares and contrasts the biology and life history of two sets of human skeletal remains of different chronometric ages found on the Pyramid Lake shoreline in 1968 by Peter Ting, an avocational archaeologist. The remains were found during a drought that lowered the shoreline of Pyramid Lake resulting in erosion due to wave action and exposure of the bones. No artifacts were found associated with the remains, so there are no direct indications of what the two men did during their lives in the Early and Middle Holocene. The two individuals are morphologically very distinct, and their chronometric ages are thousands of years apart. One individual, dated the oldest, is very robust but the skeleton is not very complete, while the other is mostly complete but with serious pathologies. In this thesis I make explicit comparisons of the two individuals, and also compare them to other human remains from the Great Basin. My main goals in analyzing the two sets of remains are: (1) to characterize how their lives differed, using as clues their skeletal morphologies, their pathologies, and their dental wear, set within the context of known periods of changing climate in the Great Basin; and (2) to determine the manner of death for each individual.

A major unsettled issue in Great Basin studies is the nature of the earliest human settlement of the region. Was the first human presence a single migration of small splinter groups trickling in from a larger migratory movement in far western North America? Were multiple migrations involved over long spans of time, which would have involved people who, by necessity adapted and re-adapted continuously to changing

environmental conditions? What technologies did the first people and their descendants use? Scholars have long debated these questions in professional publications and books. The two Pyramid Lake individuals described in this thesis hold clues for addressing important parts of this larger discourse, and their study may shed light on the shifting biological and behavioral developments during initial settlement of this region. Differences between the two individuals, such as health, stature, and dental wear, may reflect distinct environmental stresses during different periods of the Holocene, and human biological reactions to these changes.

The Great Basin is a very diverse area that has seen much climatic change during the past 10,000 years. It was during the transition from the Late Pleistocene to the Early Holocene (LP/EH) when the earliest people ventured into the area. Very few human skeletal remains have been found but they are rich sources of information about the earliest explorers into the region. In a few cases, artifacts were associated with the remains, but some skeletons have been found with no artifacts. When remains lack associated grave goods, it is difficult to determine how the individual lived. Only the bones provide an opportunity to gain insight into subsistence, life histories, health, diet, and other important aspects of life.

To understand the Pyramid Lake remains, we need to understand how the environment influenced available resources. Pyramid Lake was part of the enormous system called ancient Lake Lahontan, a massive pluvial lake that was rapidly changing

during the Late Pleistocene and Early Holocene (LP/EH). During the LP/EH, climate was relatively wet and cold, conditions favoring increased wetland, river, and lake resources. During the Middle Holocene (MH) the Western Great Basin was climatically very different. Lake Lahontan was gone with remaining lakes diminished in size. The region was generally much warmer and drier than today, leading to diminished water-dependent resources and low biotic diversity. This range of environmental productivity and available resources may have influenced the human skeletal robusticity and pathologies seen in the Pyramid Lake remains. Pathologies on the skeletons and other skeletal indicators such as dental wear reflect additional significant aspects of lifestyle, which this thesis describes.

In Chapter 2, I begin by providing background and context for the finds, summarizing what is known about changing climates in the LP/EH. Chapter 3 is a brief overview of archeological and bioanthropological research from the western Great Basin, and provides a more detailed description of all human skeletal remains found in the region, setting the stage for my thesis project; Chapter 4 is a review of methods used to study human remains, and includes the analyses of other local Paleoindians which can be compared to the two Pyramid Lake individuals; Chapter 5 presents my materials and analytical methods for studying the Pyramid Lake bones; Chapter 6 consists of discussion and comparison of results from this thesis with the earlier studies and some Late Holocene burials; and I present my conclusions in Chapter 7. All dates in this thesis are in cal BP (calendar years before present) unless otherwise noted. If a

source used BC, AD or BP (before present where present is 1950) dates, I converted them to cal BP dates. I converted dates from BP to cal BP to clarify the data using the CalPal online program by Danzeglocke et al. (2012).

## Chapter 2: Background and Context

### The Great Basin

Over the past ~12,000 years the Great Basin region of Western North America has been inhabited by highly mobile foraging people. They followed seasonal mobility patterns in search of game, plants, and toolstone resources (Broughton et al. 2008; Bryan 1988; Fenner and Smith 2011; Fowler and Hattori 2008; Graf 2007; Grayson 1993 and 2011; Jenkins et al 2001; Jones et al. 2003; Kelly and Todd 1988; Larsen and Kelly 1995; Smith 2010; Tuohy 1988b; Wigand and Rhode 2002). Some resources were cached in caves for future use. Fishbone and Crypt caves in the Winnemucca Lake Basin yielded extinct camel and horse remains, such as a horse metapodial awl, cedar bark mat dated  $13,168 \pm 260$  cal BP ( $11,250 \pm 250$  BP), coiled basketry dated  $2,449 \pm 246$  cal BP ( $2,400 \pm 200$  BP), a fur robe dated  $1447 \pm 209$  cal BP ( $1,510 \pm 200$  BP) and fish netting dated  $8,749 \pm 401$  cal BP ( $7,830 \pm 350$  BP) reflecting human activity in the caves and the lake basins lying before them throughout the Holocene (Hattori 1982). Middle Holocene occupants of Hidden Cave in the Carson Desert consumed bulrush, seeds, avian resources including waterfowl, and local fish such as the tui chub between ~5,200 cal BP to ~1,400 cal BP. Pollen evidence showed that goosefoot, amaranth, and grass families were possibly used as food resources (Rhode 2003; Wigand and Mehringer 1985). The health of prehistoric people in this region clearly was shaped by the quality and quantity of the biotic resources available to them during the Holocene.

The Great Basin (Figure 1, p. 9) encompasses most of Nevada, part of eastern California, southeastern Oregon, a part of southwestern Idaho, and western Utah. It is physiographically defined as the land area where all surface waters flow to the interior and do not reach an ocean through any river. The environment in the Great Basin has varied dramatically during the past 12,000 years, ranging at times between abundant lacustrine, riverine, and wetland environments to today's semi-arid desert environment. Life in this region has posed unique and ever changing challenges for its inhabitants. Climate models show that during the Holocene, the LP/EH summer temperatures increased and effective moisture levels decreased between 14,000 and 8,800 cal BP (Broughton et al. 2008). Position of the winter jet stream differed little from present patterns. However, during the LP/EH climatic changes contributed to the jet stream moving in correlation with the continental ice sheets, which contributed to higher snowpack in the mountains, colder temperatures, and geographical temperature variables prevailing through much of the early Holocene resulting in extremely dry summers and wet winters (Benson et al. 1990; Grayson 1993; Nowak et al. 1994; Zic et al. 2002; Broughton et al. 2008; Grayson 2011). This period also experienced an increase in diversity of flora as xeric, mesic and other plant species spread further during the LP/EH then declined during the Middle Holocene. This rapid climatic event caused many plant species to experience rapid turnover in response to temperature fluctuations (Nowak et al. 1994).

Paleoclimatic proxy data include subalpine tree lines, carbon isotopes and stable oxygen analyses of soil carbonates, mammalian fauna, wood rat (*Neotoma*) body size, and high elevation lake temperature reconstructions (Broughton et al. 2008). Plants in the Great Basin are opportunistic and take advantage of increased moisture when available increasing biomass and seed and pollen production leading to higher success/survival rates (Wigand and Rhode 2002). Plant communities during the LP/EH indicate that the xeric northern region contained a treeless sagebrush steppe with growth of russet buffaloberry (*Shepherdia canadensis*) and juniper species interspersed with rare occurrences of spruce and fir trees (Wigand and Rhode 2002). Pollen records from Steens Mountain, Oregon, indicate dominant sagebrush (*Artemisia*) and grass (*Poaceae*) with common juniper and quaking aspen moving from the low elevation subalpine grasslands nearer the mountain tops (Wigand and Rhode 2002; Grayson 2011).

In the northwest Lahontan Basin of the Smoke Creek Desert, wood rat midden data show that Utah juniper was in the region during the early Holocene, but disappeared by ~12,200 cal BP with a brief reappearance during the late Holocene (Wigand and Rhode 2002). It does not occur in the area today. In the Jackson Range, however wood rat midden data from Handprint Cave (Wigand 2012 pers. comm.) indicates that Utah juniper remained there at higher elevations throughout the Holocene. Cattail (*Typha*) pollen found in the Hidden Cave stratigraphic profiles shows extensive marshlands up until ~11,000 cal BP with increased greasewood growth and

declining sagebrush and pine for this region (Wigand and Mehringer 1985; Wigand and Rhode 2002). All of these data indicate the Early Holocene climate had summer droughts due to higher summer solar radiation and deeper mountain snow packs leading to greater spring runoff contributing to higher lake levels (Broughton et al. 2008; Grayson 2011). There were also extended episodes of summer monsoon penetration (Wigand 2012b pers. comm.).

Middle Holocene climate data show increased drought conditions based on retreating juniper, and increased sagebrush and saltbrush. The Painted Hills along the western shore of Pyramid Lake contain a midden record that was interrupted from ~8,800-4,500 cal BP likely due to juniper retreating upward as much as 200 m above their current location during the Middle Holocene. This drought is further seen in the Hidden Cave pollen record as saltbrush shrub dominates the Lahontan Basin. Grain size analysis of sediments show transport through rare colluvial (slope-wash) and eolian (wind-driven) processes. Colluvial processes result in loose sediment deposition whereas eolian processes result in finer grain deposition. When sedimentation decreases it can indicate minimal high-energy storms along with minimal rainfall resulting in reduced transportable materials by eolian action (Wigand and Rhode 2002). Drought records for this same period are corroborated in Lake Tahoe where trees grew at elevations 10-15 m below the current surface level (Lindström 1990; Wigand and Rhode 2002), and at Diamond Pond in south-central Oregon's Lake Malheur region where 80% of the pollen record is from greasewood pollen contrasting with the modern

greasewood pollen record contribution of less than 20% (Wigand and Rhode 2002). The environmental records all corroborate that the Middle Holocene climate was hotter and drier leading to final demise of Lake Lahontan with only small remnants left of this once massive lake.



Figure 1: Physiographic boundary of the Great Basin.  
([http://www.fws.gov/stillwater/wildlife\\_obs/Virttour/Virttour1.htm](http://www.fws.gov/stillwater/wildlife_obs/Virttour/Virttour1.htm)).

### Western Great Basin History – Late Pleistocene/Early Holocene and Middle Holocene

The Great Basin environment has undergone dramatic change many times during the late Quaternary, from widespread lacustrine conditions 15,000 to 10,000 cal BP to today's edaphic (rainshadow) desert with small remnants of ancient lakes. The

earliest peoples in this region utilized resources and subsistence strategies that are not currently possible. Lacustrine environments provided ample fish and game, whereas wetland resources had abundant waterfowl and plant resources for both food and tools and material culture for those who lived here. Previous lacustrine environments are evidenced by wave cut terraces on the hill sides bordering now arid basins.

Ancient pluvial Lake Lahontan was a massive lake comprised of seven subbasins (Figure 2, p. 11). This lake rose and fell many times in the past with its highstand 15,000 cal. BP reaching an elevation of 1,337 m at its highest (Benson 2004). During Lahontan's highstand period, seven subbasins filled sequentially as water levels breached sills allowing overflow from the larger lakes which included the Carson Desert in a central location, Pyramid and Winnemucca lakes slightly northwest of Carson Desert, Buena Vista east of the Carson Desert, Honey Lake to the northwest, Smoke Creek/Black Rock Desert to the north and east, and Walker Lake to the south (Benson 2004). The ancient shorelines can be seen on the lower slopes of surrounding mountain ranges and are clearly indicated by dendritic tufa deposits formed underwater during specific periods of the lake's history. The tufa reflects maximum lake levels at the time of its formation (Benson 2004). The subbasins of Lake Lahontan are of various elevations and morphology as well. The shallower basins filled more quickly and spilled in the larger ones. Filling was also dependent upon which tributary streams had the highest flow rates. In some periods the Humboldt River filled the Carson Desert first, in other cases the streams from the Sierras were more important (Wigand 2012b pers. comm.).

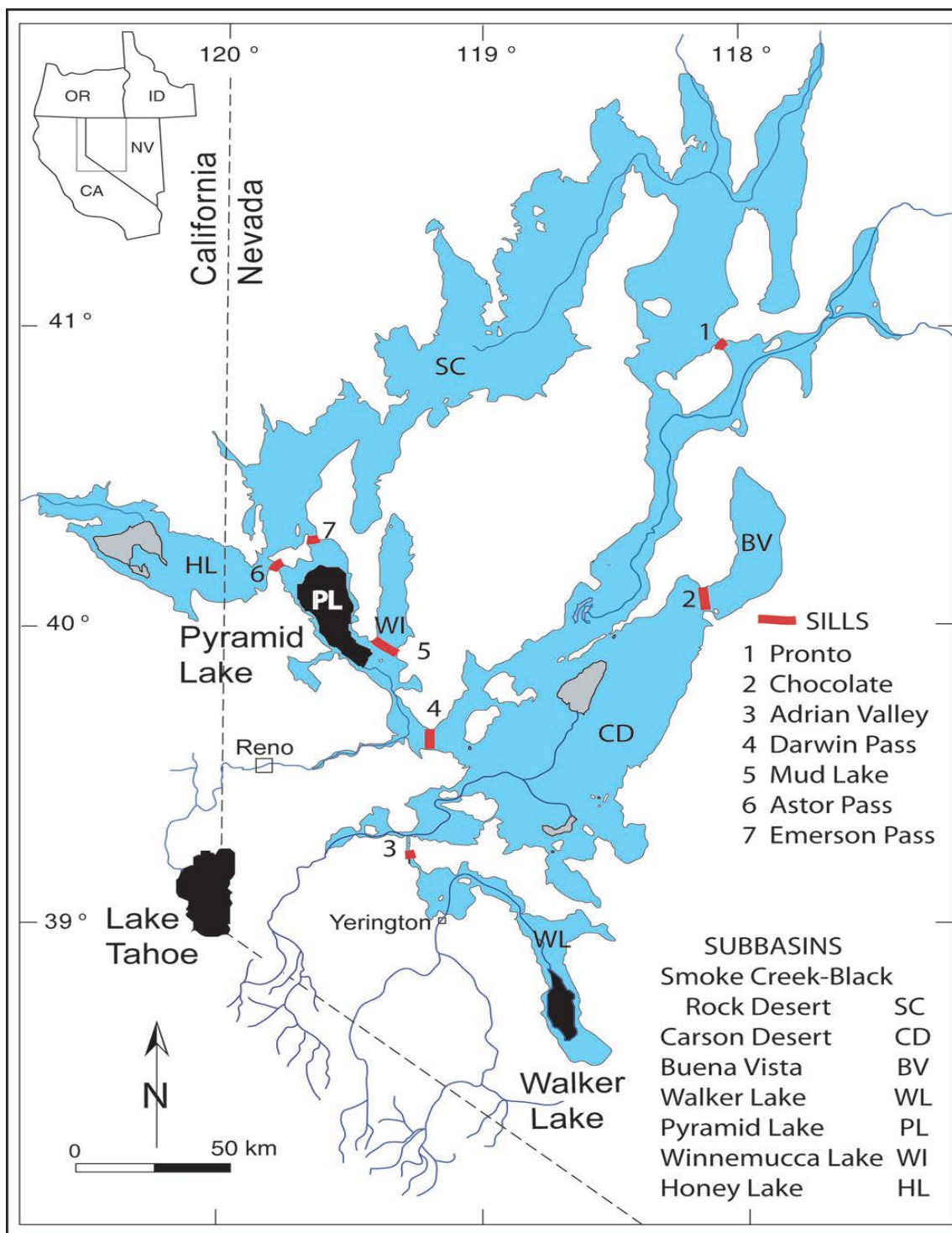


Figure 2: Ancient Lake Lahontan highstand approximately 15,000 BP. (Benson 2004)

This thesis deals primarily with the Pyramid Lake region of Pluvial Lake Lahontan. This lake was 281 m deep at the subbasin's highstand during a time of major tufa deposition. The depth at Lake Lahontan's highstand was almost three times the depth of today's Lake (106 m), with the shoreline reaching an elevation of 1,337 m (Benson 2004). The highstand of the Pyramid Lake subbasin was approximately 177 m above the present shoreline; therefore the lake has lowered by this much during the past 15,000 years as the climate has changed and become arid.

Lake levels and surface water expanses would have had a great effect on regional subsistence resources available to people. Late Pleistocene human colonizers would have found far more resources such as marsh plants, waterfowl, animals drawn to water sources, and diverse vegetation, but during the Middle Holocene life would have been more challenging after the lake system has been reduced. When Lahontan was at its highstand, the shorelines were likely very steep as they abutted the mountain fronts. The steep shorelines restricted the marsh areas. Marsh areas expanded as the lakes retreated into their basins and exposed more flat-lying margins where the shallow waters could support marshes which rely on waters only a meter or two deep or less (Wigand 2012b pers. comm.).

### **Early Holocene Environment and Subsistence**

The Holocene began approximately 11,350 cal BP (Haynes 2002:80). The vegetation in the region characterized in the Holocene was already established by

11,500 cal BP (Wigand 2012 pers. comm.). The Holocene followed the Pleistocene which is noted for glacial cold periods (2.5 Ma – 15,000 cal BP). Climate fluctuated between episodes of wetter/cooler, drier/warmer, and, during glacial maxima, cold and dry. The Last Glacial Maximum was approximately 20,000-18,000 cal BP, when large ice sheets covered much of continental North America. Archeological evidence and human skeletal remains that date before 9,000 cal BP indicate that humans made their way into this area during the Late Glacial phase of the Pleistocene. The early explorers were hunter/gatherers who dispersed into America either through an ice-free corridor between the Laurentide and Cordilleran ice sheets (Haynes 2002) or along a coastal migration route with forays inland (Dixon 1999). The earliest settlers left behind two different kinds of projectile points, which may be of different or slightly overlapping chronometric ages -- fluted bifaces known as Clovis points, dated 13,103-12,851 cal BP, and stemmed points mostly dated later than Clovis but with a few dates that may be as old or slightly older (Beck and Jones 1997:162; Haynes 2002:81; Jenkins et al. 2012). These early explorers had found their way to the southern Plains by ~11,000 years ago, and it is therefore possible they passed through the Great Basin on the way south. At the end of the LP/EH transition some megafauna such as camel and horse may have been targeted by the early hunters (Haynes 2009). Resources would have been more diverse and probably more abundant than today around the now-extinct large lakes, wetlands, and associated river deltas.

Climates varied significantly over the past 21,000 years. Here I focus on the changes of the last 12,000 years. The first human subject of this thesis, Wizards Beach Man 1 (WBM1), died within the LP/EH transition period, about 9,500 years ago. In this section I describe the ecological and climatic conditions of this time interval.

The LP/EH spanned ~13,400 cal BP to 8,300 cal BP (Beck and Jones 1997; Grayson 2011; Powell 2005; Smith 2010). The archeological evidence indicates that people first entered the Basin no earlier than 17,000 cal BP and possibly after 14,000 cal BP. At that time large pluvial lakes covered much of the Basin with ancient Lake Lahontan in northern Nevada and ancient Lake Bonneville in Utah being the largest. These large lakes were part of a lush ecosystem, which together with adjacent wetlands and rivers were utilized by early inhabitants for both subsistence and other economic resources as they followed the seemingly endless shorelines, rivers, and marshlands in a seasonal pattern foraging for resources (Jones et al. 2003; Kelly and Todd, 1988; Smith 2010).

Climate during the LP/EH was moister with colder winters and warmer summers characterized by monsoonal rains which kept water in regional lake and marsh systems into the summers (Grayson 2011). Even though Lahontan was drying during this period, its subbasins retained water and its wetlands still flourished. Monsoonal rains would have caused flash flooding in the river drainages providing moisture to the wetlands, but also resulting in erosion of the lowland slopes. Climate evidence found in wood rat

middens show an abundance of hackberry seeds at Homestead Cave in the Bonneville Basin which primarily would have grown in moist soil around the cave. Small mammals in this region include pygmy rabbits, Ord's kangaroo rats, yellow-bellied marmots, leporids (cotton-tail and jackrabbits), and bushy tailed wood rats (Grayson 2011). The presence of these small mammals and the hackberry seeds indicates abundant winter rains falling in a cool, wet landscape.

Limber Pine grew at lower elevations than today due to increased moisture and cooler temperatures (59° F is the temperature necessary for photosynthesis to occur for limber pine seedlings) as indicated in wood rat middens in the east-central Great Basin (Grayson 2011:241). At Pyramid Lake woodrat middens contain macrofossils of whitebark pine until about 11,500 years ago reflecting a cooler, almost maritime climate down to about 1219.2 m elevation in the western Great Basin (Wigand and Nowak 1992). Juniper which shared the woodland with whitebark pine at the end of the Pleistocene remains at lower elevations until about 11,000 cal BP when it disappears from the record there. Hidden Cave data from the Carson Sink show that sagebrush pollen levels were higher than today's levels and didn't reach modern levels until ~7,700 cal BP and are another indicator of increased winter precipitation in this period. Grayson (2011) points out temperatures in the Early Holocene were warm as the climate warmed in the Bonneville Basin, but the northern Great Basin did not have the summer monsoonal rains that affected the eastern or the western Great Basin. Precipitation indicators in south-central Oregon's Warner Mountains and the

Chewaucan River's western drainage reflect "one-half to one-third of what falls...now, coupled with temperatures of the warmest month from 1.8°F to 5.4°F greater than today" (Grayson 2011:241). Grayson points out that even though pollen records in the western Great Basin show warmer temperatures than those in the eastern Great Basin, conditions were wetter overall than today.

The upper elevation tree line in the Sierra Nevada was higher with abundant sagebrush due to warmer temperatures (Grayson 2011). This period of warm and moist conditions is referred to as the Anathermal after Ernst Antevs' Neothermal sequence which lasted from 10,000-7,800 cal BP (Antevs 1948; Grayson 2011). Antevs' thermal sequences were based on Scandinavian varve chronologies or annual sediment couplets and climate data to show distinctions between the sequences (Grayson 2011:243). Sedimentary layers give a timeline for habitation at a site. Environmental conditions are found in pollen data, wood rat middens, mammal bones and artifacts that are buried due to erosion, aeolian processes, or other means. Intentional human burials also may yield important information of past environments, even though humans frequently bury their dead as a ritual practice based on cultural mores.

### **Megafauna and Extinctions**

Early foragers in the Great Basin may have encountered megafauna as they traveled across the land. Megafauna are known to have inhabited the region based on skeletal remains that show many species were here as late as ~11,000 years ago, or just

before the human inhabitants arrived. Dansie et al. (1988) discuss four known paleontological sites as well as scattered fossils that have been found in the western Great Basin. Pleistocene megafauna taxa found around the shorelines of ancient Lake Lahontan include camel (*Camelops hesternus*), horse (*Equus pacificus*), bison (*Bison antiquus*), and mammoth (*Mammuthus columbi/jeffersoni*). Other fauna from fossilized bone piles found on Wizards Beach include modern bison (*Bison bison*) and cattle (*Bos taurus*), as well as extinct ground sloths - the genus and species is unknown for the ground sloth; however, Shasta Ground Sloths are known to have inhabited the region and went extinct ~12,500 cal BP (Goebel et al. 2011). It has been debated that megafaunal taxa were extinct by ~11,500 cal BP or just before or right after people entered the Great Basin; however, artifacts have been found associated with the fossilized remains noted above possibly linking megafauna with early hunters/foragers, although this evidence is ambiguous. Geochronology of the Lahontan basins indicates the earliest megafauna were present in the region after the Seho formation that spanned ~48,000 to 15,000 cal BP when Lahontan began its final recession. Pleistocene mammals in the region most likely entered the area prior to 48,000 cal BP or after 15,000 cal BP in order to have their remains found on the basin floors. The locations of these fossils at elevations of the lake, below the higher lake stands, indicates the presence of now extinct Late Pleistocene megafauna in the region at or about the same time as people entered. Taphonomic studies of fossil skeletons that once were carcasses on land surfaces can provide clues to shorelines, climatic events, or other

burial conditions at the time the animals died. Fossilization occurs when bones are rapidly buried, halting the decay processes that can destroy the bodies.

Aside from the extinct megafauna, LP/EH fauna included lagomorphs (hares, rabbits and pikas), artiodactyls (mule deer, mountain sheep, pronghorn antelope, elk, bison), birds (owls, geese, ducks, quail), rodents (voles, beaver, muskrats, rats, marmots, and squirrels), brown and black bears, wolverines, felids (dirk-toothed cat, cougars/mountain lions, bobcats, lynx), canids (dire wolf, grey wolves, coyotes), river otters, pine martens, snakes, turtles and tortoises, and fish (Heaton 1990; Surovell and Waguespack 2009; Grayson 2011).

### **Fossil Localities at Pyramid Lake**

#### ***Wizards Beach***

Wizards Beach was named because of the wind-created large dust clouds on the shoreline of the northwest corner of Pyramid Lake. Winds can exceed 30 mph on a regular basis in that area. Storm systems over Pyramid Lake can cause winds that exceed 60 mph which could rapidly move surface artifacts or carcasses across the lake (Dansie et al. 1988; USGS 2012a). Dansie et al. (1988:163) describe Wizards Beach as “a low-relief expanse of lacustrine clay and silt below 1,180 m elevation.” Wizards Beach also has numerous tufa deposits known as the Needles Rocks. White carbonate rings at

the bases of these features formed during a period when Pyramid Lake overflowed into the Winnemucca Lake subbasin at an elevation of 1,177-1,183 m (Benson 2004).

### The Harrelson Skeletons at Wizards Beach

The skeletal fauna found on Wizards Beach include the Harrelson skeletons consisting of two camels and a horse known as “Camel #1, Andon’s Camel (#2) and the Horse Called Man” and the “Norcross Bone Pile” (Dansie et al. 1988:163). The Norcross Bone Pile encompasses ~1 m<sup>2</sup> or 0.5 sq. mi. with >300 bone fragments of extinct megafauna. Early archaic artifacts have been found near the bone pile and the Harrelson’s skeletons. A basalt biface was discovered on the surface within 3 feet of Camel #2’s pelvis. Pinto points, net sinker stones, Northern side-notched points, and other artifacts not in direct association with the camel skeleton were found in the same vicinity, but their location suggested later foragers came into contact with the megafauna fossils (Dansie et al. 1988).

A complete horse skeleton (The Horse Called Man) found near the camels was located nearer the Needles about three miles north of the camels. A basalt flake tool with a Pinto point ~10 meters to the south was found among the horse bone scatter (Dansie et al. 1988). However, none of the skeletons showed any tool marks that would indicate that the points found near the remains were used on the animals. The complete articulation of the skeletons and their location suggest that they died using a water source at a low period in the lake level. A black organic material was found in Camel

#2's rib cage which when tested showed a composition of organic material presumed to be fossilized viscera. According to Dansie et al. (1988:167) the material consisted of "lungs and stomach/intestines". The completeness of Camel #2, including the preserved viscera, indicates "immediate and complete burial of a fresh carcass in stable sediments" (Dansie et al. 1988:170). Another possibility is that these animal carcasses dropped into water and remained submerged until buried. A metacarpal from Camel #2 was used for accelerator radiocarbon dating and quantitative amino acid analysis. The results of these tests yielded an age of  $30,779 \pm 599$  cal BP to  $30,357 \pm 536$  cal BP ( $25,870 \pm 590$  BP to  $25,370 \pm 420$  BP) which is probably as much as 15,000 years before people entered the region according to Dansie and colleagues (1988). Therefore, the projectile points found with this skeleton are not associated with human foraging activities.

#### The Norcross Bone Pile

Astor Pass is a narrow strait between Pyramid Lake and Honey Lake. Wizards Beach is within the southern drainage area for Astor Pass at the north end of Pyramid Lake. Numerous fragments of bones on Wizards Beach may have been carried into this low relief area through a narrow gully from Astor Pass. Rancholabrean fauna have been found in the Norcross bone pile including large and small horses, large and small camels, as well as sloth and mammoth remains. Many of the remains in the pile have a rusty stain on them that Dansie and colleagues (1988) traced to sediments at elevations of

1,167-1,173 m at Astor Pass, and no similar sediments occur near Wizards Beach (Dansie et al. 1988; Benson 2004). The megafauna bone assemblages indicate deposition in sandy-gravel at or near the time of death with some of the bones showing evidence of rounding from waters covering the gully at 1,183 m. When Lake Lahontan rose to the Astor Pass spill point, any animals that may have attempted to swim across this strait during Lahontan's rise likely drowned due to strong currents that may have swept through this channel between Pyramid Lake, the Black Rock/Smoke Creek Desert, and Honey Lake to the west, and were deposited and preserved at the Pass level. These remains were later carried down to Wizards Beach during the Seho lake recession of ~30,000 cal BP (Dansie et al. 1988; Benson 2004). None of the bones in the Norcross Bone Pile have been dated, so the relationship between them and the dated camel are unknown.

### **Middle Holocene Climate and Subsistence**

Middle Holocene (MH) climate was much warmer and dryer than today's climate. The MH lasted for approximately 3,000 years from ~8,300 cal BP to 5,200 cal BP when the Late Holocene began (Grayson 2011). This hot and dry period is often referred to as the Altithermal after Antevs' Neothermal terminology (Antevs 1948).

Antevs' final sequence is the Late Holocene Medithermal that we are currently in, which began in 5,200 cal BP, is characterized by moist and cool conditions (Antevs 1948; Grayson 2011). Most of the subbasins that Lake Lahontan filled were dry.

Resources were very different and sparse. Jackrabbits became a staple in the diet as larger game moved into the mountain regions, and to the north and west. Wetland resources were no longer locally available, so MH people increased dependence on wild seeds, such as wild rice, wild rye, chenopods, and mustards. They shifted their hunting to small mammals and fish from the few streams that still flowed.

It seemed as if most of the descendants of the people that once inhabited the Great Basin moved to more favorable areas flanking the region, leaving behind a few hardy populations. This was the period when the second human subject of my thesis lived. Schmitt et al. (2002) studied sites in the Bonneville Basin that indicate higher population density with resources centered around any small wetland patches left by ancient Lake Bonneville during the MH, with foraging rounds that indicated long distances were traveled. Therefore, Wizards Beach Man 2 (WBM2) would have foraged from much more limited wetland patches and covered longer distances between resources. The paleobasins of both Bonneville and Lahontan filled and receded simultaneously in response to climate. So the abundance and type of resources available for people during the MH and EH would have been similar. Studies from both basins indicate similar subsistence patterns, but Bonneville has been studied more than the Lahontan region with respect to MH hunting. Little is known about subsistence strategies during the MH, and what we do know comes from caves and rockshelters. Hockett (2005) analyzed leporid (rabbit and hare) bones from caves and rockshelters in the Great Basin MH period that show small mammals were hunted more often as a food

resource. Large game was found in the higher elevations some distance away from the valley bottoms or lakeshores that people lived on. At approximately 7,500 cal BP there was a climatic interval that adversely impacted the landscape as lakes dried, temperatures increased and overall the region became almost un-inhabitable.

### **Human Habitation**

The earliest evidence for occupation in the region is documented by archeological investigations of prehistoric rockshelters and open site hunting camps. Artifacts include Western Stemmed projectile points (Willig and Aikens 1988; Jones et al. 2003; Bryan 1988), textiles, woven sandals, grinding stones, food cache pits, and occasionally human remains (Powell 2005; Tuohy 1988a; Tuohy and Dansie 1997). These materials create a picture of a diverse prehistoric lifeway changing with the environment.

Artifacts found near the Wizards Beach megafauna include projectile points, bone spear points, stone net sinkers, fishing line, net bags, composite bone fishhooks, milling stones, awls, scrapers, and atlatl weights, and other stone tools (Tuohy 1988a). Of these artifacts only the fishing line was dated to 11,022 cal BP which makes it contemporaneous to human occupation of Wizards Beach but not to megafauna hunting. The fishing artifacts suggest people were taking the fish by netting them from the lake at the upper end of the lake rather than just at the lower end where the

Truckee River enters the lake. These artifacts have been found scattered at the 1,154 m shoreline on the northwest end of Pyramid Lake.

The Paleoindian population of the Great Basin is poorly known, both biologically and behaviorally. Only a handful of skeletons have been recovered, mostly incomplete. Little is known of the earliest inhabitants due to the absence of skeletal material. When LP/EH period skeletal elements are found, they are usually fragmentary (Dansie 1997). What we do know has been gleaned from artifact assemblages and minimal study of human remains. In nearby Chimney and Crypt caves, three matting samples dated ~10,393 cal BP to 10,313 cal BP indicate that Winnemucca Lake had marshlands that Paleoindians utilized to find raw materials for household goods (Dansie and Jerrems 2004).

Ancient textiles have been recovered that date over 10,000 years old according to Fowler and Hattori (2008). These ancient textiles have a unique weave style seen only in the early period. According to Fowler and Hattori (2008:61) “complex fiber artifacts, including sandals, nets, baskets, bags, mats, hats, and aprons” were made in the Pyramid Lake basin region spanning from ~13,500 cal BP to approximately 2,000 years ago. Weave pattern styles did change throughout time indicating that some styles were not made by later populations. Textiles are indicative of people utilizing resources for domestic goods as well as subsistence. Rockshelters and caves on the shorelines of prehistoric pluvial lakes have yielded artifact assemblages that provide a picture of

subsistence strategies in the LP/EH. Lithic scatters found on ancient lake bottoms, now desert playas, indicate that many sites were utilized on a seasonal basis with people following a foraging patch model (Jones et al. 2003; Smith 2010; Fenner and Smith 2011).

In the next chapter I review the five sets of LP/EH human remains that have been found in the Basin.

### Chapter 3: Great Basin Skeletal Remains from the Early Holocene

Eight sets of human skeletal remains have been found in the Great Basin from the LP/EH period; one set of human remains is from the MH and one set is from the Late Holocene (LH). Radiocarbon testing determined the time periods each human lived. Four of these individuals have been studied for more than just the radiocarbon age, including Spirit Cave Man, both Wizards Beach Men, and Buhl Woman. The other four individuals have not been studied due to incompleteness of the remains or reduction by cremation. In this chapter I describe the finds and the analyses that have been done to date. Table 1 is a summary of the remains and artifacts.

Table 1: Great Basin Skeletal Remains.

Site Name	No. of Individuals & Associated Materials	Dates cal BP	References
Fishbone Cave	1 individual Cedar Bark Mat Fish Netting	Undated 13,168±260 8,749±401	Hattori 1982; Powell 2005
Grimes Burial Shelter	2 individuals: Youth 10-12 yrs older individual Matting	11,036±152 Undated 10,813±171	Powell 2005; Dansie 1997
Spirit Cave	5 individuals: Young Male Adult female bone Matting Male, "Spirit Cave Man", 35-55 yrs 2 cremated individuals Coiled Basket Twined Grass Matting	5,390±62 10,481±105 10,440±99 10,672±73 10,215±23 2,219±79 1,621±68	Dansie in Wheeler 1997; Powell 2005
Wizards Beach	2 individuals: Male: "Wizards Beach Man" WBM1 33-45 yrs  Male: WBM2 20-30 yrs	10,379±88 & 10,839±231 *avg. 10,664±66 6,739±156	Edgar 1997; Wigand 2012 pers. comm.
Buhl, ID	1 individual: Female, "Buhl Woman" 17-21 yrs Biface; bone awl; badger baculum	12,545±157	Green et al., 1998; Powell 2005.

### **Fishbone Cave**

The oldest set of remains is from Fishbone Cave located on the shores of Winnemucca Lake, recovered by P.C. Orr in 1956 along with extinct camel and horse bones (Orr 1956; Hattori 1982; Powell 2005). The human remains consist of fragmented post-cranial bones from one individual (Powell 2005). Age and sex are undetermined due to the fragmentary nature of the bones. Radiocarbon dating was completed on the associated cultural artifacts found with the remains, including a cedar bark mat  $13,168 \pm 260$  cal BP ( $11,250 \pm 250$  BP, L-245) and fish netting  $8749 \pm 401$  cal BP ( $7,830 \pm 350$  BP, L-289) (Hattori 1982). The overall health of this individual is unknown due to the small amount of skeletal material available for study. Little has been written about the Fishbone Cave individual. The remains are curated at the Nevada State Museum (NSM). The date on the spatially associated matting, if it also dates the human skeleton, would mark this find as one of the oldest human skeletons in the New World.

### **Grimes Burial Shelter**

Grimes Burial Shelter (GBS) named by Wheeler (Dansie 1997:7) is located near Grimes Point on the edge of the Stillwater Marsh region, east of Fallon, NV. GBS yielded skeletal remains of an adolescent between 10 and 12 years old of indeterminate sex, and an older individual represented by a few bone fragments (Dansie 1997). This site was initially found by guano miners in the early 20<sup>th</sup> century. The skeletal elements include the cranium and a few post-cranial bones. The child's cranium had been cracked

by the guano miners but not collected by them. The mandible was missing as well as most of the post-cranial skeleton (Dansie 1997). The age of death was estimated based on tooth eruption in the dental arcade. The youth dated to  $11,036 \pm 152$  cal BP ( $9,700 \pm 80$  BP no lab number cited) according to Powell (2005) who further states that “carbonate in the site deposits that held this young person’s mortal remains has produced a radiometric age of  $9470 \pm 60$  yr BP (UCR-3477)” (Dixon 1999:133; Powell 2005:149). It is not known if further studies about the health of this adolescent have been performed. Organic matting from the cave was reexamined in 1995 and returned a radiocarbon date of  $10,813 \pm 171$  cal BP ( $9,470 \pm 60$  BP, UCR-3477) (Dansie 1997; Tuohy and Dansie 1997). Note that the date returned by Powell for the carbonate deposits is the same laboratory number as the matting date reported by Dansie (1997), so it is unclear what material was dated. The matting date, if it is associated with the individual, places this individual slightly older than Spirit Cave Man and contemporary with WBM1. These remains are curated at the Nevada State Museum (NSM).

### **Spirit Cave**

The most complete human skeletal assemblage found in the Great Basin is that of Spirit Cave Man (Burial no. 2), found in 1940 by Sydney and Georgia Wheeler in the Stillwater Range northeast of Grimes Point (Dansie 1997; Wheeler 1997). The Wheelers found two burial bundles and two bags containing cremated remains of one other individual. Burial no. 1 was stratigraphically superior to Burial no. 2 and covered by

matting containing “a few human bones; all that remained of some early Nevada inhabitant” (Wheeler 1997:15). Wheeler did not specify which skeletal elements were in this first burial nor did he determine sex or age for this individual. In later notes, Wheeler claims to have reburied the remains in the cave (Dansie 1997; Wheeler 1997). Later examination of the site collection indicates that they included distinctive warp face plain weave matting and scattered human remains (Fowler et al. 2000). The matting associated with Spirit Cave Man was radiocarbon dated to  $10,440 \pm 99$  cal BP ( $9,270 \pm 60$  BP, UCR-3480). Other skeletal elements represent two individuals, a male youth and a female adult dating to two different time periods. The male dated to  $5390 \pm 62$  cal BP ( $4,640 \pm 50$  BP, UCR-3473) and the female dated to  $10,481 \pm 105$  cal BP ( $9,300 \pm 70$  BP, UCR-3475 (Dansie in Wheeler 1997). Wheeler noted that Spirit Cave was a burial shelter and storage chamber and not used for habitation (Wheeler 1997). Wheeler’s theory of Spirit Cave as a burial chamber appears to be accurate because there were three more sets of remains found in the cave that date to different time periods, and the artifacts recovered from the shelter are further evidence that later Archaic ( $\sim 8,900$  cal BP to 635 cal BP) people utilized the cave for storage.

The second burial found by Wheeler was in a pit under Burial no. 1 and was also covered by matting. Burial no. 2 was originally identified as a young adult male who Wheeler attributed to about 1,500 to 2,000 years ago based on his understanding of the region’s archeology in the 1940s, an age later determined by radiocarbon dating to be inaccurate. According to Wheeler, “the bones of the lower portion of the body were

exposed but, from the hips upward, it was partly mummified.”(Wheeler 1997:16) “The scalp was complete with a small tuft of hair remaining” (Wheeler 1997:16). This individual is known as the Spirit Cave Mummy or Spirit Cave Man whose ontologic age is estimated from 35 to 55 years old at time of death (Dansie in Wheeler 1997). Care evidently had been taken in his burial. The body was “wrapped in a rabbit-skin blanket which retained a significant amount of fur, and [he] had well-constructed hide moccasins on his feet” (Wheeler 1997:17). A weighted average date for this individual is listed as 10,646±38 cal BP (9,415±25 BP) (Dansie in Wheeler 1997). Spirit Cave Man’s bone collagen was tested for total amino acids which returned a date of 10,672±73 cal BP (9,430±60 BP, UCR-3260) (Tuohy and Dansie 1997; Powell 2005).

Three bags containing cremated remains of one individual found near the Spirit Cave mummy were dated to 10,215±23 cal BP (9,040±50 BP, UCR-3478) (Dansie in Wheeler 1997; Tuohy and Dansie 1997; Fowler et al. 2000; Powell 2005). The textiles used for the three pre-10,000 cal BP burials in this cave are linked by the presence of warp face plain weave bags and matting (Tuohy and Dansie 1997; Fowler et al. 2000; Dewar 2001; Fowler and Hattori 2008). Coiled basketry and twined grass matting from the cave date to the late Archaic period with age of the basket at 2,219±79 cal BP (2,200±60 BP, UCR-3479) and the age of the grass matting at 1,621±68 cal BP (1,700±60 BP, UCR-3481) (Dansie in Wheeler 1997).

The most extensively studied burial from Spirit Cave is Burial no. 2, the mummy. He was found lying on his right side with his arms and legs in a flexed position. His last meal consisted of small fish similar to minnows whose bones were found in his intestines (Eiselt 1997; Powell 2005). An epoxy resin model was made of his skull using a CAT-scan, in order to measure the skull without damaging any remaining tissue or hair. The CAT-scan revealed that his teeth were excessively worn, indicating a diet rich in abrasive materials. There was also clear evidence of periodontal disease, including abscesses, one of which would have resulted in severe pain. His health was not very good at time of death; he has a partially healed right wrist fracture and the left side of his skull shows a small fracture along with blood clots in the fracture region. Multiple vertebrae exhibit osteophytic or bone spur growth and degenerative arthritis with a herniated intervertebral disk or a tear in the fibrous ring surrounding a disc, allowing the soft interior tissue to bulge out (Powell 2005). He also had Myelomenigocele (Spina bifida), and curvature of the spine. The cranium is dolichocephalic with its long-narrow vault, low face and high orbits. This skull shape is morphometrically similar to people with a Sundadont pattern, often seen in South Asian groups and the ancient Ainu of Japan in particular (Turner 1990; Jantz and Owsley 1997). The Spirit Cave Man's cranial measurements were included in a study of other Paleoindian crania found throughout the continent from the LP/EH, which concluded that craniometrically he did not have a resemblance to any historic group in Nevada (Jantz and Owsley 2001).

Research on Spirit Cave Man has been halted due to unsettled legal issues concerning the Native American Graves and Repatriation Act of 1990 (NAGPRA), and an ongoing dispute between the Bureau of Land Management (BLM), the responsible federal agency, and the Fallon Paiute-Shoshone Tribe in the Fallon area, who claim the individual as an ancestor. The BLM issued a statement that “no biological findings to date indicate by a ‘preponderance of the evidence’ that there is ‘affiliation’ of Spirit Cave Man...with a particular tribe” (Barker et al. 2000:64). As of this date, the remains are curated at the NSM with no further research planned until the NAGPRA claims are settled.

#### **Buhl, ID**

Operations at a rock quarry near Buhl, Idaho, in 1989 revealed a human skeleton. The rock quarry is the remnant from a flood-deposited gravel bar of ancient Lake Bonneville and though not technically in the Great Basin, its relation to Lake Bonneville, however, warrants inclusion in this review. AMS testing produced an age of  $12,608 \pm 127$  cal BP ( $10,675 \pm 95$  BP, BETA-43055 and ETH-7729) (Green et al. 1998:440). The remains were those of a young female, 17 to 21 years old, with worn teeth due a gritty diet. Under her skull lay an obsidian biface projectile point and the eye of a bone needle. Her femora show Harris lines in radiographic images suggesting that she had seasonal physiological stress due to poor nutrition in her adolescent years (Green et al. 1998; Powell 2005).

The remains, named Buhl Woman, consist of a fairly complete skeleton with good preservation as a result of consistent low annual precipitation in the region for the past 10,000 years (Green et al. 1998). She was located on Bonneville gravel deposits that were well-drained and covered with eolian silt and sand deposits. Buhl Woman is approximately 25% complete with any missing elements likely lost due to quarry operations (Green et al. 1998).

Buhl Woman's craniometric measurements were used by Green et al. (1998) to determine her affinity with living Native American and East Asian groups. She had forward projecting zygomatics, alveolar prognathism, and a moderately flared nasal aperture. These traits indicate that she falls within established ranges for East Asian and Native American populations.

Her dentition showed occlusal wear consistent with eating a gritty diet of well-processed foods. No caries or abscesses were present and her teeth did not show evidence of being used as tools for processing hides or baskets. There were linear enamel hypoplasias (LEH) present on her teeth, which are enamel defects caused by nutritional stress or deficiencies. A protostylid pit was evident in her mandibular third molars, a trait consistent with East Asian and Native American groups (Green et al. 1998).

Overall the health of Buhl Woman was good with no evident manner of death. She was buried with artifacts including "an unmodified badger baculum... [which]

appears to be an intentional grave offering” (Green et al. 1998:449). The artifacts with her burial include a pressure flaked stemmed biface, a bone needle segment, and two pieces of an incised bone awl (Green et al. 1998; Powell 2005). Buhl Woman was repatriated in 1991 to the local Shoshone-Bannock Tribes of Fort Hall Reservation according to Idaho state law.

### **Wizards Beach**

The final set of remains found in the Great Basin is that of the Wizards Beach (WB) men which I discuss in the next chapter as the focus of this thesis. These remains represent two individuals from two different time periods. Their morphologies show marked differences that can possibly represent biological responses to environmental or cultural differences. The oldest skeleton dates to  $10,664 \pm 66$  cal BP and the younger skeleton dates to  $6,739 \pm 156$  cal BP, placing the older skeleton within the Paleoindian period of Great Basin prehistory. The younger (Middle Holocene) skeleton represents a man living in a markedly different period with much lower resource availability.

## Chapter 4: Methods

In this chapter, I describe the methods used to examine and analyze the WB skeletal remains. These include relative and absolute dating and osteometrics/morphometric methods for recording and describing bones.

In order to understand how an individual lived, physical anthropologists use data gleaned from human skeletal remains along with any associated archeological artifacts. When artifacts are not found, then the skeletal elements are the only indication of what life was like for prehistoric individuals. Analyses include destructive radiocarbon dating and amino acid racemization, which require small amounts of bone; and non-destructive osteometry (including dental morphology), which are used to determine an individual's age, sex, manner of death (if evident) and pathological conditions.

### Dating

Various methods of analysis can be applied to learn more about Paleoindian people. However, the state of human health in ancient populations is not always easily determined. In the Great Basin, not only climate change would have affected health, but human choices in diet and other socio-cultural practices that changed over time would have had impacts. Health can be relatively measured through skeletal analysis, dental analysis, and the identification of pathologies observable in the skeletal remains. However, the amount of skeletal material limits the application of some analytical analyses. An example is the human skeletal find from Fishbone Cave, Nevada. The

remains were fragmentary with few elements, and therefore age and sex could not be determined for the individual. What is known about the remains was based upon the associated artifacts that could be radiocarbon dated.

Radiocarbon dating is one of the most widely used tests on archaeological finds including skeletal remains. The Carbon-14 atom's half-life limits radiocarbon dating to items that are ~45,000 years old or younger. Conventional radiocarbon dating requires 200 grams of material (Thomas and Kelly 2006), which is not a huge amount, but when it comes to Paleoindian remains that are usually fragmentary, 200 grams may be too destructive to sacrifice. Fortunately, in the 1980's accelerator mass spectrometry (AMS) for radiocarbon dating minimized the amount of material needed to obtain viable dates. AMS requires only 2-10 grams for dating bone, if preservation is adequate. AMS differs from conventional radiocarbon dating methods by using mass spectrometry along with an electrostatic tandem accelerator to proportion carbon isotopes and count them. This method was used to provide a date for Buhl Woman and the Spirit Cave remains.

Four other methods besides radiocarbon dating can be used for dating artifacts in archeological sites. The first is thermoluminescence (TL) dating which can be applied to ceramics or stone that was heated to temperatures of 500 degrees F or more. A second method used to date sediments enclosing or burying human bones is called optically stimulated luminescence (OSL). The method of electron spin resonance (ESR) is used to date tooth enamel or stone tools older than can be dated by radiocarbon. A

fourth method is potassium-argon or argon-argon dating, useful when dating rock layer formation (Thomas and Kelly 2005). A fifth method is the use of paleomagnetic dating of sediments enclosing the remains.

A use for TL dating would be on ceramic bowls or potsherds in a site; OSL would be used to date the sediments enclosing an artifact; and ESR would be used when dating bones of an ancient hominid such as a Neanderthal. In North America, it is common to depend on  $^{14}\text{C}$  dating methods because the artifacts and human remains do not surpass 45,000 years of age.

### **Osteometry**

Osteometry uses standard measurements to compare a human skeleton to known living populations. These comparisons with standard measurements are also known as osteometrics. The data are obtained using morphological feature dimensions (length, height, and breadth) and then comparing them with known population groups. Indexes for skeletal measurements provide standards of comparison and differences when determining sex or ethnic affiliation (Schwartz 2007). The tools used to measure skeletal elements are digital calipers, sliding calipers, spreading calipers (for the cranium), a measuring tape (for long bone diameters) and an osteometric board (for long bone lengths). In this research, I followed the standards of measurement set by Buikstra and Ubelaker (1994) commonly used in measuring human remains. I found that more accurate measurements were obtained using digital calipers rather than

sliding or spreading calipers for certain measurements. I also used White et al. (2012) and Bass (2005) as references of the points where skeletal elements are measured.

### **Craniometrics**

The first set of measurements used is craniometry or craniometrics, which is measuring the cranium and mandible (the lower jaw bone). Age and sex can be determined using craniometrics based on cranium size and breadth, the shape of the occipital region (the rear of the skull), the frontal eminence (brow and forehead region), the nasal region, the size and shape of eye orbits, and the size and shape of the mandible. Craniometrics was used on Spirit Cave Man, Wizards Beach Man (Jantz and Owsley 1997, 2001), and Buhl Woman (Green et al. 1998) to compare them with modern populations. I provide comparative discussion of these finds in later chapters.

#### Non-metric Cranial Traits

Non-metric cranial traits are recorded for two purposes. The first purpose is the study of differences or similarities between populations or small groups; and the second is estimating biological distance, which is the determination of how closely or distantly related a group may be to another (Schwartz 2007:264; White et al. 2012:478-481). Due to my sample size of two individuals, it is not possible for me to use either individual to compare with a population or group based on closeness or distance. A biodistance program often used to determine affinity is FORDISC. This program is a discriminant

function program to determine affinity with known modern groups. This is also the statistical analysis method that Jantz and Owsley (2001) used to determine affinity of one of the Wizards Beach remains and Spirit Cave Man with known groups, as I report later in this chapter (see Table 2 page 48 and Table 3, page 49). The scarcity of Great Basin Paleoindian skeletons precludes any study of closeness or distance with groups of the same period due to limited sample size. When there are only a few skeletons in a study group you cannot conclusively determine affinities, because variability is expected within each group and small samples do not necessarily express that variability. Therefore, for the purposes of this research I did not use non-metric cranial traits other than what Jantz and Owsley (2001) already reported.

#### Dental Morphology and Traits

Dental characteristic analyses are used to determine biological traits that relate to ethnic affiliation and genetics. Variations in tooth size and crown morphology (including the root) are absolute for presence or absence (e.g., a cranium that is lacking teeth may reflect age, pathology, or nutritional deficiencies). The tool used for dentition measurements is dental digital calipers to measure tooth crown height and width, which I used to measure the teeth in my sample of two individuals (see Table 8, page 146). According to Scott and Turner (1988:101), “tooth size, number, and morphology have a sufficiently strong genetic basis to make them useful variables for assessing biological relationships and microevolutionary trends”. Morphological traits that may indicate

ethnic affiliation are presence/absences of shovel-shaped incisors, cusp six, Carabelli's trait, winging of the incisors, and 3-rooted first molars (Scott and Turner 1988).

These traits are seen in some populations but not in others, or are in variable proportions in the populations, thereby establishing likely ethnic affiliation. Turner (1990) established that there are two dental complexes for south and east Asian groups, Sundadonty and Sinodonty, with the latter traits seen in most of the modern Asians including Siberian, Chinese, Korean, and Japanese, as well as in Native American populations. Sundadont traits are seen in ancient people and survive in a few modern east Asian groups such as the Jomon or Ainu. Modern east Asian groups are descended from populations ancestral to the Jomon and Ainu, but differ from them dentally. Population migration models indicate the first inhabitants of the American continent, while descended in distant times from ancient Asian groups (Scott and Turner 1988; Turner 1990), carry Sinodont traits.

An examination of Paleoindian dental morphology often reveals teeth that are worn, which often means that many dental traits cannot be measured or observed because they have been destroyed. This does not necessarily mean that dental traits (such as shoveling, Carabelli's trait, cusp six, etc.) were not there at one time, just that the teeth have been worn to the point that it is not possible to see the traits. What the teeth do tell us from the Paleoindian sample listed in the previous chapter is that teeth were often used to process hides or had to endure a gritty diet (Green et al. 1988).

Overall health based on presence or absence of dental abscesses that may have contributed to death can also be determined (Edgar 1997).

In this research, I noted that the teeth of both Wizards Beach skeletons are worn severely to the point where dental traits that may determine affinity to known modern groups are no longer visible. Other researchers have looked at various dentition analyses to determine dietary behavior (Leigh 1925), anterior or molar tooth wear (Hinton 1981; Smith 1984), dentin exposure (Murphy 1959), or helicoidal plane evolution and eruption (Smith 1986). Researchers have established tooth scoring methods (Hillson et al. 2004; Scott 1979; Smith 1986), using dental wear to determine age at death (Lovejoy 1985) or looked at dental modifications as a result of teeth being used as tools (Larsen 1985). All of these previous methods detail items to look for in the dentition of skeletal remains. While these are all good indicators of specific traits or behaviors, I did not find them applicable to my research due to the extreme tooth wear evident on both of the WBM skeletons. There is no cranial modification or tooth modification evident in either of the WBM. Their oral pathologies are addressed in Chapter 5, including tooth crown measurements.

The teeth of both Wizards Beach remains are worn past the occlusal surfaces used for scoring quadrants of molars, and there is no dentin showing; while their teeth may have been used as tools based on lingual or buccal wear patterning it is not evident that I can determine this conclusively. I determined age at death for each WB individual

based mostly on other elements of the skeleton, because tooth wear was so advanced. Leigh (1925) details how diet is indicated on the teeth in four modern groups – the Arikara, the Sioux, the Zuni and the Kentucky Algonquin. These groups have a unique diet that they followed in the historic period based on their tooth wear as shown in the amount of caries and abscesses. Each of these four modern Native groups used the triad of beans, squash, and corn as staples in their diet and these foods directly affected the health of their teeth and gums. However, for my research, in the Early and Middle Holocene periods, beans, corn, or squash were not grown in the Great Basin and the earliest inhabitants were not agriculturalists. Therefore, it is not possible to apply Leigh's (1925) analyses in determining the tooth wear seen in the WB individuals; the most that can be gleaned from Leigh's article is that of describing the dental pathologies seen on the WB crania, which is noted in Chapter 5.

### **Stature**

Long-bone analysis and measurements indicate height, pathologies, or nutritional deficiencies. Height is determined by measuring the bone for its maximum length or its physiological length (when in anatomical position in the body, which may shorten the maximum length). Formulas for transforming bone lengths to entire body stature have been developed for most limb elements. For example, to get a height measurement from the femur the formula is: "stature (cm)  $\pm$  3.417 = (2.26) (femur length) + 66.379" (Bass 2005:29; White and Folkens 2000:371; White et al. 2012:420). Varying stature formula tables are available for different ethnic groups when trying to

determine affiliation (White and Folkens 2000). This is the formula that I used to obtain the stature estimates for the WB men.

### **Age at Death and Sex**

The analysis of long bone length can help to determine age by recording the state of the epiphyseal ends of the bones. If the epiphyses are fully fused, then the bone can be considered to be from a person who has reached the end of that bone's growth period. Not all bones finish growing at the same time in the body, so age-estimation may be only a range of possible years since birth. If any limb epiphysis is not fully fused or remains separate, then a juvenile or subadult assignment is indicated. The proximal ends of limb elements fuse with the diaphysis (shaft) beginning ~14 years old with complete fusion by 18-25 years (Schwartz 2007). One of the factors in determining age of the Paleoindian Buhl Woman was the state of fusion of the long bone shafts separate from the epiphyses (Green et al. 1998).

The pelvis can also be used to determine age and sex in a skeleton. However the pelvic girdle is often missing or incomplete, because large parts of the bones have thin portions that are easily damaged. When the pelvic bones are present the pubic symphyses or ends where the two halves of the pubis meet can be used to determine age. The pubic symphyses have wavy or ridged surfaces that change as an individual ages, producing a smoother surface and lipping. In younger individuals the waves or ridges are more pronounced than in older individuals (Bass 2005:201-203; Schwartz

2007:234-236; White et al. 2012:396-402). While the Spirit Cave Man is the only one of the Great Basin Paleoindians which have been studied recently that has a complete pelvic girdle, the determination of his age was based on other bones and not using the pubic symphyses. The previously unanalyzed WBM2 was recovered with a pelvic girdle, which I examined to determine sex and age, as I report in chapter 5.

### **Musculoskeletal Stress Markers**

Musculoskeletal stress markers (MSM) are used to determine robusticity or gracileness, sex and the effects of repetitive activity on human remains. MSM are often seen on long bones where the muscles and tendons attach to bone. Researchers have used MSM to determine subsistence strategies (Hawkey and Merbs 1995), postcranial robusticity (Shackelford 2007), hunting methods (Peterson 1998), or repetitive actions that may account for larger MSM on one side of a skeleton (Kennedy 1998; Steen and Lane 1998; Weiss 2007). However, Hawkey and Merbs (1995:325) point out that MSM studies are most useful on large sample sizes and caution using them on small sample sizes “because artifactual and modern ethnographic information may not always correlate accurately with the skeletal record”. Hawkey and Merbs (1995) outline ideal criteria for studying MSM in skeletal series including three factors: first, there must be a small time span; second, there must be cultural or genetic isolation; and third, there must be known activities being studied.

In my research, there is a large gap in the time period when two individuals lived. They may have been genetically and/or culturally isolated but that is not definitively known, and any activities we might wish to ascribe to them are based on artifacts or subsistence remains that were not associated with them, such as items from caves, rockshelters or other localities rather than from Wizards Beach; as well, it is not necessarily advisable to use ethnographic records of activity as potential models for Paleoindian activities. Therefore, in my research, while I note in Chapter 5 that WBM1 is a robust individual with large MSM on his long bones, I cannot conclude that these are likely attributed to specific repetitive activities without risky speculation. In the case of Middle Holocene WBM2, his pathological conditions (described later) likely would have affected MSM growth and are not readily identifiable. Thus I limited myself to noting unusual skeletal markers but did not attempt to explain them in terms of activity or genetics.

### **Race/Ethnic Affinities**

Cultural relatedness is often attributed by race or ethnic affiliation. The term race is used to subdivide the human species into groups based on skin tones, tribal groups, or other small population groups (Gill 1990). Humans categorize each other based on similarities of cultural mores or physical characteristics. The issues of cultural affinity are often more widely used in Paleoindian cases when determining who has the rights to an ancient skeleton. This issue is one that I did not want to delve into in my research due to the sensitivity of this issue with modern Native groups. To determine

cultural affinity and/or race it is much easier to research a large sample size rather than one or two skeletons. Owsley and Jantz (2001) did report on what they considered WBM1's similarities and differences with modern human groups living in different geographic areas, and did not think WBM1 was especially similar to modern Native Americans in many ways, as further discussed below.

### **Data Analysis of the Great Basin Paleoindian Skeletons**

The Great Basin Paleoindian remains from the LP/EH period have been analyzed using craniometric measurements, dental morphological traits, stature estimates, and presence of pathologies in the remains. However not all of these tests have been used on all of the remains; e.g., the Fishbone Cave remains mentioned above were minimally analyzed due to incompleteness of the remains. The Grimes Burial Shelter bones have been analyzed for the age of the individual and to determine a radiocarbon age but no other analyses have been performed.

After recovery Buhl Woman's remains were analyzed with permission of the local Shoshone-Bannock-Tribes of Fort Hall before her eventual repatriation. Craniometric measurements were taken for determining or estimating ethnic affinity, age, and sex. Buhl Woman was not included in the craniometric analysis by Jantz and Owsley (2001) presumably due to repatriation of her remains; therefore, a statistic capable of showing her probable affiliations to any modern group is unknown. Her long-bones were measured to determine stature and analyzed for dietary stress, such as the

Harris lines that are indicative of nutritional deficiencies. AMS dating was performed at two different laboratories with permission from the tribes (Green et al. 1998). Her dental morphology and tooth wear indicated a gritty diet with no abscesses or carious lesions (cavities). A small piece of her bone collagen not used for radiocarbon dating was analyzed for stable isotopes. These values indicate that Buhl Woman had a diet of fish and meat resources based on high nitrogen values (Green et al. 1998).

Spirit Cave Man has been analyzed the most extensively for age, diet, pathologies, and dental wear. Using CAT-scans of the skull, a resin model was made so that the adhering soft tissue could be preserved while analysis was conducted. This model was then measured using craniometric standards in order to determine closest affinity with modern populations. The CAT-scan also revealed pathologies in bones such as the fracture on his wrist and skull, as well as the remodeling of his bones due to an infectious disease. While cause of death is not definitively known, we do know that he had abscesses in his teeth which could have contributed to disability or death. Spirit Cave Man's health has been determined based on the various tests performed on his remains. Partial mummification in the arid environment preserved his last meal which was analyzed from his intestinal tract.

The oldest Wizards Beach Man (WBM1) remains have been analyzed using craniometric standards for affinity with modern groups and to determine sex. Jantz and Owsley (2001) analyzed WBM1 along with ten other Paleoindian crania to determine

affinity with modern Native American groups using Howells' system (Howells 1973). WBM1 was compared with other samples from similar time periods and using a statistic (Mahalanobis distance) to show relation with other variables found in other groups. Mahalanobis distance tests are used to show a "typicality probability" (Jantz and Owsley 2001; Albrecht 1992) or relationship with other known skeletal series. Jantz and Owsley (2001:148) point out that "it is obvious that no early American skull derives from a contemporary population, regardless of how similar it may be". Yet they later ascribe WBM1 and Spirit Cave as part of a "centrally located cluster" (Jantz and Owsley 2001:149) that includes a female and a male from Wet Gravel, NB, both undated, a male from Prospect, OR, dated to 7,844 cal BP, and a male from Swanson Lake, NB, that is undated. Table 2 shows the results of analyses by Jantz and Owsley (2001:151) indicating that WBM1 has affinity with five different groups, none of which are statistically significant:

Table 2: Distances and probabilities for WBM1  
(Jantz and Owsley 2001:151).

Norse: 17.182 p = 0.753
Peru: 17.346 p = 0.744
Santa Cruz: 19.036 p = 0.643
Sioux: 19.164 p = 0.635
Blackfoot: 20.041 p = 0.581

None of these results are overwhelmingly positive for any one group, with the highest affinity being closest to the Norse (the lower the number the higher the probability of relationship with a known group). The same statistical analysis done on Spirit Cave Man shows a lower affinity to any known group with a minimal relationship with the Norse, according to Jantz and Owsley (2001:151):

Table 3: Distances and probabilities for Spirit Cave Man (Jantz and Owsley 2001:151).

Norse: 32.581 p = 0.068
Blackfoot: 33.491 p = 0.052
Peru: 34.278 p = 0.046
Zalavar: 34.852 p = 0.041
Ainu: 35.836 p = 0.032

The comparisons were made in order of “increasing distance” by Jantz and Owsley (2001:151 Table 3), which would make both Spirit Cave and WBM1 most closely related to the Norse rather than any modern Native American group, but sharing a distant commonality with the Blackfoot, a modern Native American group located in northern Montana and Canada.

WBM1 was determined to be in his mid to late 40's based on dental wear and cranial suture closure (Powell 2005). WBM2 had not been analyzed until my research (see Chapter 5 and results in Chapter 6). These two individuals are very distinct in their skeletal morphology and their pathologies, which may be due to them being from very different climate periods in the Great Basin.

## Chapter 5: The Paleoindians – Wizards Beach

In February 1968 a low shoreline was exposed on Pyramid Lake due to drought (Powell 2005). Peter Ting, an avocational archaeologist, discovered human remains on the surface in the Needles area of the lake at an approximate elevation of 1,156 m, about 110 m southeast of the shoreline and 275 m west of the Needles rocks. Robert Stephenson (1968), director of the Nevada Archaeological Survey, went to record and collect the remains. The site was assigned number 26WA1605 and Stephenson recorded three separate sets of remains on the beach (Stephenson 1968). He photographed the remains, noted what elements were present, and observed that they were on the surface where looting was possible. Stephenson did not excavate the shoreline for other remains and collected only the bones lying on the surface. Stephenson (1968) thought there were three individuals that he designated as Burials 1, 2, and 3, with Burial 3 represented by a single femur bone; this femur was later determined to be part of Burial 2. Burial 1 was a nearly complete skeleton and Burial 2 was a partially complete skeleton. No artifacts were found with the remains, although one piece of basalt was collected and listed as a 'possible effigy' (Stephenson 1968:3). Also collected were small mammal bones and a pelican humerus. Little other information was noted about the human skeletal remains. Prior to the current research, all that could be theorized about WBM1 is that he may have been a forager who probably followed the shorelines, marshlands, and rivers in the region for subsistence (Dansie 1990).

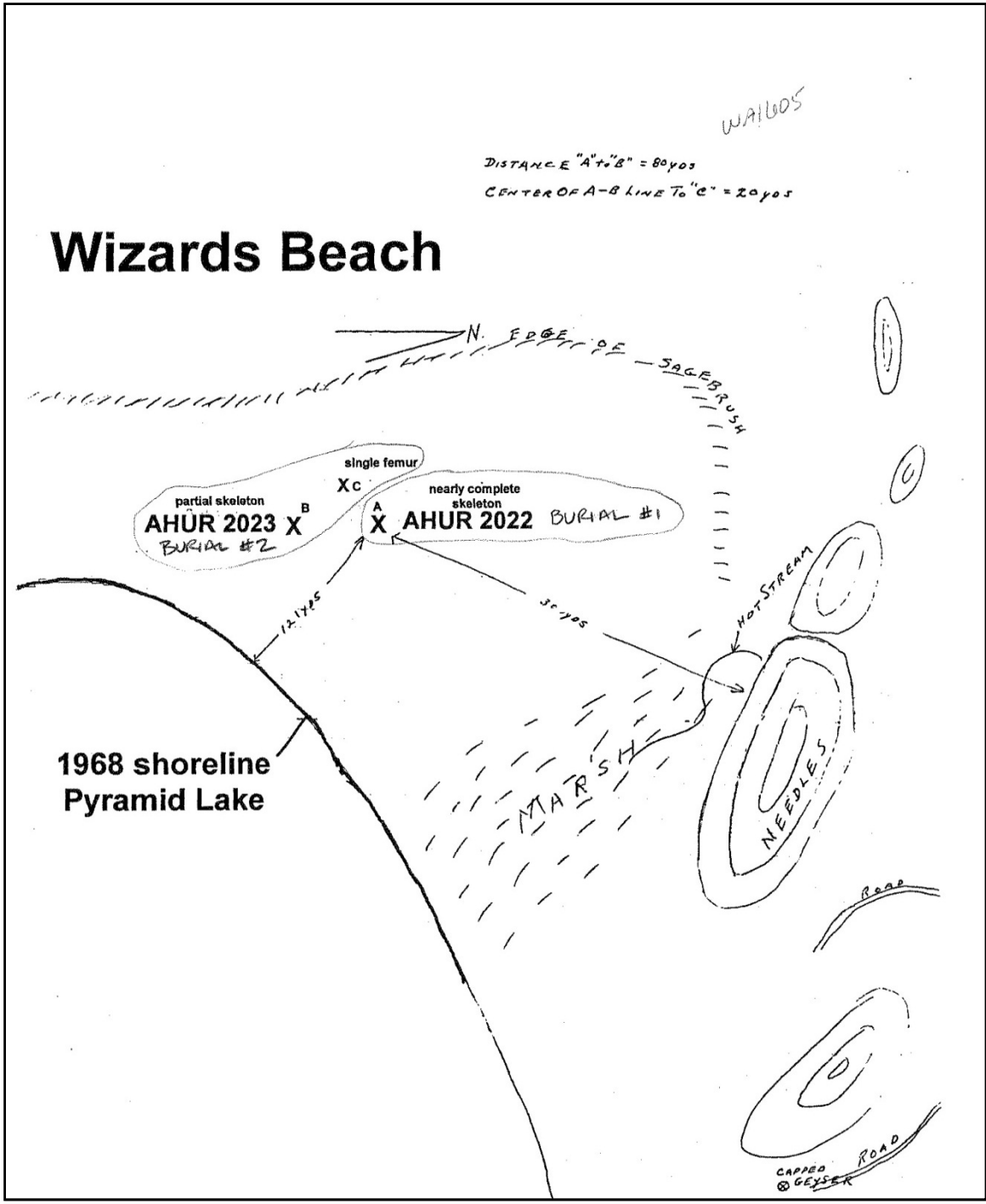


Figure 3: Wizards Beach find spots drawn by Stephenson (1968).

Fishing implements recovered in the same area of Pyramid Lake date to the Late Pleistocene or earlier (Greenspan 1990; Tuohy 1988a; Tuohy 1990). The possible effigy (Figures 4 and 5 below) that Stephenson recorded is a piece of basalt with carved shoulders. Eugene Hattori of the Nevada State Museum (NSM), (pers. communication, 2012b) and I compared this basalt piece with some of the stone net sinkers found in the same region that are in the collections of the NSM. Based on its shape, we suggest that it is a possible net sinker.



Figure 4: Basalt Probable Net Sinker, bottom view



Figure 5: Basalt Probable Net Sinker, top view

Gary Haynes (pers. communication, 2012) examined this piece and also concurred that this piece is a probable net sinker, since the configuration of the piece is not natural. Whether WBM1 used any of the fishing artifacts found in this region is uncertain. This possible net sinker found with the WBM1 remains may not necessarily be his property, especially due to the previous recovery of numerous fishing artifacts from this same site (Greenspan 1990; Tuohy 1998a; Tuohy 1990).

A later report by Amy Dansie (1997), Nevada State Museum, relabeled the burials A, B, and C. Burial A was  $^{14}\text{C}$  dated to  $6,739\pm 156$  cal BP ( $5,905\pm 125$  BP, GX-

19421-G) placing this individual in the Middle Archaic right after the beginning of the Middle Holocene, a very dry, arid period. Burial B has two reported radiocarbon dates of 10,396±90 cal BP (9,225±60 BP, UCR3445/CAMS-28124) (Hattori pers. comm.; Jantz and Owsley 1997; Tuohy and Dansie 1997) and 10,664±66 cal BP (9,515±155 BP, GX-19422-G) (Geochron 1993). According to Dansie and Kirner et al. (1997) total amino acid testing returned dates of 10,393±90 cal BP (9,200±60 BP) and 10,416±95 cal BP (9,250±60 BP) for the remains which are the most often published dates. Kirner et al. (1997) analyzed a sample of Burial B for accelerator mass spectrometry (AMS) dating, and published an average date of 10,396±90 cal BP (9,225±60 BP, UCR3445/CAMS-28124, 29810) making this individual's age range between 10,393 to 10,664 cal BP for those dates reported above. The slight differences in reported ages are an issue with Burial B, and cannot be reconciled here.

*Table 4: Radiocarbon Date Averages for WBM1.*

	Radiocarbon Date		Standard Deviation
1 WBM1 (UCR3445/CAMS-28124)	9200	±	60
2 WBM1 (GX-19422-G)	9515	±	155
	18715	±	215
standard average = (of dates 1 & 2)	9358	±	72
weighted average = (of dates 1 & 2)	9427	±	56

Formula for weighted Average

$$(t_1w_1 + t_2w_2 + t_3w_3 + t_4w_4 + \dots + t_nw_n) / (w_1 + w_2 + w_3 + w_4 + \dots + w_n)$$

$$(1/s_1^2 + 1/s_2^2 + 1/s_3^2 + 1/s_4^2 + \dots + 1/s_n^2)^{-1/2}$$

Weighted Average of radiocarbon dates #1 & # 2

Radiocarbon Age = 9427

Standard deviation = 56

(Wigand 2012 pers. comm.; formula from Sheppard 1975)

The multiple dates raised the question of which is most accurate. By averaging the dates, an age for Burial B of  $9,427 \pm 56$  BP is calculated (see Table 4 above) (Wigand pers. comm. 2012; Hattori pers. comm. 2012a; and Sheppard 1975). Burial B is therefore considered to have an age of  $10,664 \pm 66$  cal BP. The averaged radiocarbon dates indicate that this individual is a contemporary of Spirit Cave Man ( $9,430 \pm 60$  BP/ $10,672 \pm 73$  cal BP) (Dansie in Wheeler 1997; Powell 2005).

### **Wizards Beach Man 1 – AHUR 2023**

Burial 2/B has come to be known as Wizards Beach Man, AHUR 2023 (WBM1). He is about 13% complete with 16 bones recovered out of the normal 206 found in a human body. One of his phalanges destroyed during radiocarbon dating returned the date of  $10,664 \pm 66$  cal BP. On an inventory list from 1968, ribs are mentioned and listed on the 1993 Nevada State Museum (NSM) inventory, but none were with the remains when they were returned from the NSM to the University of Nevada, Reno, Anthropology Department in spring 2011 (Figure 6 below). It should also be noted that there are 21 bones listed on the NSM inventory sheet, yet when I counted the remains for my research only 16 were found, with the clavicle being a fragment and not a complete bone. I did an inventory for my research to document what skeletal elements were present or absent for each individual (Table 6, Appendix A, page 144). The inventory also includes a pelican (*Pelecanus erythrorhynchos*) humerus, and a small

bone of an unknown bird. The pelican humerus is stained black equivalent to Munsell color of Gley2/2.5/5pb (Munsell 2010) and has not been radiocarbon dated.

The WBM1 cranium had been partly buried along the sagittal plane as evidenced by bands of black to brown on the right side, with the left side bleached a light color. This striping on the cranium is caused by manganese in Pyramid Lake water (Lebo et al. 1994). The cranium has been described as “robust...a good morphometric match to either east Asian populations or North American natives” (Powell 2005:151). Owsley and Jantz (1999) ran statistical (Mahalanobis distance) tests on their craniometric data from WBM1 along with three other Paleoindian crania, including Spirit Cave Man (10,672±73 cal BP/9,430±60 BP), Pelican Rapids Woman (8,665 cal BP/7,840 yr BP) (Owsley and Jantz 1999:88; Powell 2005:136) and Brown’s Valley Man (9,760±164 cal BP/8,700±110 – 9,997±146 cal BP/8,900±80 yr BP) (Owsley and Jantz 1999:88; Powell 2005:137) to determine their affinity with 10 recent populations. These tests were discussed in the previous chapter.

The dental arcade of WBM1 shows extreme wear, abscesses and periodontal disease in the 17 teeth present (Edgar 1997; Powell 2005). Some teeth are broken or cracked and others were lost post-mortem. There is an observable abscess on the lower right first molar. This abscess was infected directly into the bone as seen through the open pulp chamber. Extreme tooth wear was common for a man of this age during prehistoric times with the occlusal (chewing) surfaces were almost all worn to root stubs (Edgar 1997).

NEVADA STATE MUSEUM CATALOG Page 1 of 1

Site No.: 260W11605 Project/Collector: [Signature] Date Collected: \_\_\_\_\_

Other Name/Number: ANM 2023, Needles, Pyc. Lk., atq Wizzard's Cove Cataloger: PL Date Cataloged: 8/1/13

Specimen Number	Description	Count	Material	Location/Association	Notes
4	Human burial				cat #s may be continued
✓	ulna	2			From 260W11605, 1, 2, 3
✓	radius	2			(NSM Box 16)
✓	clavicle	1			
✓	humerus	1			
✓	fibia	1			
✓	fibula	1			
✓	scapula	1			
✓	ribs	4			
✓	metacarpals	2			
✓	phalanges	6			
✓	vertebrae	1			
✓	cranium	1			
✓	mandible	1			
✓	<sup>Aves</sup> <del>mammal</del> bones (2)	2			Catalogued w/ human bones
✓	<sup>Vesicular Basalt, atq?</sup> <del>crustacean</del>	1			but not included on 8/1/13
✓	femur	1			

9/15  
2013

Enclosure 5

Figure 6: WBM1 Inventory Sheet from the Nevada State Museum.



Figure 7: WBM1 Maxilla, frontal view.



Figure 8: WBM1 Maxilla, endocranial view.



Figure 9: WBM1 Mandible.

None of the WBM1 teeth sockets show resorption, which would be an indicator of tooth loss pre-mortem; therefore, he had all his teeth at time of death, but they must have been lost or not collected when the remains were discovered.

As is evident in Figures 7, 8, and 9 above, abscesses can be seen in the upper molars on the maxilla in particular, specifically on the right M3, M1, the canines, and incisors (even though the teeth are not present), and left M1. On the mandible severe abscesses are seen on the right M3 and PM1, and on both M1's. These abscesses (Table 9, Appendix A, page 146) are in the maxilla and likely caused pain during his life and may have been a contributor to his death. The other abscesses while undoubtedly painful do not show evidence of major infection. Many of the teeth are cracked or broken, which may indicate that he used his teeth as tools. The teeth are worn lingually, which is unusual in Paleoindian dentition.

Cranial measurements for both individuals from Wizards Beach are shown in Table 10, Appendix A, page 147. Post-cranial measurements are shown in Table 11, Appendix A, page 148.

Powell (2005) claims that the WBM1 was in his mid to late 40's based on dental wear and cranial suture closure, but further analysis was done for this thesis as reported later.



Figure 10: WBM1 Cranium and mandible, frontal view.



Figure 11: WBM1 Cranium, occipital view.



Figure 12: WBM1 Cranium and mandible, right side.



Figure 13: WBM1 Cranium and mandible, left side.

### ***Osteological Analysis by Element***

As stated previously, the WBM1 skeleton is only approximately 20% complete with many elements missing or not collected at the time of discovery. The skull is complete including the cranium and mandible. WBM1 has atypical occipital condyles and mastoids indicative of large muscle attachments. The skull shows coloration due to weather and chemical changes from the alkalinity of Pyramid Lake (Reddy and Hoch, 2012). When bones are left exposed on the surface they usually whiten over time due to weathering. The side of exposed bone becomes lighter than the side not exposed. This is seen in the coloration of the right and left sides of the cranium of WBM1. The left side (Figure 12 above) is a lighter color (Munsell White Page/2.5y 8/2) than the right side (Figure 13, above, Munsell 7.5yr/5/6), with a dark vertical band (Munsell

Gley2/3/5pb) splitting the two sides (Figures 10 and 11 above) due to irregular manganese staining in Pyramid Lake (Munsell 2010). The lighter color of the left side would be indicative of that side being exposed longer. The right side is a darker color indicative of that side being surrounded by sediments. The striping of the cranium may be indicative of water lapping for approximately 9,000+ years against the cranium depositing a black strip, or may indicate episodes of partial exposure, reburial, and re-exposure of different parts of the cranium.

### Skull

The cranial sutures on WBM1 are completely fused with the exception of the right squamosal and coronal sutures of the temporal region. These sutures show separation along with coloration inconsistent with weathering. The right zygomatic process is separated from the malar bone along the suture line. Comparing the right and left squamosal sutures leads to the question of how would the right squamosal and coronal sutures split? Could it be due to weathering, blunt force trauma, or impact during the past 9,000 years by something on the lakeshore of Pyramid Lake? This question is addressed in Chapter 6.

WBM1's worn teeth suggest an abrasive diet, leading to abscesses that may have contributed to his death. The teeth are worn lingually with rounding on the interior surface. The occlusal surfaces are worn almost to the roots, so that dental traits indicative of ancestry (Scott and Turner 2000) are no longer visible. Almost all the teeth

are cracked and there are five abscesses present on the maxilla and four abscesses on the mandible (see Table 9, Appendix A, page 146). WBM1 does show visible mental spines on the mandible. WBM1 had all of his teeth when he died based on the lack of resorption of any teeth lost peri-mortem. The root canals are visible for all teeth, indicating that the teeth were still in place at the time of death.

### Long Bones

The long bones in a human skeleton consist of two humeri, two radii, two ulnae, two femora, two tibiae, and two fibulae. WBM1 has his left humerus, both radii, both ulnae, the left femur, the right tibia, and a right fibula. WBM1 had prominent muscle attachments on the femur, humerus, and ulnae.



Figure 14: WBM1 Left Humerus, lipping on humeral head (red arrow) and distal end (yellow arrow).

The left humerus of WBM1 shows osteoarthritic lipping of the medial and lateral condyles on the distal end (Figure 14). The humeral head exhibits a prominent muscle attachment on the intertubercular groove, minor root etching, minimal weathering and slight discoloration (Munsell Gley/4N) (Munsell 2010). The weathering, discoloration, and root etching are consistent with burial in lake sediments (Byers 2002; Reitz and Wing 2008). Munsell (2010) colors for the humerus anterior medial shaft are 10yr/6/3



Figure 15: WBM1 Left humerus, lipping, pronounced deltoid tuberosity indicated by arrow.

and for the distal end White Page/2.5y 8/1. The deltoid tuberosity is pronounced (see Figure 15 arrow), another indicator of muscle attachment.

The arm joints show osteoarthritic lipping on the radial head of each radius, on the proximal ends of both ulnae, including the trochlear notches, the guiding ridges, the coronoid processes, and the olecranons (Figure 16). The distal ends of the radii and ulnae exhibit minor lipping of the ulnar heads and the radial suprastyloid crests and styloid processes.



Figure 16: WBM1 Right ulna and radius. Remodeling near interosseous border indicated by arrow.

There is some remodeling of the radii near the interosseous borders on the posterior surfaces, but whether this is due to a break is not definitive, and may be related to muscle attachments that were enlarged from continual load bearing.



Figure 17: WBM1 Left Femur: bowing, root etching, broken lesser trochanter indicated by arrow.

WBM1's femur is very robust with marked anterior bowing (Figure 17); the linea aspera is very prominent indicating well-developed muscle attachments, and the nutrient foramen is difficult to see. The lesser trochanter was broken after recovery exposing the interior bone structure. There is slight weathering of the surface of the femur and possible root etching. The femur is stained with the same coloration as the skull and likely was buried in sediments due to the minimal weathering on the bone. Munsell (2010) colors for the femur head are Gley 1/3N, the distal end of the posterior femur shaft 10yr 4/4, and the femur shaft anterior diaphysis 10yr/5/4.



Figure 18: WBM1 Left femur, anterior view, osteoarthritic lipping of the medial (arrow) and lateral condyles.

The right tibia and fibula (Figures 19 and 20) have staining, root etching, and minimal weathering similar to the other long bones and consistent with burial in sediments. As with the other long bones, the tibia and fibula show the same discoloration, staining, and minimal weathering due to burial. The lateral and medial condyles show arthritic lipping, the tibial plateau on the proximal end is prominent, and all the epiphyses are completely fused. The talar articular surface of the distal end of the tibia does show minor arthritic lipping. The tibia is noticeably bowed anteriorly.



Figure 19: WBM1 Right tibia and fibula, lipping at distal end indicated by arrow.



Figure 20: WBM1 Right tibia, showing bowing, and fibula.

### Vertebrae, Scapula, Clavicle, Hand, and Foot Bones

The other bones recovered with WBM1 include a fragment of the left clavicle, the left scapula, one cervical vertebra (C4), two metacarpals (one left, one right) and five phalanges (all left). The inventory report by Stephenson (1968) indicate that there were four rib bones recovered with WBM1, but they were not included in the box returned to the UNR Anthropology Department. Radiocarbon dating was done on one phalanx, which, as was mentioned above, was destroyed during the dating process.

The cervical vertebra (Figures 21 and 22) exhibits deformation of the spinous process; the inferior articular facet is more worn on the right than the left, and there is minor lipping on the vertebral body. These anomalies on this vertebra made it difficult

to determine if it was a C4 or a C5, but C5 typically has a smaller spinous process than this one, whereas the spinous process on C4 has a unique shape similar to what is seen on WBM1's vertebrae.



Figure 21: WBM1 C4 Vertebra, superior view, pronounced wear on the right.



Figure 22: WBM1 C4 Vertebra, interior view, deformed spinous process indicated by arrow.

The left clavicle (Figures 23 and 24) has similar staining from Pyramid Lake sediments, with the coracoid process was broken off at some point either during recovery or while in storage. The subscapular fossa is very fragile with some bone loss due to thin bone. There is minor lipping of the glenoid fossa and the broken coracoid process has the same discoloration as the rest of the anterior portion of the scapula. It is likely the posterior side was exposed on the surface judging from the lighter coloration of the bone.



Figure23: WBM1 Left Scapula, superior view.



Figure 24: WBM1 Left Scapula, anterior view, broken coracoid process indicated by arrow.

The clavicle fragment is from the right clavicle with only 62.5 mm of the sternal end remaining. This fragment is broken into two pieces and no other measurements were possible on the piece.

Recovered were hand bones consisting of one right metacarpal, one left metacarpal and five phalanges. The radiocarbon dating process destroyed one phalanx. There were no foot bones recovered for WBM1.

## **Wizards Beach Man 2 – AHUR 2022**

The second individual from Wizards Beach (WBM2) is dated  $6,739 \pm 156$  cal BP ( $5,905 \pm 125$  BP, GX-19421-G). Radiocarbon dating was performed on a rib of this individual. This individual has not been analyzed previously. WBM2 is about 80% complete, with only a partial skull (calvarium) and mandible and most of his postcranial bones, including both femora, both tibiae, one fibula, both humeri, both radii, both ulnae, four carpals, five metacarpals, nine phalanges, six tarsals, two metatarsals, one talus, and both calcanei (see Table 6, Appendix A, page 144). The long bones are affected by osteoarthritis. Staining is seen on the right tibia (bone inclusion) suggesting deep bruising and possibly a simple fracture at the time the injury occurred. It also shows bone remodeling indicative of healing of this injury prior to WBM2's death. The bones show minimal weathering due to being buried for 5,000+ years in Pyramid Lake. The vertebrae have numerous Schmorl's Nodes and kyphosis causing severe lipping of the vertebrae and likely caused extreme discomfort and restricted mobility. The NSM Inventory Sheet shows the elements collected and catalogued in Figure 25 below. The inventory lists 23 ribs recovered but only 14 were in the box returned to UNR and one was destroyed during the radiocarbon dating process.

MA/ BL UNLITE NEVADA STATE MUSEUM CATALOG Page 1 of 2

Site No.: 26Wa1605 Project/Collector: NAS - MARY RUSCO FOR DETAILS Date Collected: \_\_\_\_\_

Other Name/Number: NEEDLES, PYRAMID LAKE Cataloger: \_\_\_\_\_ Date Cataloged: \_\_\_\_\_

AHUR 2022

Specimen Number	Description	Count	Material	Location/Association	Notes
1	HUMAN BURIAL		Bone		was mixed up with Ocala
✓	✓ CALVARIUM, SKULL FRAGS	6	"		Cave
✓	✓ MANDIBLE	1	"		
✓	✓ OS COXAE	2	"		
✓	✓ HUMERUS	2	"		
✓	✓ vertebrae	19	"		
✓	✓ calcaneus	2	"		
✓	✓ Talus	1	"		
✓	✓ Sacrum	1	"		
✓	✓ coccyx	1	"		
✓	✓ ribs	23	"		
✓	✓ tibia	2	"		
✓	✓ fibula	1	"		
✓	✓ ulna	2	"		
✓	✓ radius	2	"		
✓	✓ scapula	2	"		
✓	✓ clavicles	2	"		
✓	✓ femur	2	"		

Figure 25: NSM inventory sheet for WBM2, AHUR2022.



Figure 26: WBM2 Calvarium, frontal view.



Figure 27: WBM2 Calvarium, occipital view.



Figure 28: WBM2 Calvarium pieces.

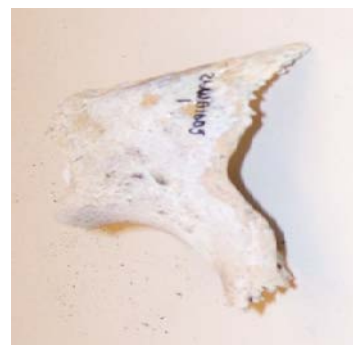


Figure 30: WBM2 Zygomatic/Orbital fragment.



Figure 29: WBM2 Calvarium, endocranial view.



Figure 31: WBM2 External meatus bone.

## Osteological Analysis by Element

### Skull

WBM2 does not have a complete skull; only the calvarium and his mandible were recovered. His facial bones are missing. The calvarium has black staining (Munsell Gley 2/3/5pb) in the frontal region similar to that of WBM1 (Figure 26) (Munsell 2010). The posterior view of the calvarium shows the fused lambdoid and sagittal sutures (Figure 27), the occipital and parietal bones of the cranium. The interior of the calvarium has concentric rings that indicate water accumulated inside the calvarium at various periods of time, leaving behind ring staining. There are also small bone pieces that probably belonged to the calvarium, including part of the left temporal bone showing the external acoustic meatus (Figure 31); part of the left zygomatic showing the zygomaticofacial foramen and orbital margin (Figure 30); and associated calvarium flakes that a note said "confirmed fit with calvarium" (see Figure 28, unknown who wrote the note). I was unable to fit these pieces to the calvarium, yet the coloring is consistent with the calvarium. A point of interest is that at some time, possibly during curation at the Nevada Archaeological Survey, University of Nevada, Las Vegas or NSM, the frontal bone was glued at the suture. It is noteworthy that the calvarium and associated missing facial bones were in such fractured condition.

Facial bones are delicate and are often some of the first bones to be lost during decomposition, yet by comparing WBM1 with WBM2 cranial bones it seems odd that no

facial bones of WBM2 survived when they were both buried in lake sediments for millennia. The rest of WBM2's skeletal remains were preserved in good condition, with the missing elements likely not collected in 1968. The reason why the cranium of WBM2 is damaged is not evident.

The mandible (Figures 32, 33, and 34) is intact with two teeth missing (right premolar 2 lost post-mortem, and left incisor 1 is broken off with the root remaining in the socket). WBM2's mandibular mental spines are very pronounced and there is a mandibular torus present with a prominent mylohyoid line. The teeth are worn buccally and all occlusal surfaces are worn with nothing remaining that would show any distinct dental traits that might indicate ancestral affiliations. The third molars are fully erupted and the occlusal surfaces are worn. There is an abscess on the left first premolar. The left mandibular condyle and ramus are stained similar to the calvarium. Weathering cracks are visible in the mandibular body.

Many of the teeth do have cracks in them and some have small chips missing; however, there are no caries (cavities) or calculus (tartar). The teeth do not appear to show any distinct traits to identify ancestry, such as shoveling, winging, or other traits (Scott and Turner 2000).



Figure 32: WBM2 Mandible, occlusal view.

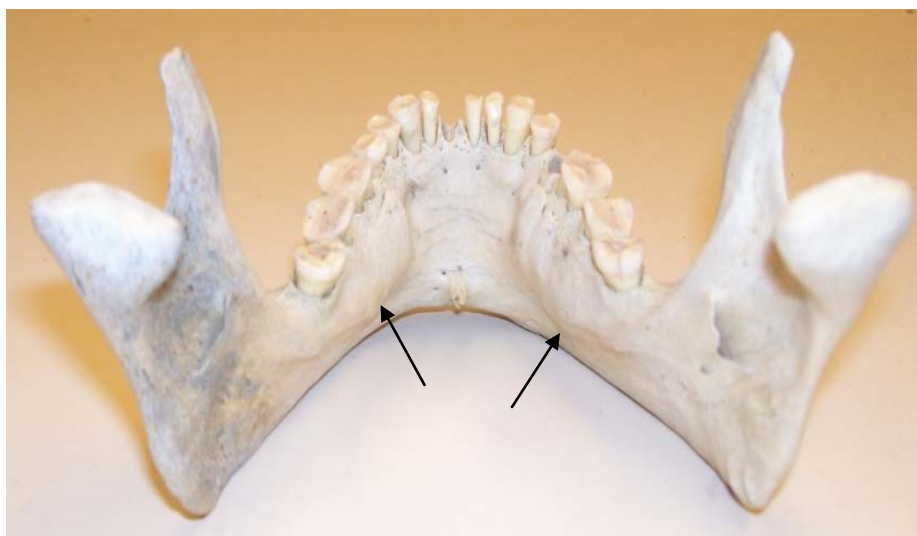


Figure 33: WBM2 Mandible, anterior view. Mandibular torus indicated by arrows



Figure 34: WBM2 Mandible, left buccal view.

### Long Bones: Upper Limbs

WBM2 was found with all long bones intact. These include the humeri, radii, ulnae, femora, tibiae, and fibulae. The measurements for long bones are included in Table 11, Appendix A, page 148. On both humeri the deltoid tuberosity is prominent. Osteoarthritis is developing on the trochleas (Figure 35). The epiphyses are fused and there are longitudinal weathering cracks on the left humerus with some cortical bone loss on the humeral head. The radii and ulnae are complete with no anomalies present other than osteoarthritis developing on the radial notches and olecranons (Figure 36).



Figure 35: WBM2 upper limb bones, left side. Arrow indicates trochlea lipping.



Figure 36: WBM2 right upper limb bones. Left arrow indicates deltoid tuberosity; right arrow indicates osteoarthritis on radial notches and olecranons.

There is cortical bone loss at the distal end of the right ulna; longitudinal weathering cracks are evident on the right radius. The bone coloration is not completely bleached nor is it the dark, manganese staining seen on the calvarium. Preservation of these bones with minimal weathering is likely attributed to being buried or submerged for ~5,000+ years in Pyramid Lake.

### Long Bones: Lower Limbs

WBM2 has almost all of the lower limb bones which include the femora, tibiae, and the left fibula. He also has the left patella, left talus bone, and both calcanei (Figure



Figure 37: WBM2 Lower limb bones.

37). There are some anomalies. The femora and tibiae are slightly bowed anteriorly. There is some cortical bone loss on the right femoral head, the left greater trochanter is missing showing the interior bone, the left femoral head has a circular crack, and the linea aspera is slightly prominent. Coloration of the bones is consistent with the upper limb bones, slightly darker in parts, but not bleached by sun exposure.



Figure 38: WBM2 Right tibia, arrow indicates bone remodeling.

The tibiae are slightly darker than the femora, with the right tibia having bone remodeling 115.2mm from the proximal end (Figure 38). The remodeled area on the tibia measures 49.7mm length x 24.8mm breadth with a diameter of 34.8mm. This

remodeling was in response to an injury, likely due to a fall which may have created an infraction or incomplete fracture of the bone. While this injury would not have caused death, it probably caused considerable pain while it was healing as the bone remodeled.



Figure 39: WBM2 Tibiae, proximal ends, arrow indicates epiphysis fusion line still visible.

The epiphyses show fusion lines on the proximal end (Figure 39). Normally the epiphyses begin to fuse by 15-18 years of age (White et al. 2012:261) with complete fusion between 20 and 23 years (Schwartz 2007:159). This is another indicator of age for WBM2. The tibial tuberosities are easily identifiable with no unusual shaping. There is slight anterior bowing of the tibiae and there are no anomalies on the distal ends. The left fibula has no anomalies, and the proximal end is fully fused to the shaft (fusion occurs between 23 and 25 years of age) (Schwartz 2007:161). No longitudinal fractures are present. The minimal weathering of the long bones is consistent with being covered with water and sediments for ~5,000+ years. The patella shows no unusual wear. The talus and calcanei are described below as part of the hand and foot bones.

### Hand and Foot Bones

WBM2 was recovered with hand (Figure 40) and foot bones (Figure 41) which are often lost or not collected. Recovered with WBM2 were four carpals (two from each side), five metacarpals (two from the left, three from the right) and nine phalanges (five from the left and four from the right). Also recovered with WBM2 were the calcanei, the left talus, six tarsals (five left, one right), and two left metatarsals. None of these small bones are unusual in shape or size. The coloration of the bones is consistent with minimal weathering or exposure.



Figure 40: WBM2 Hand bones, in the lower and upper parts of the photo.



Figure 41: WBM2 Foot bones.

### Torso: Clavicle, Scapula, Ribs, Pelvis, Vertebrae

Many of the bones from the torso were recovered from WBM2, including the clavicles, the scapulae, fourteen ribs (seven each side), the sacrum, the os coxae, and much of the vertebral column (the atlas, six cervical, nine thoracic, and four lumbar

vertebrae). Missing is the sternum, ten ribs (one was destroyed during radiocarbon dating), and six vertebrae.

The clavicles and scapulae (Figures 42 and 43) are intact with bone coloration consistent with that of the rest of the elements. The right clavicle has a minor deformity on the acromial portion which may be an enlarged conoid tubercle on the lateral end (see Figure 42, arrow points to conoid tubercle).

This enlargement may be related to the attachment for the *deltoideus muscle*. This may indicate that WBM2 was probably right handed because the enlarged conoid tubercle is on his right clavicle and the same enlargement is not visible on his left clavicle.

The scapulae are very fragile as seen in the cracks and breakage of the infraspinous fossa and the supraspinous fossa due to weathering. The coracoid processes on both scapulae have been broken and lost, either during storage or because they were not collected in 1968. The muscle attachments on the scapulae are not unusual or enlarged, which is consistent with a gracile build. The coloration of the scapulae is consistent with minimal weathering and being submerged by water for the past ~5,000+ years.



Figure 42: WBM2 Clavicles and Scapulae, superior view.



Figure 43: WBM2 Clavicles and Scapulae, anterior view.

### Torso: Ribs

The ribs (Figure 44) collected with WBM2 include seven ribs from each side of his torso. One of the ribs was sampled for radiocarbon dating. Rib 11 on the left side is broken, possibly during collection, but may have been the specimen sampled for dating.



Figure 44: WBM2 Ribs.

Some of the rib heads show wear and lipping, matching lipping seen in the vertebral column, which is described in the next section. Coloration is lighter brown (Munsell White Page/2.5y 8/1) to gray (Munsell Gley/4N) (Munsell 2010). Weathering is minimal and consistent with being covered by water since death. The NSM inventory sheet lists 23 ribs (see Figure 25), but only 14 were in the box returned to UNR.

### Torso: Vertebral Column

The vertebral column of WBM2 includes all seven cervical vertebrae (atlas, axis and C3-C7, Figure 45); seven thoracic (T1 Figure 46, T4-T6, T9-12, Figure 47); and four lumbar (L1-L4, Figure 48) vertebrae. The pathologies of the vertebral column include the presence of Schmorl's Nodes, disc wedging, kyphosis, and possibly scoliosis. All of these pathologies indicate that WBM2 probably had a rounded back, was in constant pain and likely had limited mobility. Schmorl's Nodes develop when "the disc contents exert pressure on the vertebral body" (Roberts and Manchester 2007:140) leading to herniated disc cartilage onto "the end plates of adjacent vertebrae" (Schwartz 2007:333).

Kyphosis is described as when "the vertebral column curves forward to a degree greater than normal" (Byers 2002:335). Disc wedging is a result of microfractures causing "the anterior part of the bodies to reduce in height" (Schwartz 2007:335). Another condition associated with vertebral lipping and wedging of discs is osteophytic growths which create lipping. Schwartz (2007) attributes vertebral wedging to heavy-lifting occupations and osteoporosis. According to Byers (2002) kyphosis is a congenital disease, so it is possible that this condition began in childhood since WBM2's age is not consistent with the pathologies that typically develop over a longer lifetime.

Tuberculosis causes vertebral lipping and degeneration. Tuberculosis is difficult to diagnose on the skeleton but according to Schwartz (2007), abscesses develop

“anteriorly in thoracic vertebrae” (2007:323). No abscesses are visible on WBM2’s thoracic vertebrae, therefore it is not likely he had tuberculosis or if he did, no effects are evident on his vertebrae.

Another condition that may relate to the pathologies seen on WBM2’s vertebrae is that of scoliosis. Ortner (2003) describes scoliosis development “often starts in childhood and progresses throughout the growing age” (Ortner 2003:466). According to Ortner (2003) determining scoliosis and kyphosis are easier in an articulated spine, but in archeological settings, scoliosis can be overlooked in disarticulated vertebrae unless evident in burial positioning seen during excavation (2003:467). Scoliosis is seen as extreme “S” shaped lateral curvature of the vertebrae with torsion; fusion can occur, and joint formations can be seen with the ribs in severe cases (Ortner 2003).

Juvenile kyphosis or Scheuermann’s Disease is defined by Ortner (2003) as a deformity that affects males more than females and develops in adolescents (2003:463). This pathology is seen on the vertebrae as an “extrusion of nucleus pulposus material of the cartilage disk, mostly onto adjacent vertebral bodies” (Ortner 2003:464) and resulting in the formation of Schmorl’s Nodes. According to Ortner (2003:464) abnormalities in the vertebral column are difficult to assess in disarticulated skeletons. Based on the sources cited above, it is not possible to determine conclusively what pathological condition WBM2 suffered from by the condition of his vertebrae. However, it is possible that any of the above conditions would have caused him

discomfort and pain during his life, as evidence of osteophytic growths, lipping, wedging, and Schmorl's Nodes are exhibited on his vertebral column. The disc lipping, wedging, and Schmorl's Nodes are seen on the vertebrae of WBM2 in Figures 45 through 48 below.



Figure 45: WBM2 Cervical (C1-C7) vertebrae, with wedging, lipping, and wear on superior auricular facets.

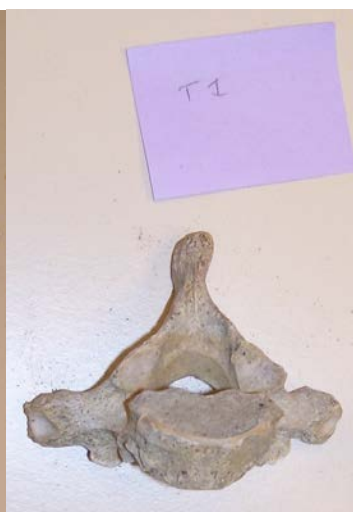


Figure 46: WBM2 Thoracic (T1) vertebra.



Figure 47: WBM2 Thoracic (T4, T5, and T6) vertebrae with wedging and lipping.



Figure 48: WBM2 T9-T12, L1-L4: all have lipping and wedging. Arrows indicate Schmorl's Nodes.

### Torso: Pelvis

The pelvis includes the sacrum, coccyx, and os coxae. WBM2 had all three of these elements which were used to determine the sex and age of the remains. The sacrum is somewhat fragmented with the coccyx separate. The sacrum also shows lipping, wedging and curvature. The separation of the first transverse ridge is an indicator of stress. There is lipping seen on the anteroinferior ala (wing) on Figure 49 below (indicated by arrow). The posterosuperior view shows flattening of the superior articular facets, and the alae (wings) do not sweep laterally as they should but instead curve inwards (see Figure 50 below, red arrows). The coccyx is known as the “vestigial tail” (White et al. 2012:225) and can have up to five fused segments. The segment shown in Figures 49 and 50 is the Cx-1 with visible transverse processes.



Figure 49: WBM2 Sacrum, anteroinferior view. Arrow indicates lipping.

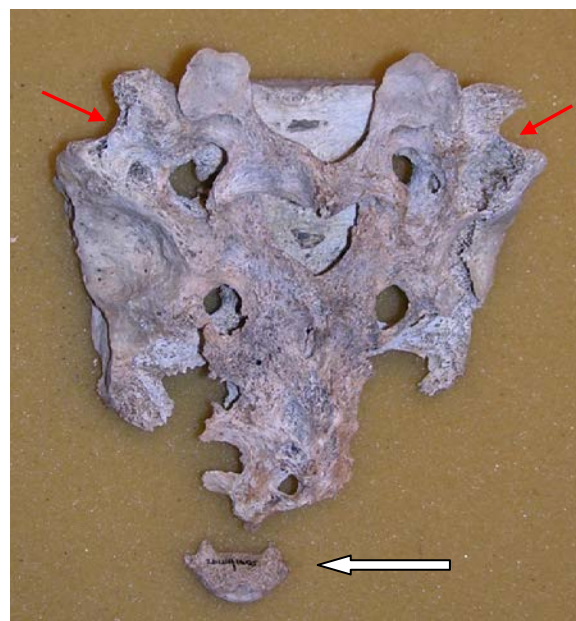


Figure 50: WBM2 Sacrum, posterosuperior view. Red arrows indicate abnormal alae; white arrow indicates coccyx.

The os coxae articulate with the femora and the sacrum. WBM2 has all three parts of his os coxae which show coloration similar to that of the rest of his bones with tan to gray portions. There are weathering longitudinal lines on the ischium and ilium. There is minimal flaking of the cortical surface, which is another indicator of minimal weathering. As seen in Figure 51, the two halves of the pubis form a relatively sharp angle along the ventral arc. Sex is determined by examining the shape of the ventral arc (whether the edges are round or not), the presence or absence of the subpubic concavity (females have this, males do not), and by whether the ischiopubic medial

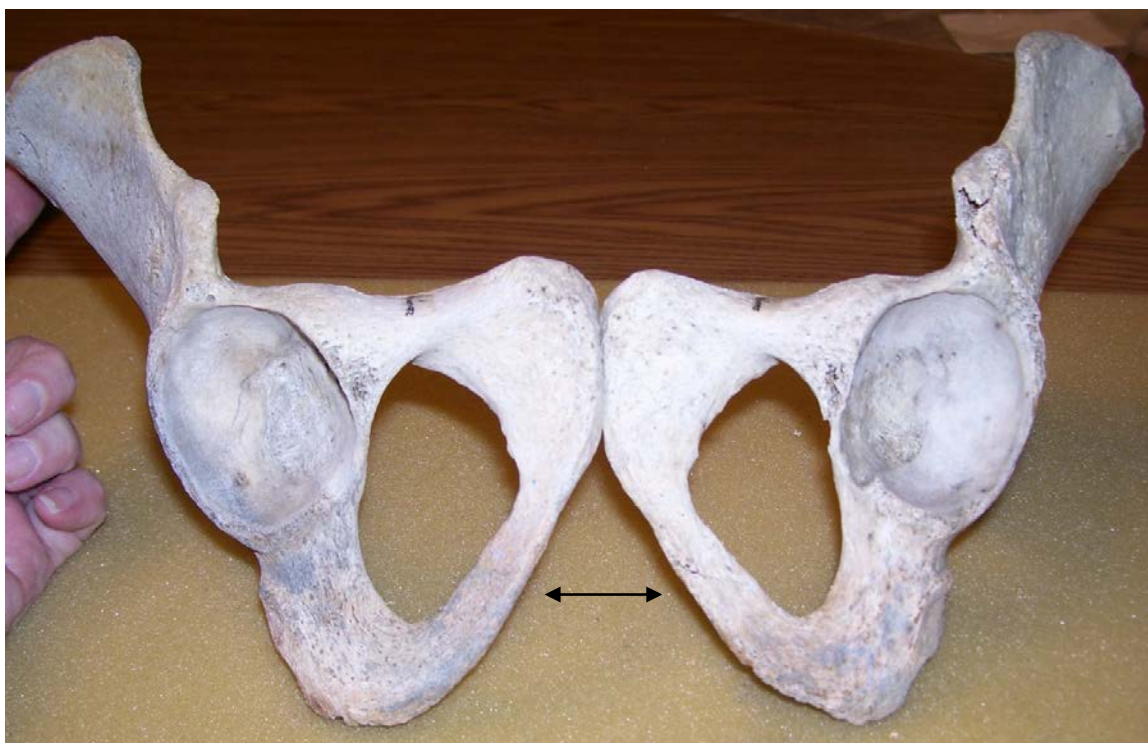


Figure 51: WBM2 Os coxae. Arrow indicates subpubic angle.

aspect has a sharp edge or not (females have this edge, males do not). WBM2's ventral arc is rounded, the subpubic concavity is not there, and the medial aspect of the ischiopubic ramus is broad, blunt, and flat, all indicative of a male os coxae.

Observations of the pubic symphyseal surfaces of WBM2 show some ridging visible, with billowing. Figure 52 shows the anteroinferior view of the right pubis with the symphyseal surface indicated by an arrow.

Comparisons of these WBM1 and WBM2 with other known skeletal remains from the Late Holocene are presented in the next chapter, detailing any similarities or differences in pathologies, injuries, and burial practices.



Figure 52: WBM2 Pubic symphyseal surface indicated by arrow, anteroinferior view.

## Chapter 6: Results and Comparisons

### WBM1

Based on dental eruption and skeletal features such as suture fusion and osteoarthritic lipping, WBM1 is a middle-aged male with dental abscesses, periodontal disease and extremely worn teeth, typical of an abrasive diet. Common mandible wear patterns in Paleoindian teeth are heavier buccally as seen in the Buhl Woman (Green et al., 1998). Due to WBM1's extreme tooth wear it is not known if the teeth originally had any other observable dental traits that might indicate a relationship to other prehistoric groups, such as Carabelli's trait, distinct molar cusp patterns, enamel shoveling, or winging (Scott and Turner 1988; 2000).

#### WBM1 Age at Death

The WBM1 crania is dolichocephalic (long and narrow) with broad, flat zygomatic arches, and a tall projecting nasal bone. WBM1's long bones show large muscular skeletal attachments indicating he was a robust individual with some osteoarthritic lipping at the joints. His height was approximately 5'6" to 5'8" based on femur length using White's stature formula (Table 5, page 91, White et al. 2012:371). I propose that his age is closer to 44 years rather than the span of 33-44 years reported by Jantz and Owsley (1999) based on the osteoarthritic lipping and complete fusion of the left cranial sutures and the palatine sutures, which place his age as a minimum of 40 or older (White et al. 2012:392-393).

Table 5: Stature estimates for WBM 1 and 2. (White et al. 2012:171)

White's Stature Formula	$Stature (cm) \pm 3.417 = (2.26)(femur\ length) + 66.379$	centimeters x 0.3937 = inches
AHUR 2023 WBM1	$2.26 \times 46.2 + 66.379 = 170.791$	
	$170.791 + 3.417 = 174.208$	$174.208 \times 0.39 = 68.58$ or 5'8"
	$170.791 - 3.417 = 167.374$	$167.374 \times 0.39 = 65.89$ or 5'6"
AHUR 2022 WBM2	$2.26 \times 42.1 + 66.379 = 161.525$	
	$161.525 + 3.417 = 164.942$	$164.942 \times 0.39 = 64.94$ or 5'5"
	$161.525 - 3.417 = 158.133$	$158.133 \times 0.39 = 62.25$ or 5'2"

### WBM1 Manner of death

The bones of WBM1 do not indicate any obvious manner of death, but a few clues may help to determine it. One of the pathologies noted on the cranium is the squamosal suture line on the right side splitting apart, with radiating fractures from the parietal region. Several factors may account for the condition of the cranium, including weathering or trauma (peri-mortem or post-mortem).

Weathering of bone follows distinct stages and results in bone cracks along grain lines, such as longitudinal cracks in long bones, and cortical bone flaking due to long-term exposure to sunlight. Cortical bone flaking is seen on the WBM1 long bones and in the right parietal region on the cranium, consistent with stage one weathering. The bones were covered by water and sediments for thousands of years, and they were not exposed continually to sunlight, so weathering is minimal. Something caused the coronal suture and squamosal suture on WBM1's cranium to separate and minimal weathering is not likely the cause of this amount of cranial damage.

Mineralization via growth or precipitation of dissolved minerals on bone is not a factor in the separation seen on the right parietal and squamosal sutures. The Needles Rocks area is adjacent to Wizards Cove and it supports hot springs, which add carbonate minerals into the lake. Root etching causes lines that curve, cross, and intersect on bones leaving behind a pattern of the roots; this can also result in cortical bone loss (Byers 2002; Fisher 1995; Reitz and Wing 2008). Root etching is visible on WBM1's femur and the bone's weight suggests mineralization may have occurred, but there is no visible mineral growth on the bone surface. The skull does not show evidence of mineralization on the bone, even though there are definite color changes to the bone surface which are the result of exposure to minerals in Pyramid Lake sediments over millennia.

Upon examining the cranial vault under illumination, I noted subdural shading that may have originated from a brain hemorrhage caused by injury; however this attribute alone is not definitive due to the mineral staining on this and other bones from the lake waters. There are, however, small, minute fractures emanating from the parietal area (Figure 55 below) where some cortical bone has flaked. When comparing the fracture line of this region with that of other blunt force trauma fractures (Figures 53 and 54 below), there is similarity in the pattern that the fracture lines follow and how the sutures split (Roberts and Manchester 2007:110; Byers 2002:305; Pickering and Bachman 1997:130).



Figure 53: Cranial blunt force trauma fracture from an English Roman period skull (Roberts & Manchester 2007:111).



Figure 54: Cranial blunt force trauma fracture on a modern skull from New Mexico (Byers 2002:305).



Figure 55: WBM1 Parietal fracture with separation of squamosal and zygomatic sutures, possible impact point indicated by arrow.

This type of radiating fracture is described as an “infracture” (Byers 2002:304) of the region it occurs in. When a bone has slow, steady pressure put on it after death it is likely to fracture in straighter lines rather than radiating lines giving the appearance of a “caving in” (Pickering and Bachman, 1997) of the cranium as a result of pressure. Usually this type of fracturing can be seen in burial contexts where something heavy pressed on the cranium for an extended period, such as in a cemetery context where weight from dirt, rocks, or a casket part has pressed on the bone resulting in fracture.

Concentric radiating fractures are usually attributed to blunt force trauma (Roberts and Manchester 2007:111) due to their distinctive pattern. Force that is applied in a singular event, such as application of blunt force trauma, will result in fracture lines that radiate out from the impact zone, seen here (Figures 53, 54, and 55) on the parietal region of WBM1 and continuing into the suture lines. If WBM1 had been intentionally buried on the shores of Pyramid Lake, the fracture pattern would be sharper with straight lines resulting from the weight of rocks or sediment pressing onto the parietal region.

However, as previously mentioned in the description of the cranial color, the bones indicate that the WBM1 corpse came to rest with the right side down, and it is possible the body landed on something hard buried in the lake sediments, resulting in the fracture. It is also possible the fracturing occurred close to the time of death, resulting in the infraction in his parietal region and eventual separation of the squamosal suture and also the fracturing of the zygomatic process from the malar bone on the suture line between these two. It is not possible to determine whether this fracture (if prior to death) was intentional or a result of the body coming to rest on the shoreline. However, a point of interest is that the lake level may have been ~15.24 m higher at the time of death than the eventual shoreline WBM1 was found on. If WBM1 fell into the lake at a different spot and was carried by currents and wind action to the northwest region of the lake where he was found, then his body sank by the time it reached the area it was eventually found in, and did not land with force upon a hard

surface. Wizards Beach is comprised of fine grained sediments ranging from clay to sand, according to Hattori (2012c).

According to Edgar (1997) in 1996, Nevada State Museum staff conducted a reexamination of 49 sets of remains (45 individuals from the NSM permanent collection and four from a historical forensic context, Edgar 1997:57) in the NSM collection, which included WBM1. This reexamination resulted in the article by Edgar (1997) detailing the paleopathologies of Spirit Cave Man and Wizards Beach Man (WBM1). Edgar (1997) determined that the WBM1 remains are very robust with distinct muscle attachments seen on the clavicle, left femur, radii, right tibia, and right fibula (Edgar 1997; Dewar 2001). Osteoarthritis is present on the radii at the distal ends and on the proximal end of the left radius. There is enlargement of the joint surfaces including porosities and osteophytic bone growth indicative of degenerative bone disease causing some discomfort to the individual though not severe (Edgar 1997). I propose that it is difficult to determine any vertebral pathological conditions or diseases WBM1 may have had because only one cervical vertebra (C4) is present, so vertebral osteoarthritis is undetermined.

Edgar (1997) noted that the long bones show remodeling by a layer of periosteum on new bone or the covering sheath on the bones and possibly due to presence of infection being reacted to by periosteal growth. Edgar believed that WBM1

had the bone infection for a long period before death, though it is not an indicator of cause of death (Edgar 1997).

WBM1 has an anteriorly bowed femur that is likely due to continual load bearing and bending which caused his femur to change as he aged. As discussed by Karakaş and Harma (2008:31) “shortening of the femur is at least partly due to axial loading and bending forces”. There are two characteristics giving evidence of this remodeling bowing process, which includes permanent bowing without fractures of the femur bone shaft and the periosteal formation that may cause morphological changes to compensate for continual stress from load bearing and bending (Karakaş and Harma 2008). The anterior bowing exhibited on the femur and tibia bones of WBM1 is likely due to frequent or sustained load bearing activities over his lifetime.

Minimal weathering has affected the surface of WBM1’s bones, rather than remodeling through surgical bone formation indicative of a bone disease; the remains were buried, submerged, and exposed along the shoreline for 9,000+ years. There are six stages of weathering that affect bones on the surface, with stage one being the least amount of damage and stage six so advanced that intact bones rarely survive to be collected for archeological data (Reitz and Wing 2008). Since the WBM remains were not exposed continuously on the surface, neither of the two skeletons had advanced weathering damage. Pictures taken by Stephenson in 1968 (Figures 56 and 57) do not

clearly indicate that either of these individuals were in typical burial postures, such as flexed or extended, and the remains are spread on the surface.

When bones are buried in a stable depositional environment, such as in lake sediments, the organic material preserves with little weathering (Reitz and Wing 2008). As both of the WBM remains were found on the Pyramid Lake shoreline, it is likely their preservation is due to being covered by lake sediments for most of the time, and not to deliberate burial.

#### WBM1 Biological Affinities

As previously noted, Jantz and Owsley (1999) analyzed WBM1 using craniometric standards for affinity with modern groups and to determine sex. They determined his age at death of a male between 33 and 44 years old was based on dental wear and cranial suture closure (Jantz and Owsley 1999). The statistical tests that Owsley and Jantz (1999) performed to determine affinity with modern populations showed that the WBM1 cranium aligns most closely to the Norse as shown in Table 3, Chapter 4, page 49. It should be noted that the Jantz and Owsley statistical test for affinity returned affiliations where the statistical probability is insignificant for a match with any particular modern group.

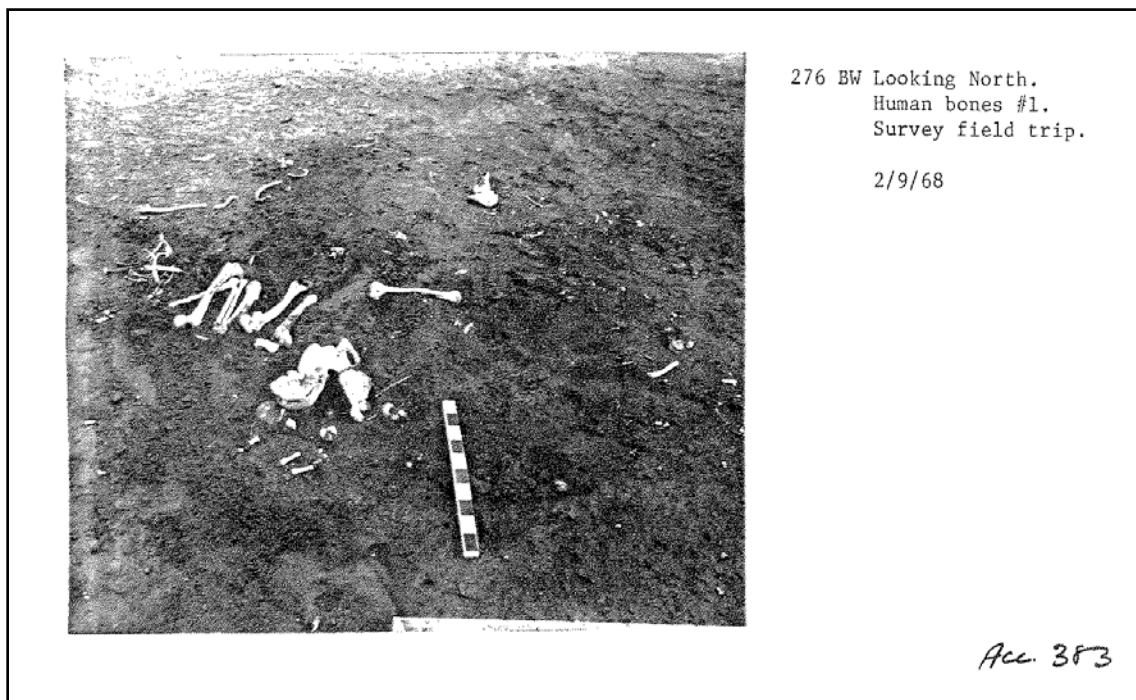


Figure 56: In situ WBM2 remains (Stephenson 1968).

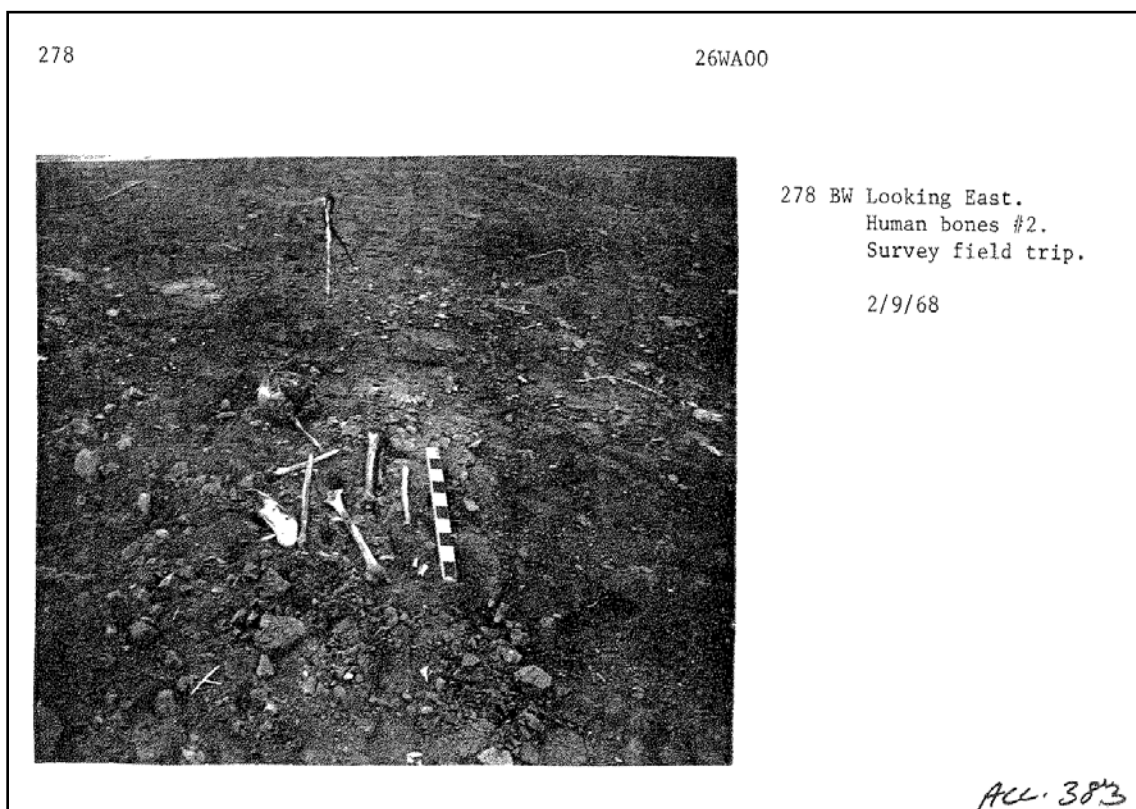


Figure 57: In situ WBM1 remains (Stephenson 1968).

## **WBM2**

The second individual from Wizards Beach (WBM2) has a date of  $6,739 \pm 156$  cal BP. This individual had not been analyzed until my research was undertaken. WBM2 is about 80% complete, consisting of a calvarium, mandible, and most of the postcranial bones. The long bones indicate osteoarthritis and bone remodeling on one tibia stained at the impact site suggesting deep bruising or a simple fracture healing. The vertebrae show that the individual had limited mobility and possibly needed assistance to survive. The calvarium shows multiple fractures that possibly are related to the cause of death.

### WBM2 Age and Sex

Sex was determined based on the narrow subpubic angle and short pubis indicative of a male (Bass 2005; White et al. 2012). The WBM2 teeth show extreme wear consistent with a gritty diet and use of the teeth as tools. The third molars are fully erupted indicating that WBM2 is older than 18 years old (third molars usually erupt by age 18 in young adults) (White et al. 2012:387). His stature was determined using the measurements from the femur, which returned a height of 5'2"-5'5" (see Table 5, page 91). Age is determined by the pubic symphysis ridges. As a person ages, pubic ridges change. When a person is a young adult, the ridges are prominent, by the mid-20's they start to be less billowed with few distinct ridges, and by the early-mid 30's the ridges are barely visible and exhibit a fine-grained surface. A middle-aged adult in his or her 40's show the symphyseal surface with a rim around it, and by the time a person is in the

50's and above the symphyseal surface shows erosion of the rims (White et al. 2012:399). Observations of the pubic symphyseal surfaces of WBM2 exhibits some ridging visible, with billowing beginning, which corresponds with an age of between 22 and 24 years old (White 2012:297). Age at death was in the mid-20's based on pubic symphyses, dental wear, closure of the cranial sutures, and fusion of long bone epiphyses.

### WBM2 Manner of Death

There are four possible scenarios of death for WBM2 based on his skeletal elements. The first possible manner of death for WBM2 is drowning when caught in a flash flood crossing Astor Pass, and the body was transported to Wizards Beach. A second scenario for his death could be he fell into Pyramid Lake at another part of the lake, could not swim and drowned, and wound up in the Wizards Cove region in an intact state before decomposition occurred. The third scenario for his death is more troubling, but still possible. WBM2's right tibia staining with bone remodeling indicates he fell and likely sustained a simple fracture that had recently healed. If WBM2 was physically limited due to his injury and required care by others, it is possible he was a liability to people he lived with. The damage seen on his cranium and facial bones could indicate that he suffered blunt force trauma to his face before being thrown into the lake to drown. The fourth scenario, a less dramatic but equally tragic possibility, is he may have fallen, severely damaging his facial region, and wound up in the lake, where

he eventually drowned. However, if WBM2 had fallen and injured his face to the extent of the fracturing seen in the remaining calvarium, the long bones or ribs probably would have had impact fractures as well, which are not present. The possibility of accidental drowning in the first, second, and fourth scenarios is tenuous as a manner of death for WBM2. The evidence for deliberate violent trauma by another person is suggestive but fits with the damage seen on his calvarium and lack of facial bones.

A final possibility for the lack of facial bones and damage to the calvarium may be due to trampling by animals post-mortem. As previously noted mammals have used the Wizards Beach region for millennia, such as cattle wandering along the shoreline in search of a water resource or other larger mammals that may have walked upon the bones. According to Fisher (1995) trampling on bones is evident by three attributes; first, there need to be bone striations present; second, several elements should have striation marks; and third, there should be a variable range in the striation width and orientation. Fisher (1995) also points out that weathering may eliminate striations on bone, making a determination for trampling difficult. There are no visible striation marks on the WBM2 calvarium or cranial fragments. It is possible that striations may have been eroded by weathering if trampling did occur or alternatively trampling is not the cause of the damage seen on the calvarium.

### **Consideration of Whether WBM1 and 2 Were Deliberately Buried**

According to Benson et al. (1990) lake levels are estimated to be 1180 m by 5,764 cal BP. This indicates that at the time of WBM2's death, the lake levels were higher than where he was found, and removes the possibility of intentional burial.

Mehring (1986) interprets the Mazama ash layering in the Carson Sink to be indicative of lake levels at 1200.9 m elevation about 8,883 cal BP. Goebel et al. (2011) published an elevation for Lake Lahontan of 1,180 m elevation at 7,000 cal BP. Later studies of when Mount Mazama erupted place the date of eruption at approximately 7,599 cal BP (Grayson 2011). If lake levels were between 1180 m (Benson et al. 1990; Adams et al. 2008) and 1171.5 m (Mehring 1986) elevation when WBM2 died, then it is unlikely that WBM2 would have been buried because the find spot would have been under water that was 15-24 m above the 1155.8 m elevation he was found at in 1968 (Stephenson 1968).

The lake levels listed above apply to the individual lake basins that once comprised Lake Lahontan. Lake Lahontan began to separate into individual lake basins after its highstand of approximately 15,000 cal BP. The lake level in the discovery year 1968 reflected an extreme drought period that lowered the lake.

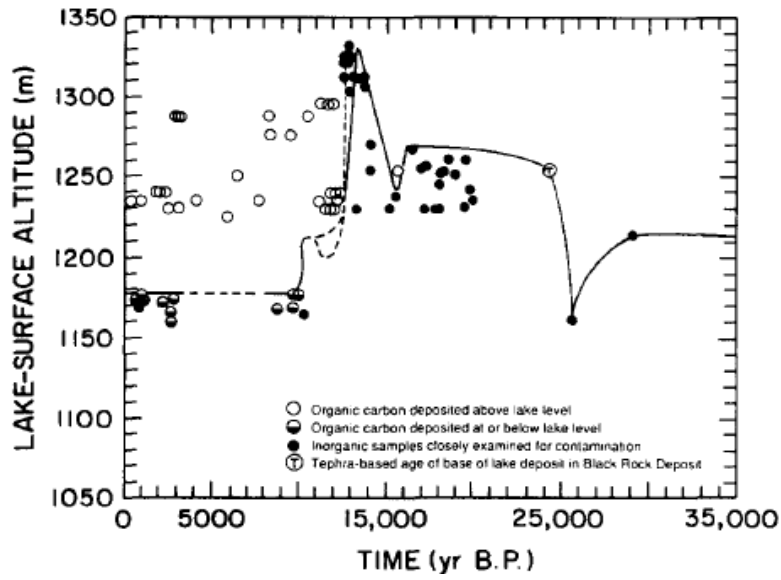


Figure 58: Lahontan Lake Surface (Benson et al. 1990:254).

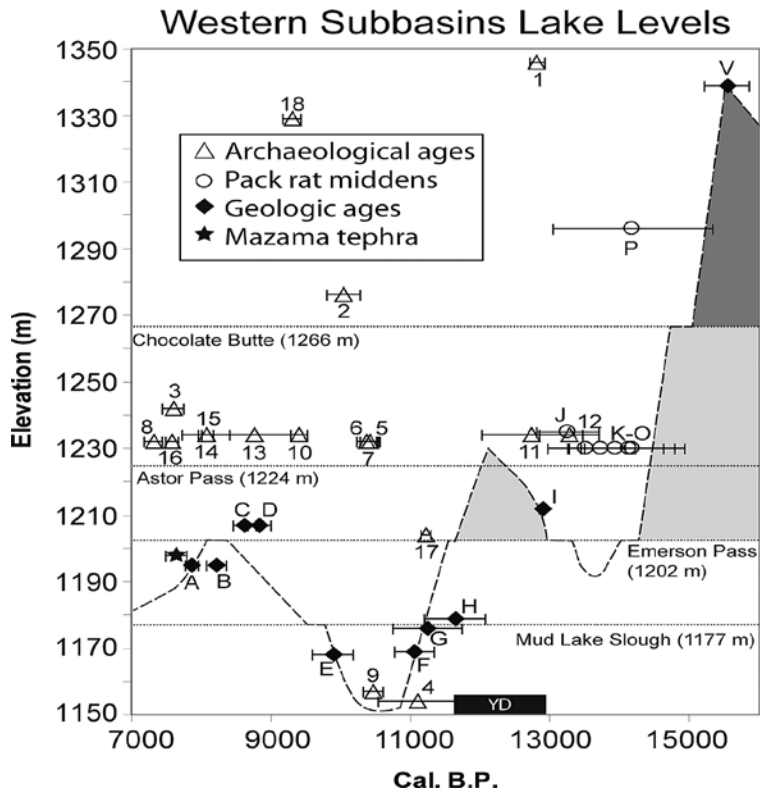


Figure 59: Lahontan Lake Surface (Adams et al. 2008:625).

The modern lake level for Pyramid Lake is 1155 m, which is the same level as the 1968 level noted by Stephenson (1968) when the WB skeletons were collected. The modern lake level is regulated by the Newlands, Bureau of Reclamation diversion project at Derby Dam, which was completed in 1905 (Hattori 1982). The lake is fed by the Truckee River from an elevation of 1174 m, which is fed by Lake Tahoe, at the 1899 m elevation (Hattori 1982).

The elements recovered indicate the bodies did not decompose in separating pieces as suggested by Byers' (2002) fluvial transport stages. Byers (2002) describes three stages of fluvial transport. In stage one the body moves as a unit from point of entry into the water transported by currents. Air escapes from the lungs and the body sinks where damage can occur due to scraping or dragging along the bottom of a lake or stream bed. In the second stage, intestinal bacteria causes bloating and a body may rise again to be moved by currents. During stage two, it is possible for the body elements to separate into segments during transport, with the skull, mandible, and hands separating first, followed by the arms, lower legs, and feet. Finally the torso with the thighs will separate. During the final phase of water transport, it is likely the cranium will move long distances, with the long bones or smaller bones remaining near the point of entry (Byers 2002:371-370).

The Wizards Beach region is noted for bones washing into the area during the Pleistocene (Dansie et al. 1988), through the Astor Pass drainage as suggested by the

Norcross Bone Pile collection. According to Dansie et al. (1988) bloated carcasses can be moved miles across Pyramid Lake before they sink upon release of gases from the body. Water temperatures determine whether a body floats or sinks. If the water temperature is above 7° C (45° F) a body will float, whereas if water temperature is below 4° C (40° F) a body will rarely bloat and will sink, making recovery difficult (Dansie et al. 1988:161). Modern water temperatures in Pyramid Lake average 12°C to 6°C (54°F to 42°F) for November 2012 (USGS 2012a), allowing carcasses to float.

Pyramid Lake during the Early Holocene would have had warmer water temperatures due to the warm climatic conditions present during lake recession. Winds across Pyramid Lake blow from a southwesterly direction (Benson et al. 1996; Benson et al. 2012) to the northwest. Wizards Beach is located in the northwest section of Pyramid Lake. If a body entered the lake at a point south of Wizards Beach, winds and water currents would carry the body to the northwest.

WBM1 and WBM2 both had their cranial bones, long bones, and some postcranial bones, which confirm that decomposition occurred where they were found on the shoreline. It is unlikely that either WBM1 or WBM2 could have been buried intentionally on a shoreline that was underwater. It is possible that they were carried separately to Wizards Beach cove by water and wind actions where they sank and were covered with lake sediments until exposure in 1968. Neither individual was intentionally buried in sediments by other people. The minimal weathering shown of

their bones indicates they were covered with water and lake sediments for millennia, and the high lake levels during each individual's lifetime would not have allowed burial in the spot they were found. Burials for the two periods that these individuals lived in are most often found in caves or rockshelters, such as Spirit Cave, where multiple people were interred from different time periods.

As indicated by the amount of elements recovered with both WBM1 and WBM2 it is likely they were transported before Byers' (2002) stages two or three occurred and before they sank in the Wizards Cove area of Pyramid Lake. The presence of many of the long bones, small bones, and each cranium and mandible are evidence that neither man decomposed before sinking. Although WBM2 has only a calvarium without facial bones, events affecting the cranium may have occurred during final deposition of the body.

#### Natural Burial in Lake Sediments

Lake sedimentation processes are usually very slow, and the rapid burial of bodies is not common, which is why disarticulated skeletons are found on lake margins more often than articulated skeletons. Lacustrine scavengers, wave currents, and the chemical composition of water in Pyramid Lake all affect bodies in the lake. It is unlikely that either WBM1 or WBM2 sank in deep water, but rather were swept to the shoreline and then gently disarticulated due to lake processes. Where skeletal remains are found is another indication of lake shorelines at the time of death (Dansie et al. 1988:162). Byers (2002) detailed how fluvial action affects disarticulation of a body; however, there

is no evidence that either WBM1 or WBM2 disarticulated before deposition on the shoreline. Their missing skeletal elements are likely due to the collection procedures by Stephenson (1968), since he did not excavate the remains but only collected the elements on the surface, which had been subjected to wave action and erosion after exposure (Dansie 1997:8).

One or both WB individuals may have suffered trauma or alternatively drowned, and their bodies were naturally deposited. The evidence to support deliberate blunt force trauma is only suggestive. WBM1's robustness indicates an active lifestyle, whereas WBM2's pathologies would have limited his mobility and caused chronic pain in his vertebral column perhaps making him a burden on the limited, shared resources of his group.

### **Other Prehistoric Human Remains in the Great Basin**

There are few Late Pleistocene/Early Holocene (LP/EH) skeletons from the Great Basin that can be compared with WBM1, as noted in Chapter 3. For the Middle Holocene the known skeletal remains are even more limited. Therefore, for the purpose here I refer to remains from the Late Holocene period for comparative purposes, even though climate and resources were very different from what either WMB1 or WBM2 experienced during their lifetimes.

The Late Holocene (LH) began about 5,164 cal BP and extends to the present (Beck and Jones 1997; Grayson 2011). The burials that I compared to the WBM remains are from three locations. The first is to the northwest in Lake Malheur, Oregon; the second is that of the Stillwater Burials near Fallon, Nevada, in the Carson Sink; and the third is the Great Salt Lake Wetlands, Utah, on the shore of the Great Salt Lake, a modern remnant of ancient Lake Bonneville. All remains in each locality were exposed after seasons of high moisture were followed by seasons of drought, with receding water action resulting in the exposure of skeletons.

#### Lake Malheur, Oregon

Lake Malheur in south-central Oregon is part of the Harney Basin. The Harney Basin contains three lakes: Malheur, Mud, and Harney. Some lakes are ephemeral such as Mud Lake, variably filled by precipitation, and others usually contain water, such as Malheur (Grayson 2011). According to Grayson (2011), Lake Malheur has an outlet to the ocean; when the lake level reaches 1,254 m, the water flows into the Malheur Gap and through to the Snake River, which flows into the Columbia River whose outlet is the Pacific Ocean. Grayson (2011) points out that for Malheur to reach its highstand and flow into Malheur Gap, it only needs to rise 8.23 m from a modern basin level of 1,246 m. This rise in elevation last occurred in ~897 cal BP. Modern highstands in this lake have occurred as recently as the early 1980's where Malheur reached a highstand of

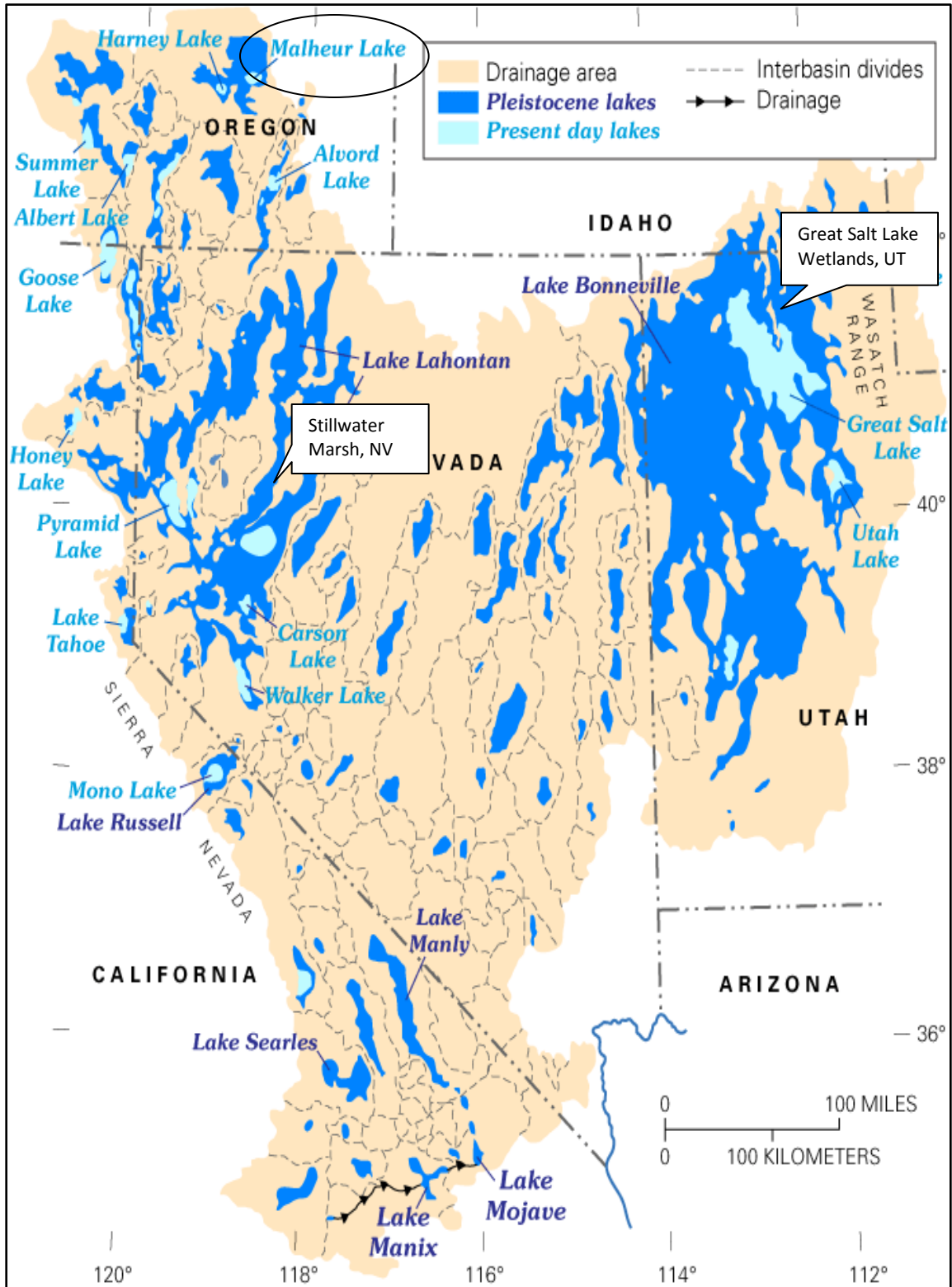


Figure 60: Late Pleistocene Lakes in Great Basin (USGS 2012b).

1252.1 m (Grayson 2011:220-221). It is due to this latest rise in lake levels that remains were discovered when the lake receded beginning in 1986.

In the early 1980's rainfall and snow increased in much of the Great Basin including the Harney Basin in Oregon due to a La Niña. This increased moisture led to modern highstands of many lakes from 1983 to 1986. In the Harney Basin, flooding occurred during this period and it is due to the lake recession beginning in 1985 that archeological sites were exposed by wind and water actions (Hemphill 1992). Beginning in 1988 and 1989 eleven sites yielded 17 burials and 114 elements; in 1989, seven burials were found at two sites; a further 14 bodies were exposed in 1990 at three sites; and 129 elements were also collected from six sites (not complete bodies), for a minimum number of individuals (MNI) at one site of 38 and a total of 243 isolated elements from 22 sites. Hemphill (1992) points out that excavation stopped when a private landowner (adjacent property to the Malheur National Wildlife Refuge) determined he no longer wanted to be responsible for exposing more Native American remains on his land. At that point the landowner only permitted surface collection, yielding another seven elements and 10 burials, increasing the total to 45 burials and 250 elements.

During the 1988-90 field seasons, 31 burials were excavated, including 16 females, 13 males, and two young children of undetermined sex. The age span includes children to mature adults in their later years. Pathologies in this group included

osteoarthritis, pathological stress markers during the formative years, periostitis, cancer, trauma, and osteomyelitis. Periostitis and osteomyelitis are terms used to describe features on bones that are anomalies and non-specific, but may reflect infectious disease or a condition such as syphilis (White 2011:443). Hemphill (1992) points out that the trauma is “more indicative of malevolence than accidental injury” (Hemphill 1992:iii). Regarding trauma, there are at least three skeletons that show injury to the cranium. The first is Burial 1906.1 that has a blunt force injury to the frontal region of the cranium, which the person may have survived for a short time prior to death based on minimal remodeling of the bone both internally and externally (Hemphill 1992:4-92, 93). The second is an isolated cranium identified as 35HA1904-1.59 which shows a compression fracture on the left zygo-maxillary suture, which had partially healed prior to death (Hemphill 1992:5-37, 38). The third is another isolated cranium identified as 35HA1949-HB3, seen in photos showing burial compression fractures that have sharp, well-defined edges even though there are no anomalies or pathologies noted on the cranium by Hemphill (1992:5-200,201). These three examples, are evidence that intentional trauma did occur prehistorically with at least two individuals suffering life-threatening injuries due to cranial trauma, and makes it plausible that the possible peri-mortem injury to the WBM1 cranium was deliberate.

Dental analyses found abscesses, ante-mortem tooth loss, alveolar remodeling, tooth wear consistent with gritty diets, and carious lesions. Standard osteological measurements were taken of the remains where possible to determine age, stature,

and sex. Non-metric osteological variations were noted as present or absent. Pathologies were noted if present on the remains and radiocarbon dating was performed on a sample determined by the Burns Paiute Tribal Council. Hemphill (1992) does not give the radiocarbon dates returned for the remains excavated in the report (all three volumes), so actual dates are unknown. However, Aikens and Greenspan (1988) reported on an archeological site excavated in the late 1980's from Lake Malheur whose radiocarbon dates on artifacts returned a span of about 2,000 years of occupation, likely on seasonal basis. The dates range from 2,450±155 cal BP (2,350±80 BP, GAK3302) to 160±120 cal BP (170±80 BP, GAK3294) from the Blitzen Marsh site adjacent to Lake Malheur. Given these radiocarbon dates it is possible that the burials excavated by Hemphill and colleagues date to this period. All remains from Lake Malheur were repatriated in the spring of 1992.

#### Stillwater Marsh in the Carson Sink, Nevada

Bioarchaeological studies of the MH and LH in the Great Basin were given a boost with the discovery of numerous remains at Stillwater Marsh, NV. The Stillwater Marsh is located in the Carson Sink, NV, and is a remnant of ancient Lake Lahontan. Flooding in the mid-1980's followed by drying of the marsh exposed several archeological features, artifacts, and human burials. Throughout the Holocene the marshes were used as part of seasonal foraging ranges by inhabitants of the western Great Basin. Theoretically the marshes saw increased use during wet years rather than

during dry years as resources were more or less plentiful based on climatic conditions (Kelly 1995:22). Some of the archeological features exposed in the 1980's include storage pits, caves, pithouse outlines, lithic resharpening features in the western dunes of the Marsh, and flake tool reduction on the valley floor (Kelly 1995:22-23). As the floodwaters receded, human burials were revealed at the site. Field surveys in 1986 and 1987 revealed 416 burials of many ontological ages at burial, both sexes, and in various burial positions.

Out of the 416 burials, 85 of them were studied for pathologies and dental health, and measured for anthropometric standards. Age and sex were determined for each individual using morphological standards (Larsen 1995:38). The radiocarbon ages for the burials span from  $2,258 \pm 79$  cal BP ( $2,265 \pm 70$  BP) to  $320 \pm 126$  cal BP ( $290 \pm 80$  BP) (Larsen 1995:37).

The 85 individuals studied represented 35 juveniles and 50 adults (Larsen et al. 1995:42). Pathologies found in the Stillwater remains include infections, fractures, and osteoarthritis. Dental wear was also studied. Osteoarthritis was greater in men than women, with women showing vertebral compression probably due to load-bearing activities. This osteoarthritic division between the sexes may be indicative of men hunting and women gathering, which is a clear sexual division of labor among this population (Larsen et al. 1995:64). Dentition studies revealed that the Stillwater population had a gritty diet reflected by tooth wear; the teeth of older adults were worn

to the gums with dentin exposure, while linear enamel hypoplasia or nutritional stress lines were recorded on the teeth of young individuals. There were few caries (Larsen et al. 1995:65). The morphological data indicate that the Stillwater individuals were a highly mobile group. The dietary isotope data indicate that fish was not their food resource; even though they lived on the edge of a marsh, they continued to hunt terrestrial game. The Stillwater remains were repatriated by the Fallon Paiute Shoshone Tribe.

#### The Great Salt Lake Wetlands, Utah

The Fremont culture is known to have been in the Eastern Great Basin and on the Colorado Plateau beginning about 2100 years ago to 800 years ago (Simms 1999:22). The Fremont culture is known for horticultural and foraging subsistence strategies.

As part of the 1987 adaptive diversity project to study behavioral dynamism in an Archaic Fremont society, the Great Salt Lake Wetlands (GSLW) project was undertaken. During the mid-1980's the Great Salt Lake experienced flooding followed by recession, similar to what happened in Stillwater Marsh and Lake Malheur. Flooding began in 1983 and by 1987 the lake had receded to very low levels, exposing burials on the Eastern shoreline northwest of Ogden, UT. The GSLW habitat supports numerous species of waterfowl, small mammals, larger mammals such as bison and other ungulates, as well as fish (Simms 1999:22). With the diversity of resources available it

might be hypothesized that the Fremont in this region utilized the abundant natural resources rather than depending on horticulture.

Upon lake recession by 1987, archaeological investigations began in the GSLW region. Low lake levels exposed archeological features, artifacts, and human burials as had been the case in the Stillwater Marsh. The GSLW burials represent 85 individuals. AMS  $^{14}\text{C}$  bone collagen analysis returned dates from  $1,315\pm 30$  cal BP to  $400\pm 64$  cal BP (1388 BP to 338 BP) (Simms 1999:23). The GSLW analysis focused on burial context rather than skeletal morphology and pathology. The artifacts associated with the burials indicate that the Fremont in this region intermittently conducted horticulture but used foraging as their prime subsistence strategy (Simms 1999:25). Thus the adaptive strategy of the GSL Fremont was to use the resources available to them while maintaining some horticulture for dietary supplements. According to Simms (pers. comm. 2012), the GSLW remains were repatriated into a Utah burial vault by the Northwestern Band of the Shoshone Nation, Ft. Hall, Idaho.

### **Comparative Discussion of Late Holocene and Paleoindian Human Remains**

The Late Holocene (LH) burials were analyzed for  $^{14}\text{C}$  dates, pathologies, dentition, and other physical measurements. The isotopic data show that in the case of the Stillwater people they were seasonal foragers who hunted more than they used the resources of the marsh. The Fremont GSLW people utilized abundant natural resources while supplementing their diet with horticulture. The LH burials, in all three localities

(Malheur, Stillwater, GSLW), show similarities in their discovery due to wet winters followed by dry winters which led to lake recession and exposure of the burials in the mid-1980's. A comparison of the chronology of the Stillwater with the Fremont indicates they were contemporaries, but not necessarily sharing a trade network, although the Stillwater burials are close enough in age to those of Lake Malheur that these two populations may have shared an exchange network.

Comparative studies of Archaic burials and the Wizards Beach human skeletons show that deliberate infliction of trauma did occur on people in prehistory and that some were intentionally buried and some were not. Childhood diseases such as scoliosis, hypoplasias, and Harris lines indicating interrupted growth patterns (seen in Archaic burials and Buhl Woman) or other pathological conditions are present throughout time, reflecting nutritional stresses and/or genetic disorders. Our knowledge of prehistoric health has been expanded by the study of human remains. Further comparisons with WBM1 and 2 are presented in the next chapter.

Rockshelters such as Bonneville Estates (Graf 2007), Smith Creek Cave (Bryan 1979), Kelvin's Cave (Henrikson and Long 2007), Falcon Hill (Hattori 1983), and Hidden Cave (Grayson 1993; Grayson 2011; Wigand and Mehringer 1985) give us a look into how people utilized these shelters during seasonal foraging cycles. While none of these have yielded human remains it is possible there are other caves not yet excavated with human remains in them from other Holocene ages. The very warm and dry Middle

Holocene is represented by few human burials, yet people were clearly still living in the Great Basin based on artifact assemblages (Graf and Schmitt 2010; Grayson 2011).

## Chapter 7: Summary and Conclusion

Archeologists studying prehistoric sites tend to focus on the artifacts since they are the best indicators of ancient human behavior and cultural patterns. Lithic studies are conducted on the projectile points found throughout the Great Basin as a means to understand the tools being used and their toolstone procurement strategies (Goebel 2007; Kelly and Todd 1998; Jones et al. 2003; Smith 2010). Textile research has been conducted on burial wrappings, basketry, bags, clothing, netting, and woven sandals found with the remains (Tuohy 1988a; Fowler and Hattori 2008; Fowler et al. 2000). Past research also indicates that a broader knowledge of prehistoric cultures can be gained by including the study of human remains along with artifact analysis.

Prior to this research, all that could be suggested about the life of WBM1 was that he was a hunter/gatherer who probably followed shorelines, marshlands and rivers for subsistence. However, the bones tell us much more than that. The WMB2 skeleton had not been studied prior to this research, so nothing was known about him other than a radiocarbon age.

The WBM1 skeletal remains are minimal, but he was clearly a robust individual. The WBM2 skeletal elements are numerous, but reveal multiple pathologies. WBM2 had a difficult life in the Middle Holocene, as indicated by his numerous pathologies and short life. These two men had very divergent lifestyles, in different climates, utilizing different resources, as is evident from their remains. The research questions that I

sought to answer were (1) to characterize how their lives differed, using as clues their skeletal morphologies, their pathologies, and their dental wear, set within the context of known periods of changing climate in the Great Basin; and (2) to determine the manner of death for each individual.

### **Comparative Morphology**

The two WB men varied greatly in their skeletal morphology. Weathering is minimal on both sets of WB men remains. Enclosure in lake sediments and submersion for millennia account for the preservation of the skeletal elements.

WBM1 was in his mid-40's, around 5'6" to 5'8" in stature, with robust muscle attachments on his long bones, and osteoarthritis due to his age. WBM1's dental wear is not unusual for the Paleoindian period, and he had periodontal disease and abscesses that likely caused him pain. The abscesses seen in WBM1's dentition may have contributed to his overall health. There is no remodeling of WBM1 bones that indicate he had a fracture of any kind. WBM1 was someone who carried heavy loads for extended periods, as indicated by the shape of his single cervical vertebra (C4) with its spinous process deformation, as well as his atypical occipital condyles and mastoids related to large muscle attachments, and his anteriorly bowed limb bones. The WBM1 long bones have well defined muscle attachment areas also indicative of a well-muscled individual. There is a single anomaly on the WBM1 bones and that is a possible peri-mortem fracture to the right parietal region of his skull, radiating fractures into the

squamosal and coronal suture, which ultimately caused separation of the squamosal suture and the zygomatic process to separate from the malar bone.

WBM2 has very different pathologies than WBM1. WBM2 was in his mid-20's, 5'2" to 5'5", with relatively gracile bones showing average muscle attachments. The vertebral column of WMB2 has Schmorl's Nodes, kyphosis, osteoarthritic lipping, and possibly scoliosis. WBM2 long bones have minimal arthritic lipping. WBM2's right tibia has bone remodeling and staining indicative of either a healing simple fracture or a deep bone bruise. These two pathological conditions likely limited WBM2's mobility and may have been an indirect factor in his death. WMB2's dentition exhibited worn teeth and an abscess consistent with a gritty diet. The WBM2 calvarium posed an interesting dilemma. Upon close observation, it was noted that, at some point after collection, the frontal region of the calvarium had been glued onto the parietal region, and there were a few small bone fragments collected with the calvarium but no other facial bones. It does not seem likely that WBM2 would have lost his facial bones due to decomposition if he had been covered by water and lake sediments for ~5,000+ years since his death, unless somehow these bones were fractured peri-mortem to the point of small pieces or trampled post-mortem.

With the pathologies that WBM2 had to live with, he may have been a drain on resources for those who cared for him. If the trauma to his calvarium is the result of a

major fall on rocks somewhere along the lakeshore, there should be other evidence of the fall on his other bones such as fractures or impact trauma, which are not evident.

Comparing these two individuals with the later Archaic period remains show that their pathological conditions are also present in later populations, such as osteoarthritis, worn teeth, and trauma. Changing resources during the Holocene may have contributed to how resources were utilized and what lengths people went to acquire subsistence. Pressure on resources shared by several groups during harsh times may lead to conflict and motivate humans to reduce competition in otherwise unacceptable ways, such as mercy killing. The two WB men were not intentionally buried, so why they wound up on the shoreline where they were found may be another clue to their causes of death. Intentional burials in the Paleoindian period were usually in caves or rockshelters, such as at Spirit Cave, Grimes Point Shelter, and Fishbone Cave. Buhl Woman was interred in a gravel bar, with grave goods, so even though she was not found in a cave or rockshelter, people obviously took care to bury her intentionally. Burial patterns had changed by the Archaic period and remains were interred on lake shores in obvious burial positions, often along with grave goods.

### **Manner of Death**

The WB remains were found on the shoreline of the northwest side of Pyramid Lake just below the 1,156 m elevation. One reconstruction of water levels in the lake at the time of death of the two WB individuals place the shore at ~1,175 m (Benson et al.

1990; Mehringer, Jr., 1986) for WBM1, and at a similar elevation for the time of death of WBM2 (Adams et al 2008; Benson et al. 1990; Goebel et al. 2011). However, Wigand (2012c pers. comm.) points out that lake levels in the Pyramid Basin have advanced and retreated numerous times during the past 15,000 years, and brief episodes of high and low shorelines occur often today. Adams et al. (2008) place the lake levels at a much lower elevation at the time of death of WBM1, making the find site dry land at the time of death.

The contradictory lake level reconstructions for the 10,000 cal BP period of Benson et al. (1990 and 2012) and Adams et al. (2008) are the result of reliance on different data points, such as wood rat middens or tufa growth. This discrepancy in lake-level curves makes it arguable whether WBM1 could have been deliberately buried on a shoreline or had to have come to rest under water. I have made a case in this thesis that both men died elsewhere, and their bodies were deposited by the waters of Pyramid Lake.

I suggest that if WBM1 sustained an intentional or accidental injury to his cranium resulting in a fall into the lake, it is possible he drowned and was carried across the lake by wind currents to the Wizards Beach region in the northwest corner of the lake where he was eventually found ~9,000+ years after his death.

I suggest that WBM2 suffered an intentional blow or blows to his facial region that fragmented his face and frontal region of his skull leaving only a few pieces of his

facial bones and calvarium available for collection. WBM2 may have been intentionally placed in Pyramid Lake by someone who delivered the blow to his cranium, and he either drowned while in Pyramid Lake or was already dead when placed in the lake. This is only a suggestion, however, based on the lack of facial bones, lack of long bone fractures, and lack of trampling striations that would suggest another reason for the missing facial bones.

Wind and water currents took the WBM bodies from where they entered the lake to Wizards Beach, where they sank due to release of body gases, and decomposed near the future shoreline underwater, where they remained for millennia.

### **Future Research**

The research that has been conducted on Great Basin Paleoindian remains has been very informative despite their fragmentary nature of some of the remains. However, more research is needed to better understand how the early inhabitants of the region lived and died. Numerous rockshelters have been excavated including those containing human remains. The earliest inhabitants of the Basin had nutritional deficiencies seen in Buhl Woman, pathologies seen in Spirit Cave Man, and were of variable builds including robust WBM1 and more gracile WBM2. People with a range of ages were deliberately buried, such as the Grimes Burial Shelter youth. Analysis of ancient DNA (aDNA) could be conducted to determine affiliation on the four samples still available from that locality (Bettinger 1999). Stable isotope studies of dental

calculus (Scott and Poulson 2012) to determine diet is also a possibility, when calculus is present. Further studies are needed to determine how changing wetlands and marshes would have affected subsistence strategies for the Paleoindians during the LP/EH.

The repatriation of Buhl Woman does not allow further research on her remains. Future repatriation is an ongoing issue with Spirit Cave Man and WBM1. The complicating issues of repatriation have led some researchers to avoid recovery of human remains found in archeological contexts. Human remains are often catalogued and stored in boxes, and eventually forgotten on museum shelves until an interest arises for a particular set of remains. The lack of research on these early inhabitants of America limits our knowledge of what life was like in the Great Basin during the LP/EH period through the Archaic period (up to the past 700 years). While some analyses have already been conducted on the Great Basin Paleoindians, further tests could be performed, which, while often destructive, could determine possible ethnic affiliation more conclusively than craniometrics. Biochemical tests such as stable isotope signatures will determine diet and subsistence, thus increasing our knowledge of human use of plant and animal resources in antiquity.

Research on the Grimes Burial Shelter remains could be expanded if the Bureau of Land Management authorized/permitted it, but repatriation claims would possibly prevent any more work or possibly lead to more work if the claims were conflicting. Fishbone Cave could be reexamined for other artifacts or bones that may have been

missed or overlooked when the remains were collected. Research on the Fishbone Cave and Grimes Burial Shelter remains has been limited due to the fragmentary nature of the remains. While much research has already been conducted on the more complete skeletons such as Spirit Cave Man or Buhl Woman, WBM1 was only minimally researched for cranial morphology, age, and sex, and no examination had been conducted on WBM2, before my thesis project.

A potential cooperative research agreement could be forged between the entity (e.g.: BLM, private parties, UNR, etc.) with jurisdiction over the remains and local tribal groups that may initiate NAGPRA requests for ancient remains. Further research is still possible with tribal cooperation and respect, as seen in the case of Buhl Woman or the later Stillwater Marsh Remains from the Archaic period (Larsen and Kelly 1995); in other cases, research has been restricted as seen with Spirit Cave Man and his well-known contemporary, Kennewick Man. Simms and Raymond (1999) have described how prehistoric remains may be researched based on cooperative agreements with local tribal groups at the time of discovery.

While some research has been completed on the fecal material found in Spirit Cave Man's intestines and dental analysis indicates a gritty diet, the overall subsistence of Paleoindians during the LP/EH period could be studied further to determine how the plant and animal resources were utilized and changed over time during this transitory period. We do know that Paleoindians utilized fish resources from lacustrine and

wetlands (Eiselt 1997). However, it is not known if fish was a staple or an expedient choice in the Paleo diet because terrestrial game became more difficult to find from the Early Holocene to the Middle Holocene. The Paleoindian record stretches to ~6,354 cal BP, when there appears to be a rapid climatic change in the Basin, and evidence for humans is sparse for the next 1,000 years (Aikens 2006; Dansie and Jerrems 2005; Grayson 1993; Grayson 2011). This scarcity is also seen in lithic and other artifact assemblages.

The research conducted on WBM2 in this thesis is a rare look at how someone may have lived in the Middle Holocene period in the Great Basin with limited resources and serious pathologies. Due to the numerous pathologies, perhaps WBM2 should not be considered an accurate representative of his period, but rather an anomaly. It is likely that there were people living with him that did not have the same pathologies and limitations. WBM2 is also evidence that people did live in the Western Great Basin in the Pyramid Lake region during a hot, dry period when large game was limited, which led to small game replacing large game in the diet. The utilization of small game took priority as larger game was limited to the higher elevations (Hockett 2005) based on faunal remains from caves and rockshelters.

The issue of violence is rarely addressed with regards to Paleoindian remains and to my knowledge had not been seen in Great Basin remains until the later Archaic period burials in Stillwater Marsh, Lake Malheur, and GSLW. Yet it is apparent that

traumatic injury occurred, whether through intentional or accidental means. WBM1 has a cranial fracture that could be interpreted as the result of a possible violent attack leading to his death. This type of injury also was noted on the Spirit Cave Man remains, but his skull fracture showed remodeling indicating that he lived with the injury for some time prior to his death. WBM2 has missing facial elements and a fractured calvarium, also suggesting a possible violent act that may have led to his death. It is possible that both these men fell, accidentally injuring the cranium or facial bones; and ended up in Pyramid Lake where they eventually drowned and were moved to Wizards Beach by wind and water actions before sinking and decomposing on the lake bottom. No other fractures evident on the rest of the skeletal elements confirm a fall. As noted previously in Chapter 6 there are several possibilities for the demise of this individual and my conclusions are suggestive only.

Sedimentation covered their remains preserving them for collection and later study. Water action disarticulated their remains, but overall the skeletal elements stayed fairly close together in the same area. As in the case with the Archaic burials, the WB men were exposed due to lowered shorelines during drought. Such wet and dry cycles have been happening within the Great Basin for millennia, and over time more skeletal remains may be uncovered in other regions of the Great Basin so that we may continue to expand our knowledge of how the earliest Americans lived in divergent environments.

It is hoped that this research has answered questions about the WB men beyond revealing evidence for age, stature, and sex. The question of age is answered by their skeletal remains such as state of the pubic symphysis, cranial suture closure, long bone epiphyses fusion, and dental wear. Their radiocarbon ages are known from testing done at different labs during the prior research on the remains. Pathological conditions were examined for each individual that reveal how different they are from each other, which may be attributable to nutritional resources and lifestyle. Their deaths may be due to slightly different events with a similar ending by drowning and eventual decomposition in Wizards Cove.

We do not like to think that humans would intentionally eliminate one of their own by violence in prehistory, yet because resources are limited, humans may often face difficult choices about how to survive and how to reduce competition for scarce resources. WBM2 was not a fully fit individual and he may have contributed less than other to the group he was part of. WBM1 was a very robust individual who likely worked hard and contributed much to his group; his skeletal elements speak of the fact he was an active individual with osteoarthritis due to age and an active lifestyle. Yet both of these men may have suffered peri-mortem trauma which led to their deaths. Trauma is often seen in burials that are related to events of war or conflict but trauma on isolated individuals reminds us that violence is a part of human behavior.

WBM2 lived in the Great Basin during a time of extreme harshness, where resources were harder to acquire, hunting required traveling longer distances to find large mammals, and groups of people likely stayed near water sources and depended on small game.

These two Wizards Beach individuals, from divergent climates and environmental subsistence resources, are indicative of how harsh life was in the Early and Middle Holocene periods. Further research such as DNA analysis may show genetic affiliation, and stable isotope analyses might provide more information about diet.

In this thesis I have tried to show that the lives of two men have not been forgotten, even thousands of years after their deaths, and that the biological signs of their trials in life instruct us about how human beings survived in the Great Basin so long ago.

### References Cited

- Adams, K. D., T. Goebel, K. Graf, G. S. Smith, A. J. Camp, R. W. Briggs, and D. Rhode  
 2008 Late Pleistocene and Early Holocene Lake-level Fluctuations in the Lahontan Basin, Nevada: Implications for the Distribution of Archaeological Sites. *Geoarchaeology* 23:608-643.
- Aikens, C. M.  
 2006 Paleo-Indian: West. In: *Handbook of North American Indians: Environment, Origins and Populations Volume 3*. Edited by William C. Sturtevant and Douglas H. Ubelaker. Smithsonian Institution Press, Washington, D.C., pp. 194-207.
- Aikens, C. M. and R. L. Greenspan  
 1988 Ancient Lakeside Culture in the Northern Great Basin: Lake Malheur, Oregon. *Journal of California and Great Basin Anthropology*, Vol. 10, No. 1:32-61.
- Albrecht, G. H.  
 1992 Assessing the Affinities of Fossils Using Canonical Variates and Generalized Distances. *Human Evolution*, 7:49-69.
- Antevs, E.  
 1948 Climatic Changes and Pre-White Man. *The Great Basin, with Emphasis on Postglacial Times*. University of Utah Bulletin 38, 20:167-191.
- Barker, J. P., C. Ellis, and S. Damadio  
 2000 *Determination of Cultural Affiliation of Ancient Human Remains From Spirit Cave, Nevada*. US Bureau of Land Management, Nevada State Office, July 26, 2000.
- Bass, W. M.  
 2005 *Human Osteology, a Laboratory and Field Manual, 5<sup>th</sup> Edition*. Special Publication No. 2 of the Missouri Archaeological Society, Columbia, MO.
- Beck, C. and G. T. Jones  
 1997 The Terminal Pleistocene/Early Holocene Archaeology of the Great Basin. *Journal of World Prehistory*, 11(2):161-236.
- Benson, L. V.  
 2004 *The Tufas of Pyramid Lake, Nevada*. U.S. Geological Survey Circular 1267, 14 p.

- Bensen, L. V., D. R. Currey, R. I. Dorn, K. R. Lajoie, C. G. Oviatt, S. W. Robinson, G. I. Smith, and S. Stine  
 1990 Chronology of Expansion and Contraction of Four Great Basin Lake Systems During the Past 35,000 Years. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 78:241-286.
- Benson, L. V., L. D. White, and R. Rye  
 1996 Carbonate Deposition, Pyramid Lake Subbasin, Nevada: 4. Comparison of the Stable Isotope Values of Carbonate Deposits (Tufas) and the Lahontan Lake-level Record, *Palaeogeography, Palaeoclimatology, Palaeoecology*, 122:45-76.
- Bettinger, R. L.  
 1999 Faces in Prehistory: Great Basin Wetlands Skeletal Populations. In: *Prehistoric Lifeways in the Great Basin Wetlands: Bioarchaeological Reconstructions and Interpretation*. Edited by Brian E. Hemphill and Clark Spencer Larsen, University of Utah Press, Salt Lake City, 15:321-332.
- Broughton, J. M., D. A. Byers, R. A. Bryson, W. Eckerle and D. B. Madsen  
 2008 Did Climatic Seasonality Control Late Quaternary Artiodactyl Densities in Western North America? *Quaternary Science Reviews*, 27:1918-1937.
- Bryan, A. L.  
 1979 *The Archaeology of Smith Creek Canyon, Eastern Nevada*. Nevada State Museum Anthropological Papers no. 17, Carson City.  
 1988 The Relationship of the Stemmed Point and Fluted Point Traditions in the Great Basin. In *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by J. A. Willig, C. M Aikens and J. L. Fagan. Nevada State Museum Anthropological Papers No. 21:53-74, Carson City.
- Buikstra, J. E. and D. H. Ubelaker  
 1994 *Standards for Data Collection from Human Skeletal Remains*. Arkansas Archeological Survey Research Series No. 44.
- Byers, S. N.  
 2002 *Introduction to Forensic Anthropology, A Textbook*. Allyn and Bacon, Boston, MA.
- Dansie, A. J.  
 1990 Prehistoric Carnivore Usage in the Wetland Habitats of Western Nevada. In: *Wetland Adaptations in the Great Basin*, edited by Joel C. Janetski and David

- B. Madsen, 10:159-171. Museum of Peoples and Cultures, Occasional Papers No. 1, Brigham Young University.
- 1997 Early Holocene Burials in Nevada: Overview of Localities, Research and Legal Issues. *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):4-14.
- Dansie, A. J. and W. J. Jerrems
- 2004 Lahontan Chronology and the Early Human Occupation in the Western Great Basin: A New Look at Old Collections. *New Perspective on the First Americans*. Edited by Bradley T. Lepper and Robson Bonnichsen. Center for the Study for the First Americans, Texas A & M University, p. 55-63.
- 2005 More Bits and Pieces: A New Look at Lahontan Chronology and Human Occupation. In: *Paleoamerican Origins: Beyond Clovis*. Edited by Robson Bonnichsen, Bradley T. Lepper, Dennis Stanford, and Michael R. Waters. Center for the Study for the First Americans, Texas A & M University, p 51-80.
- Dansie, A. J., J. O. Davis, and T. W. Stafford, Jr.
- 1988 The Wizards Beach Recession: Farmdalian (25,500 yr B.P.) Vertebrate Fossils Co-occur with Early Holocene Artifacts. *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by Judith A. Willig, C. Melvin Akins, and John L. Fagan, Nevada State Museum Anthropological Papers ,21:153-200.
- Danzeglocke, U., Jöris, O., Weninger, B.
- 2012 CalPal-2007online. <http://www.calpal-online.de/>, accessed 2012-12-01.
- Dewar, E.
- 2001 *Bones: Uncovering the First Americans*. Carroll and Graf Publishers, New York.
- Dixon, E. J.
- 1999 *Bones, Boats & Bison: Archeology and the First Colonization of Western North America*. University of New Mexico Press, Albuquerque.
- Edgar, H. J. H.
- 1997 Paleopathology of the Wizards Beach Man (AHUR 2023) and the Spirit Cave Mummy (AHUR 2064). *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):57-61.

Eiselt, B. S.

- 1997 Fish Remains from the Spirit Cave Paleofecal Material: 9,400 Year Old Evidence for Great Basin Utilization of Small Fishes. *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):117-139.

Fenner, L. A. and G. M. Smith

- 2011 *Black Rock Revisited: Continued Investigations of Cultural Resources in the East Arm of the Black Rock Desert, Humboldt County, Nevada*. Report submitted to the Bureau of Land Management, Winnemucca Field Office.

Fisher, Jr., J. W.

- 1995 Bone Surface Modifications in Zooarchaeology. *Journal of Archaeological Method and Theory*, vol. 2, 1:7-68.

Fowler, C. S., E. M. Hattori, and A. J. Dansie

- 2000 Ancient Matting from Spirit Cave, Nevada: Technical Implications. In *Beyond Cloth and Cordage: Archaeological Textile Research in the Americas*, edited by Penelope Ballard Drooker and Laurie D. Webster, pp. 119-139. University of Utah Press, Salt Lake City.

Fowler, C. S. and E. M. Hattori

- 2008 The Great Basin's Oldest Textiles. In *The Great Basin: People and Place in Ancient Times*, edited by Catherine S. Fowler and Don D. Fowler. School for Advanced Research Press, Santa Fe.

Geochron Laboratories Division

- 1993 Report of Analytical Work for Wizards Beach Men remains, sample numbers GX-19421-G and GX-19422-G. Krueger Enterprises, Inc., Cambridge, Massachusetts.

Gill, G. W.

- 1990 Introduction. In *Skeletal Attribution of Race*. Maxwell Museum of Anthropology, Anthropological Papers No. 4:xiii-xvii.

Goebel, T.

- 2007 Pre-Archaic and Early Archaic Technological Activities at Bonneville Estates Rockshelter: A First Look at the Lithic Artifact Record. In: *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt. University of Utah Press, Salt Lake City, 9:156-186.

- Goebel, T., B. Hockett, K. D. Adams, D. Rhode and K. Graf  
 2011 Climate, Environment, and Humans in North America's Great Basin during the Younger Dryas, 12,900-11,600 Calendar Years Ago. *Quaternary International*, 242:479-501.
- Goodfriend, G. A.  
 1989 Complimentary Use of Amino-Acid Epimerization and Radiocarbon Analysis for Dating of Mixed-Aged Fossil Assemblages. *Radiocarbon*, Vol. 31, 3:1041-0147.
- Graf, K. E.  
 2007 Stratigraphy and Chronology of the Pleistocene to Holocene Transition at Bonneville Estates Rockshelter, Eastern Great Basin. In: *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt. University of Utah Press, Salt Lake City, 5:82-104.
- Grayson, D. K.  
 1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington D.C.  
 2011 *The Great Basin: A Natural Prehistory*. University of California Press, Berkeley.
- Green, T. J., B. Cochran, T. W. Fenton, J. C. Woods, G. L. Titmus, L. Tieszen, M. A. Davis, and S. J. Miller  
 1998 The Buhl Burial: A Paleoindian Woman from Southern Idaho. *American Antiquity*, 63(3):437-456.
- Greenspan, R. L.  
 1990 Prehistoric Fishing in the Northern Great Basin. In: *Wetland Adaptations in the Great Basin*, edited by Joel C. Janetski and David B. Madsen, 13:207-232. Museum of Peoples and Cultures, Occasional Papers No. 1, Brigham Young University.
- Hattori, E. M.  
 1982 *The Archaeology of Falcon Hill, Winnemucca Lake, Washoe County, Nevada*, edited by Donald R. Tuohy. Nevada State Museum Anthropological Papers 18, Carson City.  
 2012a Email personal communication regarding original radiocarbon dates for Wizards Beach Men according to files at the Nevada State Museum.

- 2012b Email personal communication regarding possible net sinker found with WBM1 and comparison to NSM collections that have net sinkers from ~3,700 ft. shoreline.
- 2012c Email personal communication regarding the composition of the soil at Wizards Beach.

Haynes, G.

- 2002 *The Early Settlement of North America: The Clovis Era*. Cambridge University Press, Cambridge.
- 2009 Estimates of Clovis-Era Megafaunal Populations and Their Extinction Risks. In *American Megafaunal Extinctions at the End of the Pleistocene*, edited by Gary Haynes, 3:39-53.
- 2012 Personal communication regarding possible net sinker found with WBM1 and its shape that probably is not a natural configuration.

Heaton, T. H.

- 1990 Quaternary Mammals of the Great Basin: Extinct Giants, Pleistocene Relicts, and Recent Immigrants. In *Causes of Evolution: A Paleontological Perspective*, edited by Robert M. Ross and Warren D. Allmon. University of Chicago Press, 15:422-465.

Hemphill, B. E.

- 1992 *An Osteological Analysis of the Human Remains from Malheur Lake, Oregon. Volume 1: HRA Field Seasons, 1988-1990*. U.S. Department of the Interior Fish and Wildlife Service, Region 1, Cultural Resource Series Number 6.

Henrikson, L. S. and M. M. Long

- 2007 In Pursuit of Humans and Extinct Megafauna in the Northern Great Basin: Results of the Kelvin's Cave Excavations. In: *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt. University of Utah Press, Salt Lake City, 3:42-56.

Hillson, S., C. Fitzgerald, and H. Finn

- 2004 Alternative Dental Measurements: Proposals and Relationships with Other Measurements. *American Journal of Physical Anthropology* 126:413-426.

Hinton, R. J.

- 1981 Form and Patterning of Anterior Tooth Wear Among Aboriginal Human Groups. *American Journal of Physical Anthropology* 54:555-564.

Hockett, B.

- 2005 Middle and Late Holocene Hunting in the Great Basin: A Critical Review of the Debate and Future Prospects. *American Antiquity*, Vol. 70, No 4, pp. 713-731.

Howells, W. W.

- 1973 Cranial Variation in Man. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, MA, 67:229.

James, L.A., J. Harbor, D. Fabel, D. Dahms, and D. Elmore

- 2002 Late Pleistocene Glaciations in the Northwestern Sierra Nevada, California. *Quaternary Research*, 57:409-419.

Jantz, R. L. and D. W. Owsley

- 1997 Pathology, Taphonomy, and Cranial Morphometrics of the Spirit Cave Mummy. *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):62-84.
- 2001 Variation Among Early North American Crania. *American Journal of Physical Anthropology*, 114:145-155.

Jenkins, D. L., L. G. Davis, T. W. Stafford Jr., P. F. Campos, B. Hockett, G. T. Jones, L. S. Cummings, C. Yost, T. J. Connolly, R. M. Yohe II, S. C. Gibbons, M. Raghavan, M. Rasmussen, J. L. A. Paijmans, M. Hofreiter, B. M. Kemp, J. L. Barta, C. Monroe, M. T. P. Gilbert, and E. Willerslev

- 2012 Clovis Age Western Stemmed Projectile Points and Human Coprolites at the Paisley Caves. *Science*, 337:223-228.

Jones, G. T., C. Beck, E. E. Jones, and R. E. Hughes

- 2003 Lithic Source Use and Paleoarchaic Foraging Territories in the Great Basin. *American Antiquity*, 68(1):5-38.

Karakaş, H. M. and A. Harma

- 2008 Femoral Shaft Bowing with Age: A Digital Radiological Study of Anatolian Caucasian Adults. *Diagn Interv Radiol*, Turkish Society of Radiology, 14:29-32.

Kelly, R. T. and L. C. Todd

- 1988 Coming into the Country: Early Paleoindian Hunting and Mobility. *American Antiquity* 53(2):231-244.

- Kennedy, K. A. R.  
1998 Markers of Occupational Stress: Conspectus and Prognosis of Research. *International Journal of Osteoarchaeology* 8:305-310.
- Kirner, D. L., R. Burky, K. Selsor, D. George, R. E. Taylor, and J. R. Southon  
1997 Dating the Spirit Cave Mummy, the Value of Reexamination. *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):54-56.
- Larsen, C. S.  
1985 Dental Modifications and Tool Use in the Western Great Basin. *American Journal of Physical Anthropology* 67:393-402.
- Larsen, C. S. and R. L. Kelly, editors  
1995 Bioarchaeology of the Stillwater Marsh: Prehistoric Human Adaptations in the Western Great Basin. American Museum of Natural History, Anthropological Papers, no. 77, New York.
- Lebo, M.E., J.E. Reuter, and C. R. Goldman  
1994 *Pyramid Lake Paiute Indian Tribe Nonpoint Source Assessment and Management Plan*. Ecological Resource Associates, Davis, CA.
- Leigh, R. W.  
1925 Dental Pathology of Indian Tribes of Varied Environmental and Food Conditions. *American Journal of Physical Anthropology* vol. 8, 2:179-199.
- Lindström, S.  
1990 Submerged Tree Stumps as Indicators of Mid-Holocene Aridity in the Lake Tahoe Basin. *Journal of California and Great Basin Anthropology*, 12(2):146-157.
- Lovejoy, C. O.  
1985 Dental Wear in the Libben Population: Its Functional Pattern and Role in the Determination of Adult Skeletal Age at Death. *American Journal of Physical Anthropology* 68:47-56.
- Mehring, Jr., P. J.  
1986 Prehistoric Environments. *Handbook of North American Indians: Great Basin Volume 11*, Edited by William C. Sturtevant and Warren L. d'Azevedo. Smithsonian Institution Press, Washington, D.C., pp. 31-50.

Munsell Soil Color Chart

2010 Munsell Color Company, Inc., Baltimore, MD.

Murphy, T.

1959 The Changing Pattern of Dentine Exposure in Human Tooth Attrition. *American Journal of Physical Anthropology* vol. 17, 3:167-178.

Namecek, S.

2000 Who Were the First Americans? *Scientific American*, 283:80-87.

Nowak, C. L., R. S. Nowak, R. J. Tausch, and P. E. Wigand

1994 A 30,000 Year Record of Vegetation Dynamics at a Semi-Arid Locale in the Great Basin. *Journal of Vegetation Science*, 5:579-590.

Orr, P. C.

1956 *Pleistocene Man in Fishbone Cave, Pershing County, Nevada*. Department of Archaeology, Nevada State Museum Bulletin, no. 2, p. 1-20.

Ortner, D. J.

2003 *Identification of Pathological Conditions in Human Skeletal Remains, 2<sup>nd</sup> Edition*. Academic Press, San Diego, CA.

Owsley, D. W. and R. L. Jantz

1999 Databases for Paleoamerican Skeletal Biology Research. In: *Who Were the First Americans?* Edited by Robson Bonnichsen. Center for the Study of the First Americans, Oregon State University, Corvallis p 79-96.

Peterson, J.

1998 The Natufian Hunting Conundrum: Spears, Atlatls, or Bows? Musculoskeletal and Armature Evidence. *International Journal of Osteoarchaeology* 8:378-389.

Pickering, R. B. and D. C. Bachman

1997 *The Use of Forensic Anthropology*. CRC Press, Boca Raton, FL.

Powell, J. F.

2005 *The First Americans: Race, Evolution, and the Origin of the Native Americans*. Cambridge University Press, Cambridge.

Reddy, M. M. and A. Hoch

2012 Calcium Carbonate Nucleation in an Alkaline Lake Surface Water, Pyramid Lake, NV, USA. *Aquat Geochem*, 18:95-113.

Reitz, E. J. and E. S. Wing

2008 *Zooarchaeology*. Cambridge University Press, New York, NY.

Rhode, D. E.

2003 Coprolites from Hidden Cave, Revisited: Evidence for Site Occupation History, Diet and Sex of Occupants. *Journal of Archaeological Science*, vol. 30:909-922.

Roberts, C. and K. Manchester

2007 *The Archaeology of Disease, 3<sup>rd</sup> Edition*. Cornell University Press, Ithaca, NY.

Schmitt, D. N., D. B. Madsen and K. D. Lupo

2002 The Worst of Times, the Best of Times: Jackrabbit Hunting by Middle Holocene Human Foragers in the Bonneville Basin of Western North America. *9<sup>th</sup> ICAZ Conference, Durham. Colonization, Migration, and Marginal Areas*. Edited by M. Mondini, S. Muñoz and S. Wickler, 11:86-95.

Schwartz, J. H.

2007 *Skeleton Keys: An Introduction to Human Skeletal Morphology, Development, and Analysis, 2<sup>nd</sup> Edition*. Oxford University Press, New York.

Scott, E. C.

1979 Dental Wear Scoring Technique. *American Journal of Physical Anthropology* 51:213-218.

Scott, G. R. and S. R. Poulson

2012 Stable Carbon and Nitrogen Isotopes of Human Dental Calculus: A Potentially New Non-destructive Proxy for Paleodietary Analysis. *Journal of Archaeological Science*, 39:1388-1393.

Scott, G. R. and C. G. Turner, II

1988 Dental Anthropology. *Annual Review of Anthropology*, 17:99-126.

2000 *The Anthropology of Modern Human Teeth*. Cambridge University Press, Cambridge, UK.

Sheppard, J. C.

1975 *A Radiocarbon Dating Primer*. Washington State University, College of Engineering Bulletin 338. Radiocarbon Laboratory, Department of Chemical and Nuclear Engineering, Engineering Extension Service. Pullman, Washington.

Simms, S. R.

- 2012 Personal email communication on November 14, 2012 regarding status of Great Salt Lake Wetlands burials and repatriation of the remains.

Simms, S. R. and A. W. Raymond

- 1999 No One Owns the Deceased! The Treatment of Human Remains from Three Great Basin Cases. In: *Prehistoric Lifeways in the Great Basin Wetlands: Bioarchaeological Reconstructions and Interpretation*. Edited by Brian E. Hemphill and Clark Spencer Larsen, University of Utah Press, Salt Lake City, 2:8-20.

Smith, B. H.

- 1984 Patterns of Molar Wear in Hunter-Gatherers and Agriculturalists. *American Journal of Physical Anthropology* 63:39-56.
- 1986 Development and Evolution of the Helicoidal Plane of Dental Occlusion. *American Journal of Physical Anthropology* 69:21-35.

Smith, G. M.

- 2010 Footprints Across the Black Rock: Temporal Variability in Prehistoric Foraging Territories and Toolstone Procurement Strategies in the Western Great Basin. *American Antiquity* 75(4):865-885.

Steen, S. L. and R. W. Lane

- 1998 Evaluation of Habitual Activities Among Two Alaskan Eskimo Populations Based on Musculoskeletal Stress Markers. *International Journal of Osteoarchaeology* 8:341-353.

Stephenson, R. L.

- 1968 26WA1605 Nevada Archaeological Survey, Desert Research Institute, Site Survey Record.

Surovell, T. A. and N. M. Waguespack

- 2009 Human Prey Choice in the Late Pleistocene and Its Relation to Megafaunal Extinctions. In *American Megafaunal Extinctions at the End of the Pleistocene*, edited by Gary Haynes. 5:77-105.

Thomas, D. H. and R. L. Kelly

- 2006 *Archaeology*, 4<sup>th</sup> Edition. Thomson Wadsworth Publishers, Belmont.

Tuohy, D. R.

- 1988a Artifacts from the Northwestern Pyramid Lake Shoreline. In *Early Human Occupation in Far Western North America: The Clovis Archaic Interface*, edited by J.A. Willig, C. M. Aikens, and J. L. Fagan, pp 201-216. Nevada State Museum Anthropological Papers 21, Carson City.
- 1988b Paleoindian and Early Archaic Cultural Complexes from Three Nevada Localities. In *Early Human Occupation in Far Western North America: The Clovis Archaic Interface*, edited by J.A. Willig, C. M. Aikens, and J. L. Fagan, pp 217-230. Nevada State Museum Anthropological Papers 21, Carson City.
- 1990 Pyramid Lake Fishing: The Archaeological Record. In: *Wetland Adaptations in the Great Basin*, edited by Joel C. Janetski and David B. Madsen, 9:121-158. Museum of Peoples and Cultures, Occasional Papers No. 1, Brigham Young University.

Tuohy, D. R. and A. J. Dansie

- 1997 New Information Regarding Early Holocene Manifestations in the Western Great Basin. *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):24-53.

Turner, C. G., II

- 1990 Major Features of Sundadonty and Sinodonty, Including Suggestions About East Asian Microevolution, Population History, and Late Pleistocene Relationships With Australian Aboriginals. *American Journal of Physical Anthropology*, 82:295-317.

United States Geological Survey

- 2012a Water data of Pyramid Lake, Nevada  
[http://waterdata.usgs.gov/usa/nwis/uv?site\\_no=10351700](http://waterdata.usgs.gov/usa/nwis/uv?site_no=10351700) accessed August 7, 2012 and November 10, 2012.
- 2012b Paleoclimate Variability of the American Southwest  
[http://esp.cr.usgs.gov/info/paleo\\_hyd/paleolakes.html](http://esp.cr.usgs.gov/info/paleo_hyd/paleolakes.html) accessed November 4, 2012.

Weiss, E.

- 2007 Muscle Markers Revisited: Activity Pattern Reconstruction With Controls in a Central California Amerind Population. *American Journal of Physical Anthropology* 133:931-940.

Wheeler, S. M.

- 1997 Cave Burials Near Fallon, Nevada. *Nevada Historical Society Quarterly*, edited by W. D. Rowley, J. E. Edwards, and J. S. Pierson, 40(1):15-23 [includes Dansie, Amy: "Note on textiles associated with the Spirit Cave burials," pp. 17-18].

White, T. D. and P. A. Folkens

2000 *Human Osteology, 2<sup>nd</sup> Edition*. Academic Press, San Diego, CA.

White, T. D., M.T. Black, and P. A. Folkens

2011 *Human Osteology, 3<sup>rd</sup> Edition*. Academic Press, San Diego, CA.

Wigand, P. E.

2012a Email personal communication on April 30, 2012 regarding radiocarbon dating of Wizards Beach Men and averages based on the two dates from the University of California, Riverside & Geochron laboratories on file at the Nevada State Museum.

2012b Email personal communication on November 27, 2012 regarding climate, biotic resources, and pollen evidence from the Early to Middle Holocene in the Great Basin, particularly Hidden Cave and Pyramid Lake.

2012c Personal communication on November 29, 2012 regarding lake levels in Pyramid Lake during different time periods based on midden evidence, pollen evidence and tufa formation.

Wigand, P. E. and P. J. Mehringer, Jr.

1985 Pollen and Seed Analysis. In *The Archaeology of Hidden Cave, Nevada* edited by David Hurst Thomas. Anthropological Papers of the American Museum of Natural History, vol. 61, 9:108-124. Smithsonian Institution Press, Washington, D.C.

Wigand, P. E. and D. Rhode

2002 *Great Basin Vegetation History and Aquatic Systems: The Last 150,000 Years*, edited by R. Hershler, D. B. Madsen and D. R. Currey. Great Basin Aquatic Systems History, Smithsonian Contributions to Earth Sciences, 33:309-367. Smithsonian Institution Press, Washington, D. C.

Willig, J. A. and C. M. Aikens

1988 The Clovis-Archaic Interface in Far Western North America. In *Early Human Occupation in Far Western North America: The Clovis Archaic Interface*, edited by J.A. Willig, C. M. Aikens, and J. L. Fagan, pp 1-40. Nevada State Museum Anthropological Papers 21, Carson City.

Zic, M., R. M. Negrini and P. E. Wigand

2002 Evidence of Synchronous Climate Change Across the Northern Hemisphere Between the North Atlantic and the Northwestern Great Basin, United States. *Geological Society of America*, 30:635-638.

**APPENDIX A**

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Table 6: Bones Counts for Wizards Beach Men 1 and 2.

Cranium		WBM1		WBM2	
		Left	Right	Left	Right
	Frontal	X	X	X	X
	Parietal	X	X	X	X
	Occipital	X	X	X	X
	Temporal	X	X		
	TMJ	X	X		
	Sphenoid	X	X		
	Zygomatic	X	X		
	Maxilla	X	X		
	Palantine	X	X		
	Mandible	X	X	X	X
Clavicle		Fragment	X	X	
Scapula	Body	X		X	X
	Glenoid Fossa	X		X	X
Patella			X		
Sacrum			X	X	
Os Coxae	Ilium			X	X
	Ishium			X	X
	Pubis			X	X
	Acetabulum			X	X
	Auricular Surface			X	X
Vertebrae		Centrum	Neural Arch	Centrum	Neural Arch
	Cervical 1: Atlas			X	X
	Cervical 2: Axis			X	X
	Cervical 3			X	X
	Cervical 4	X	X	X	X
	Cervical 5			X	X
	Cervical 6			X	X
	Cervical 7			X	X
	Thoracic 1			X	X
	Thoracic 2				
	Thoracic 3				
	Thoracic 4			X	X
	Thoracic 5			X	X
	Thoracic 6			X	X
	Thoracic 7				
	Thoracic 8				
	Thoracic 9			X	X
	Thoracic 10			X	X
	Thoracic 11			X	X
	Thoracic 12			X	X
	Lumbar 1			X	X
	Lumbar 2			X	X
	Lumbar 3			X	X
	Lumbar 4			X	X
	Lumbar 5				
Sternum					



Table 8: Dental Measurements (left side only in mm)

WBM1 Maxilla								
Tooth	I1	I2	C	PM1	PM2	M1	M2	M3
Mesiodistal diameter				0.35			0.8	
Buccolingual diameter				0.6			0.8	
Crown Height				0.35			0.7	
WBM1 Mandible								
Tooth	M3	M2	M1	PM2	PM1	C	I2	I1
Mesiodistal diameter		0.8	0.8	0.3	0.3	0.3	0.25	
Buccolingual diameter		0.8	0.7	0.5	0.5	0.6	0.4	
Crown Height		0.45	0.6	0.3	0.4	0.6	0.6	
WBM2 Maxilla = not present								
Tooth	I1	I2	C	PM1	PM2	M1	M2	M3
Mesiodistal diameter								
Buccolingual diameter								
Crown Height								
WBM2 Mandible								
Tooth	M3	M2	M1	PM2	PM1	C	I2	I1
Mesiodistal diameter	0.8	0.9	0.9	0.5	0.4	0.5	0.25	
Buccolingual diameter	0.85	0.85	0.9	0.5	0.55	0.55	0.4	
Crown Height	0.4	0.4	0.5	0.4	0.4	0.6	0.5	

Table 9: Dental Abscesses (present or absent)

Maxilla Right								
	M3	M2	M1	PM2	PM1	C	I2	I1
WBM1	P		P			P		
WBM2								
Maxilla Left								
	M3	M2	M1	PM2	PM1	C	I2	I1
WBM1			P					P
WBM2								
Mandible Right								
	M3	M2	M1	PM2	PM1	C	I2	I1
WBM1			P					
WBM2								
Mandible Left								
	M3	M2	M1	PM2	PM1	C	I2	I1
WBM1	P		P		P			
WBM2					P			P

Table 10: Cranial Measurements (in mm.)

	WBM1	WBM2
Maximum Length	185.0	175.0
Maximum Breadth	134.0	138.0
Bizygomatic Diameter	137.2	
Basion-Bregma Height	137.5	
Cranial Base Length	114.0	
Basion-Prosthion Length	92.8	
Maxillo-Alveolar Breadth	63.0	
Maxillo-Alveolar Length	5.7	
Biauricular Breadth	103.8	
Upper Facial Height	63.6	
Minimum Frontal Breadth	93.1	
Upper Facial Breadth	130.2	
Nasal Breadth	25.2	
Nasal Height	36.3	
Orbital Breadth	37.7	
Orbital Height	34.9	
Biorbital Breadth	97.4	
Interorbital Breadth	31.8	
Frontal Chord	109.9	
Pariatal Chord	109.9	
Occipital Chord	43.1	
Foramen Magnum Length	39.6	
Foramen Magnum Breadth	32.2	
Mastoid Length	35.4	
Occipital Condylar Breadth	58.5	
Palate Breadth	35.7	
Palate Exterior Breadth	55.2	
Palate Exterior Length	59.5	
Palate Length	38.2	
Mandible Measurements	WBM1	WBM2
Bicondylar Breadth	119.3	125.7
Bigonial Width	104.8	97.4
Mandibular Angle	129.1	129.3
Mandibular Body Breadth	11.0	13.8
Mandibular Body Height	34.6	34.5
Mandibular Length	100.2	100.4
Mandibular Symphysis Height	33.0	34.6
Maximum Ramus Breadth	49.0	53.0
Maximum Ramus Height	68.7	62.1
Minimum Ramus Breadth	35.5	39.2

Table 11: Post-cranial Measurements (in mm.) r = Right side if Left not present

Clavicle		WBM1	WBM2
	Maximum Length	62.5r frag	144.0
	Anterior-Posterior Diameter at Midshaft		10.2
	Superior-Inferior Diameter at Midshaft		11.2
	Clavicular Midshaft Circumference		35.0
Scapula			
	Height	153.5	150.8
	Breadth	151.6	133.8
	Spine Length	141.5	140.1
	Supraspinous Line Length	88.6	69.5
	Infraspinous Line Length	80.3	96.0
Humerus			
	Maximum Length	337.5	308.0
	Bi-Epicondylar Breadth	63.2	62.1
	Vertical Diameter of Head	50.4	44.0
	Maximum Diameter at Midshaft	29.4	23.7
	Minimum Diameter at Midshaft	21.0	17.3
Radius			
	Maximum Length	260.0	250.0
	Anterior-Posterior Diameter at Midshaft	13.7	12.0
	Medial-Lateral Diameter at Midshaft	17.1	14.3
Ulna			
	Maximum Length	281.0	270.0
	Anterior-Posterior Diameter	15.8	15.9
	Medial-Lateral Diameter	13.7	12.5
	Physiological Length	249.0	236.0
	Minimum Circumference	41.0	38.0
Sacrum			
	Maximum Anterior Height		124.9
	Maximum Anterior Breadth		108.3
	Anterosuperior Breadth		101.6
	Ventral Height Arc		120.7
	Dorsal Height		102.5
	Middle Breadth		86.7
	Auricular Surface Height		65.2
	Auricular Surface Breadth		17.5
Os Coxae			
	Height		200.0
	Superior Iliac Breadth		127.5
	Pubis Length		74.8
	Ishium Length		107.4
	Iliac Length		124.2
	Acetabular Height		46.8
	Acetabulosymphyseal Length		40.6
	Acetabular Depth		37.2
	Obturator Foramen Length		55.7
	Obturator Foramen Breadth		37.9
Femur			
	Maximum Length	463.0	421.0
	Bicondylar Length	440.0	411.0
	Epicondylar Breadth	78.6	68.8
	Maximum Diameter of the Femur Head	50.1	42.5
	Anterior-Posterior Subtrochanteric Diameter	42.1	34.8
	Medial-Lateral Subtrochanteric Diameter	33.6	24.8
	Anterior-Posterior Midshaft Diameter	31.6	28.9
	Medial-Lateral Midshaft Diameter	26.8	24.6
	Midshaft Circumference	95.0	85.0
Tibia			

Table 11: Post-cranial Measurements (in mm.) r = Right side if Left not present

	Length	394.0r	364.0
	Maximum Proximal Epiphyseal Breadth	78.6r	74.2
	Maximum Distal Epiphyseal Breadth	55.9r	47.1
	Maximum Diameter at the Nutrient Foramen	38.2r	33.4
	Medial-Lateral Diameter at the Nutrient Foramen	22.4r	20.9
	Circumference at the Nutrient Foramen	96.0	92.0
Fibula			
	Maximum Length	372.0r	353.0
	Maximum Diameter at Midshaft	17.3r	14.9
Calcaneous			
	Maximum Length		73.2
	Middle Breadth		25.0
Patella			
	Maximum Height		40.0r
	Maximum Breadth		40.5r
Notes:	WBM1 has marked femoral bowing level 4 (White et al. 2012:252)		
	WMB2 has a right tibial contusion and slight femoral bowing (White et al. 2012:252).		
	Contusion Length = 49.75; breadth = 24.79; length from proximal head = 115.16		
	Contusion Diameter = 34.77; contusion medial-lateral diameter = 21.27		