Journal of California and Great Basin Anthropology | Vol. 26, No. 1 (2006) | pp. 77-94

Mosquito Willie (42TO137): A Late Archaic Site on the Western Edge of the Great Salt Lake Desert

JOEL C. JANETSKI
Department of Anthropology, Brigham Young University

The western margin of the Great Salt Lake Desert is today a forbidding landscape. East from Wendover, Utah, the salt flats stretch for miles, with the Hogup and Cedar mountains shimmering dimly in the distance. Immediately to the west are the Desert Hills, an aptly named series of low, relatively barren, rocky eminences. Resources seem scarce and fresh water scarcer yet. Yet nearby are some of the earliest evidences of human occupation in the Great Basin: Danger Cave lies on the northern outskirts of town and Bonneville Estates Rockshelter is just a few miles to the south. Dates from these sheltered sites place people in the area before 11,000 years ago (Jennings 1957; Madsen and Rhode 1998; Graf et al. 2004; Rhode et al. 2005), and the deep, artifact-rich deposits document sporadic if not continuous use throughout the Holocene. The attraction of Danger Cave, Bonneville Estates Rockshelter, and other sites in the area to past peoples is certainly in part due to the shelter they provided, but other factors may have been important as well. At Danger Cave, a nearby spring and associated marsh undoubtedly were important reasons for the intensive cave use (Madsen and Rhode 1998). Although springs are absent at Bonneville Estates Rockshelter, just a few miles east of it are two lush, spring-fed marshlands: Blue Lake and Mosquito Willie. The marsh areas currently closest to Bonneville Estates are at Mosquito Willie, and the presence of marsh resources in the rockshelter deposits, perhaps even in the earliest levels (Graf et al. 2004), is evidence that the nearby marshes were exploited.

Given the above, Mosquito Willie is a significant spot on the edge of the salt flats, and the resources available there did not go unnoticed by native peoples. Cultural debris is widely scattered on the ground surface adjacent to the springs and at the base of nearby rocky outcrops. Given that Mosquito Willie was and is a fertile location in an otherwise rather barren landscape, the site there is perceived as having the potential to increase our understanding of past productive strategies, perhaps even into the very distant past (Johnson and Arkush 1997; Arkush 1998; Janetski 2004). For that reason, and because of some erosion problems, Hill AFB requested that limited site testing be carried out; that work was done in the summer of 2003. A primary focus of the research was chronology (Janetski 2004). If the springs at Mosquito Willie were active, people living in this water-scarce landscape would be expected to have visited the site to obtain water and to exploit the marsh flora and fauna; in addition, we should expect to see human use in the early Holocene coinciding with the emergence of the spring as Lake Bonneville waters dropped. Previous tests at Mosquito Willie by Johnson and Arkush (1997), however, found direct evidence of use dating back only to about 400 AD (see discussion of dating below). The intent of the 2003 work was to test the site more extensively and to core and date the marshes themselves to determine when they formed. If the marshes had been present, we predicted that the site should have been occupied.

In addition to assessing site chronology, we were interested in examining an open site in a region where caves and rockshelters such as those cited above have received the bulk of archaeological attention. The function of the site, therefore, including its role in the regional subsistence-settlement system, was of interest, as was its role as a (presumably) non-agricultural site during the Fremont period. Although it is clearly located on the extreme western periphery of the Fremont area, it seemed possible to explore this topic, since Johnson and Arkush (1997) recovered Fremont ceramics from the site.

SITE SETTING AND DESCRIPTION

Mosquito Willie is a multi-component site adjacent to a marsh 20 miles south of Wendover, Utah (Figure 1). To the east stretch the flatlands of the Great Salt Lake Desert; to the west are the low, barren Lead Mine Hills containing several shelters used in prehistory, including the massive Bonneville Estates Rockshelter about two miles to the west (Arkush 1998). About three miles north is another, larger marsh, Blue Lake, which boasts a series of medium-sized ponds, some quite deep.

The site centers on a limestone outcrop, at the base of which are two freshwater springs that drain east into the salt flats (Figure 2). The north spring feeds a small

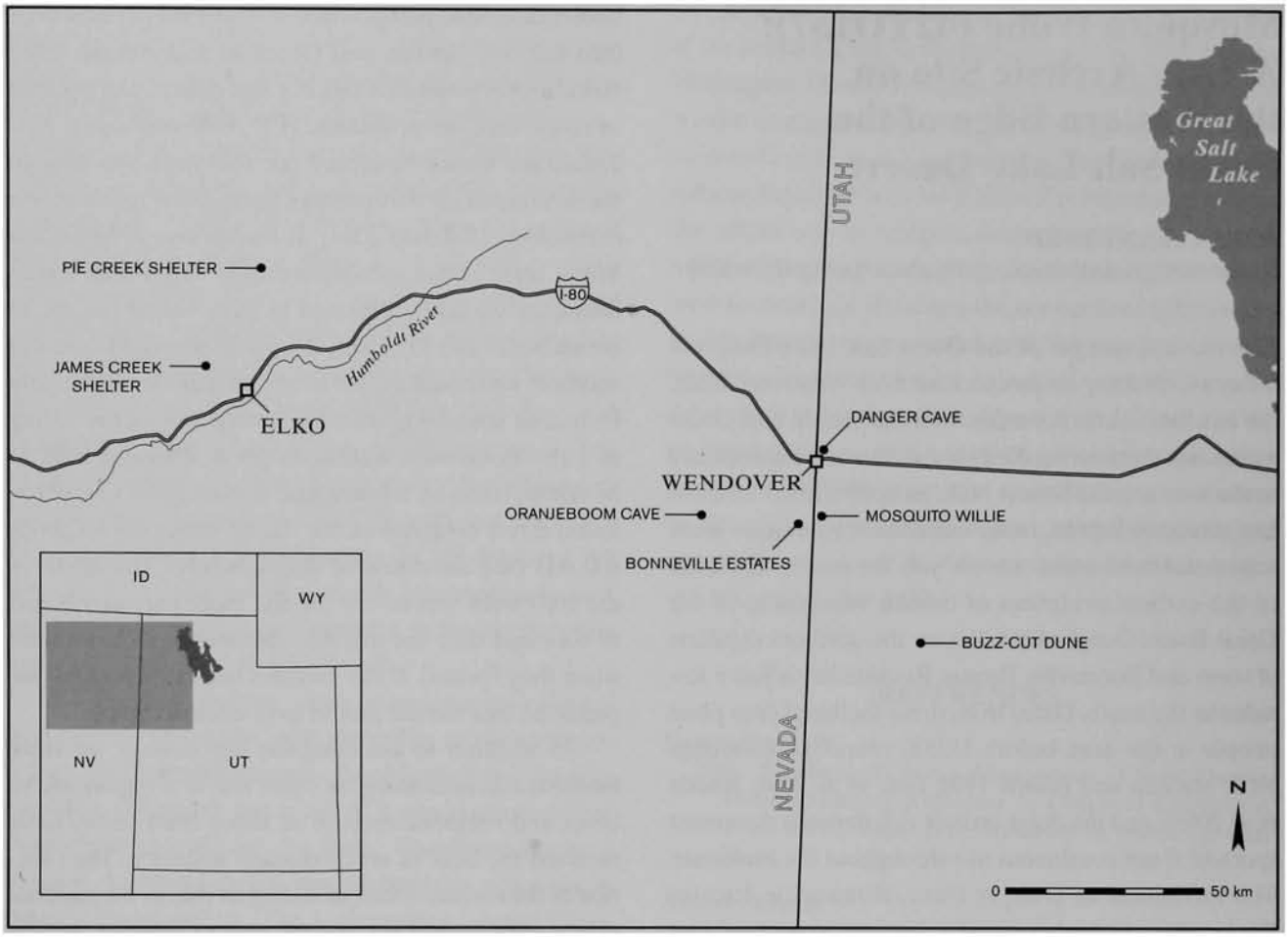


Figure 1. Location of Mosquito Willie and other sites mentioned in the text.

pond containing a resident population of Utah chub (*Gila atraria*). Both springs feed substantial stands of bulrush (*Scirpus* sp.), sedges (*Carex* sp.), and cattail (*Typha latifolia*) that extend along the stream margins for several hundred meters. The taller vegetation merges with salt grass (*Distichlis* sp.) and eventually pickleweed (*Allenrolfea* spp.) as one moves laterally away from the small streams. Vegetation on and off site to the west consists of clumps of greasewood (*Sarcobatus* sp.) and salt grass on the flats, which quickly gives way to a shadscale (*Atriplex* sp.) community on the higher elevations.

Both historic and prehistoric occupations are present, although the historic structures (several corrals, piles of hay, and a crude shelter) and living debris tend to swamp the prehistoric material (Figure 3). The historic occupation and site name is attributed to an eccentric recluse, Gilbert McCauley (a.k.a. Mosquito Willie or Skeeter Bill), who pursued mustangs in the area during the mid-twentieth century and made a home in a small cave in the upper portion of the site (Figure 4) (Harris 2004). Prehistoric material—mostly chipped stone detritus, a few grinding stones, and an occasional ceramic sherd—is widespread adjacent to the small cave above the rocky outcrop (Figure 5), at the base of the outcrop, and to the south of it. This prehistoric scatter extends south and west for a considerable distance, and substantial anthropogenic deposits are clearly visible inside the southern-most corral. The midden is gradually eroding into the shallow wash cut by slope and erosion from the southern spring.

RESEARCH STRATEGY

The Mosquito Willie site has been known for some time (see Janetski 2004, and Arkush 1998 for a review). Most recently, Johnson and Arkush (1997) placed two 1 x 4 m. test trenches in the cultural deposits at the base of the

Figure 2. Overview of the salt flats looking east from Mosquito Willie. Note corrals in the foreground.

rocky outcrop. Their tests documented cultural deposits to a depth of 1.2 m. and confirmed the role of Mosquito Willie as a cache and hunting camp that was most heavily used during the Late Archaic period (A.D 300 to A.D. 1400).

The research at Mosquito Willie in 2003 was done in two phases. Phase 1 involved a coring exercise at Mosquito Willie and Blue Lake that was designed to assess the age of both springs as part of a paleoecological evaluation. This was accomplished in June, 2003. Phase 2 constituted site testing, which was done in early August, 2003.

MOSQUITO WILLIE AND BLUE LAKE CORING

Cores were taken from both the south and north marshes east of and supported by the Mosquito Willie springs.[1] The deepest core (~2.5–3 mbgs.) contained Bonneville Lake deposits overlain by alternating bands of beach sand and shells, clays, organics, a thin white gritty layer that could be Mazama ash, and peat. A single 5 m.-long core was collected in the *Scirpus* bog near the head of the spring complex at Blue Lake. Dates from the coring exercise are presented in Table 1, and clearly demonstrate that both Mosquito Willie and Blue Lake springs were flowing during the early Holocene.

TEST EXCAVATION RESULTS

The 2003 assessment placed six test pits in the site; five were located in the southwest portion (Locus 3), and one was located in the north area of Locus 2, near one of the Johnson and Arkush test pits (Figure 3).[2] All test pits were excavated by 10 cm. levels until sterile sediments were reached, and all sediments were screened with eighth-inch sieves. Strata were defined and numbered following the exposure of profiles; consequently, faunal data and

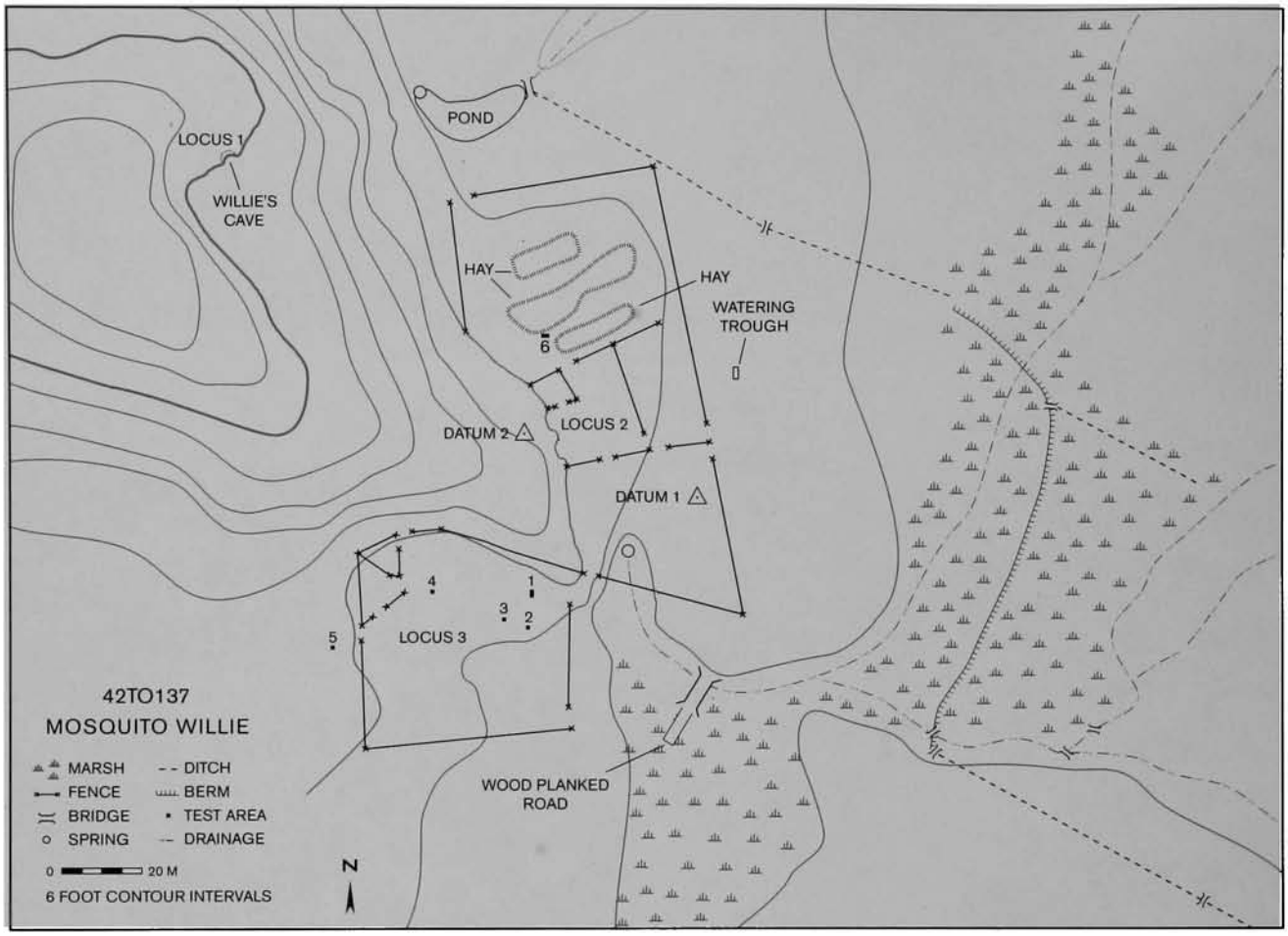


Figure 3. Map of Mosquito Willie site.

material culture proveniences reflect the arbitrary levels as well as the assigned strata. All of the tested areas were rather heavily disturbed by rodent bioturbation.

Test Area 1

This 1 x 2 m. test pit was placed in Locus 3 near the eastern edge of the south corrals (Figure 3). Cultural deposits were present to a depth of about 1 m. below ground surface, below which lay a layer of angular limestone rock in a matrix of light gray silts (Stratum 2; Figure 6a). The test pit was extended an additional 20 cm. into sterile, cream-colored lake silts (Stratum 1). Above Stratum 2, the sediments yielded cultural materials, including bone scraps, chipped stone tools, and debitage, although quantities diminished significantly in Stratum 3 and cultural debris there was largely a consequence of

Table 1

AMS RADIOCARBON AGES FROM THE CORES AT MOSQUITO WILLIE AND BLUE LAKE MARSHES.

Location	Beta Sample No.	Material	Depth bgs	Radiocarbon Age	Calibrated Age 2 sigma
Mosquito Willie, south marsh, Core 1-3	Beta-184532	organic sediment	74-75 cm	3990 ± 40 BP	2580 to 2450 BC
Mosquito Willie, south marsh, Core 1-5	Beta-184533	organic sediment	71-72 cm	4110 ± 40 BP	2520 to 2500 BC
Mosquito Willie, south marsh, L2-C1	Beta-186789	organic sediment	121 cm	7150 ± 40 BP	6060 to 5980 BC
Mosquito Willie, south marsh, L2-C1	Beta-186790	organic sediment	142 cm	7630 ± 50 BP	6510 to 6410 BC
Blue Lake	Beta-184531	organic sediment	~4.5 m	9010 ± 40 BP	8280 to 8200 BC

Figure 4. Mosquito Willie's camp in 1976. This is in Locus 1 of the site map.

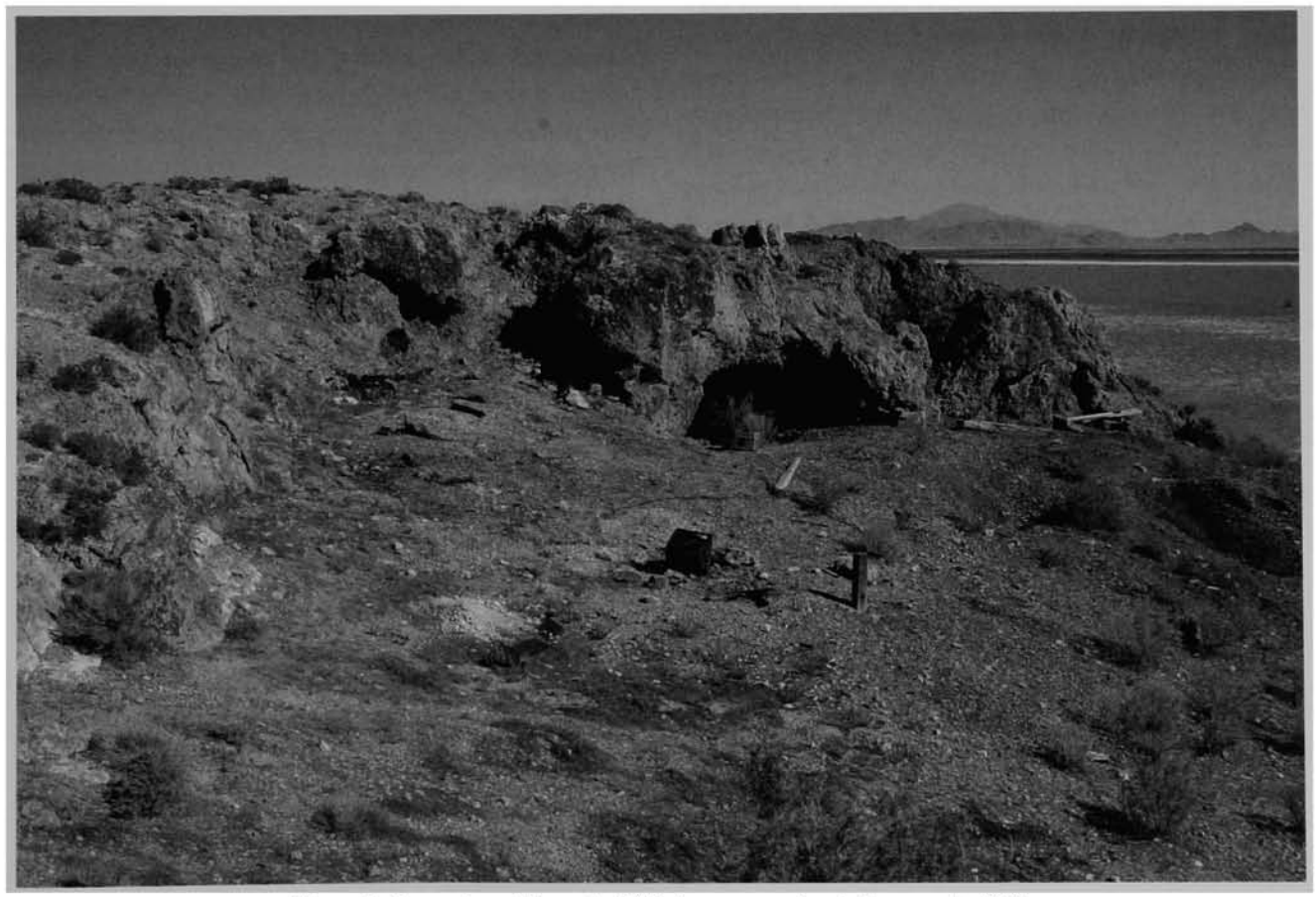
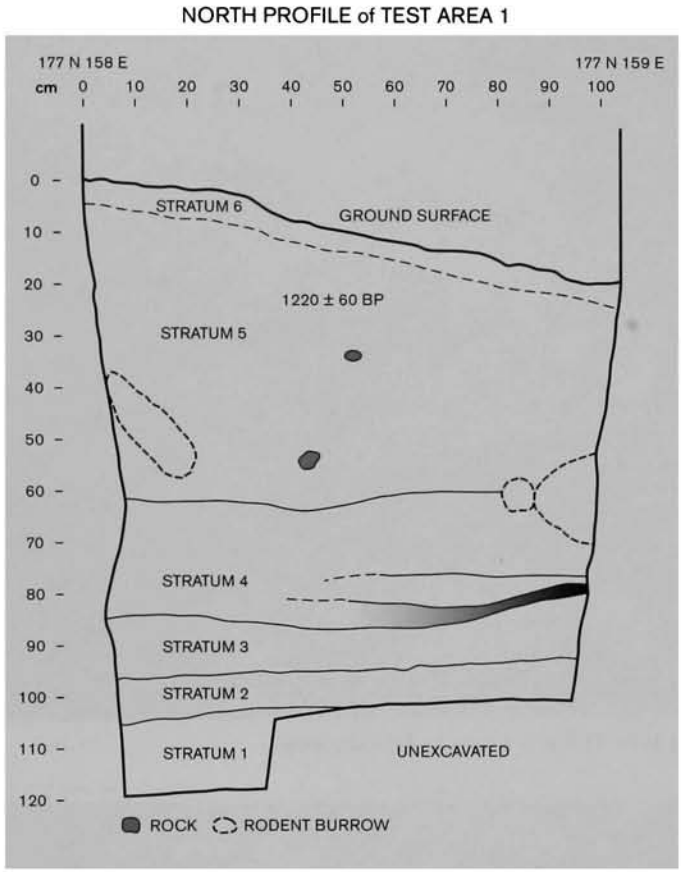
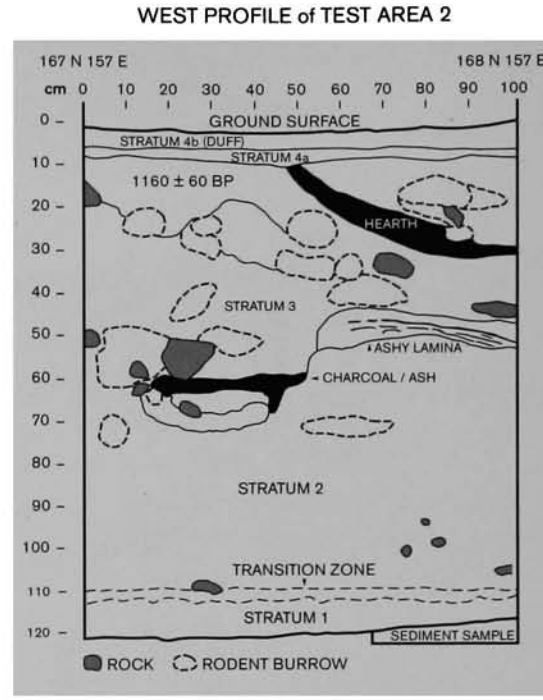
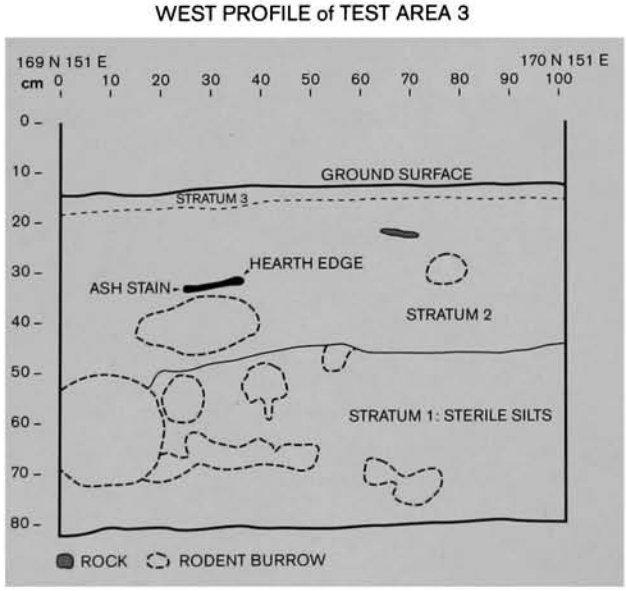


Figure 5. Area where Mosquito Willie's camp was located as seen in 2003.







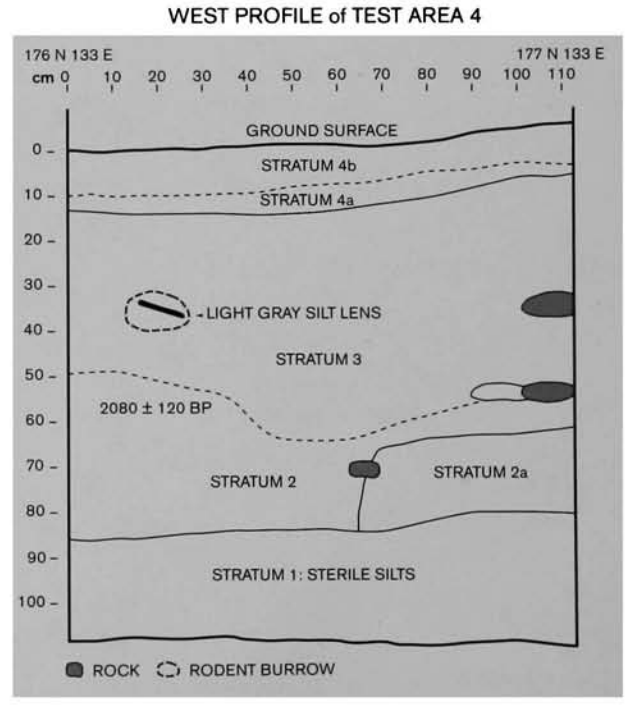


Figure 6. Profiles of Test Areas: (a) Test Area 1, (b) Test Area 2, (c) Test Area 3, (d) Test Area 4.

Table 2

RADIOCARBON DATES FROM MOSQUITO WILLIE (42TO137).

Beta Sample No.	Test Area, Stratum	Material*	Radiocarbon age	2 sigma calibration
Beta-184093	Stratum 5, Test Area 1	Pooled charcoal,	1230±60 BP	AD 670 to 960
Beta-184094	Stratum 3, Test Area 2	Pooled charcoal	1190±60 BP	AD 690 to 990
Beta-184095	Stratum 5, Test Area 5	Pooled charcoal	2220±110 BP	520 BC to AD 10
Beta-184096	Stratum 2, Test Area 4	Pooled charcoal	2110±120 BP	400 BC to AD 130
Beta-185805	Stratum 4, Test Area 6	Pooled charcoal	2280±40 BP	400 BC to 210 BC

bioturbation. A probable hearth was discovered in the northeast corner of the test pit at a depth of about 80 cm. below ground surface. The feature consisted of a lens of fine ash underlain by some charcoal flecks. A date of 1230 ± 60 B.P. (Table 2) was obtained from the upper level of Stratum 5.

Test Area 2

This 1 x 1 m. test pit was also located on the east side of Locus 3 but was a few meters south of Test Area 1. The cultural deposits here contrasted with those in Test Area 1 in that anthropogenic sediments were not so dark, nor as deep, extending just ~70 cm. below the ground surface (Figure 6b). The stratigraphy was more complex, with a number of overlapping features, including two possible hearths. An enigmatic feature, consisting of arcing deposits of indurated tan sediments overlying thin layers of ash, may be the edge of a structure. The cultural layer, Stratum 3, was dated to 1160 ± 60 B.P. Stratum 2 was a rather massive deposit of sterile, cream-colored sandy silts similar in color to Stratum 1 in Test Area 1. Stratum 1 consisted of gray, clayey sediments with some small pebbles and concretions.

Test Area 3

This 1 x 1 m. test pit was placed in the middle of the south corral; the excavations extended to about 65 cm. below ground surface (Figure 6c). The cultural sediments here were heavily bioturbated, and were about 40 cm. deep. This area was rich in bone, as well as in chipped stone tools and worked bone. No features were identified, and no date obtained.

Test Area 4

Test Area 4 was a 1 x 1 m. test pit in the northwest portion of the south corrals, close to the slope of the hill that lies just north of the corrals. The ground surface was covered with small, angular, limestone rock that no doubt derived from the slope to the north. Below the surface duff were two cultural strata, both of which contained the angular rock found on the surface (Figure 6d). Stratum 2 was dated to 2110 ± 120 B.P. No features were discovered in this test pit. Lake silts (Stratum 1) were also found underlying the cultural deposits.

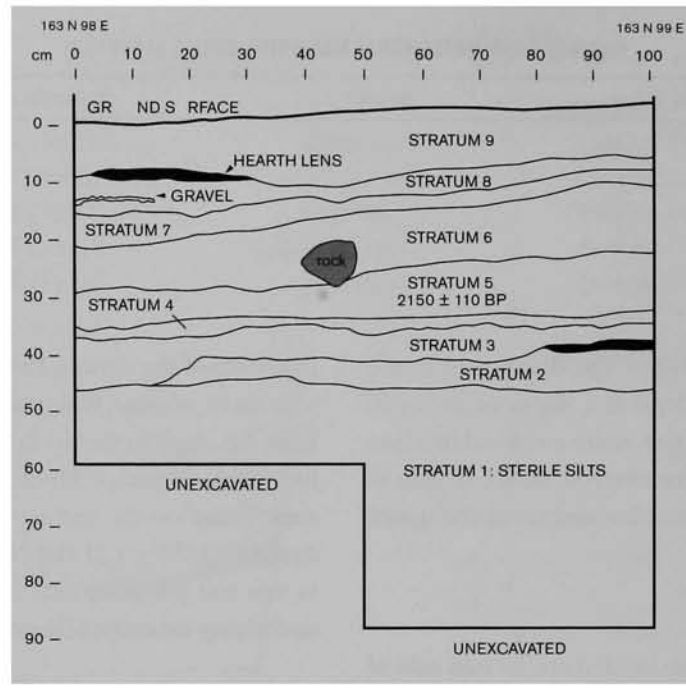
Test Area 5

This 1 x 1 m. test pit was placed just west of the south corrals, at the southwest corner of the site, in what appeared to be a soil stain. The test pit exposed the most complex stratigraphy of any of the six test pits (Figure 7a), with eight cultural strata identified. Two possible hearths were present, one at the base of Stratum 9 and one between Strata 2 and 3. A radiocarbon date of 2220 ± 110 B.P. was obtained from pooled charcoal in Stratum 5.[3] Sterile silts were encountered here as well.

Test Area 6

This consisted of a 1 x 2 m. trench in the northernmost fenced enclosure just east of the rocky outcrop, a few meters east of a Johnson and Arkush test pit. The sediments here were extremely dark and the uppermost deposits were very compacted, perhaps due to livestock trampling, although they did not appear disturbed. The cultural deposits were not as deep as those encountered in Locus 3 (Figure 7b), with unmixed sediments only extending about 30 cm. below ground surface. Below Stratum 4 the sediments continued to yield bone and artifacts, but the deposits were mixed through bioturbation. Chunky lake silts (Stratum 1) underlay this level. Charcoal from Stratum 4 yielded a date of 2280 ± 40 B.P.

NORTH PROFILE of TEST AREA 5



SOUTH PROFILE of TEST AREA 6

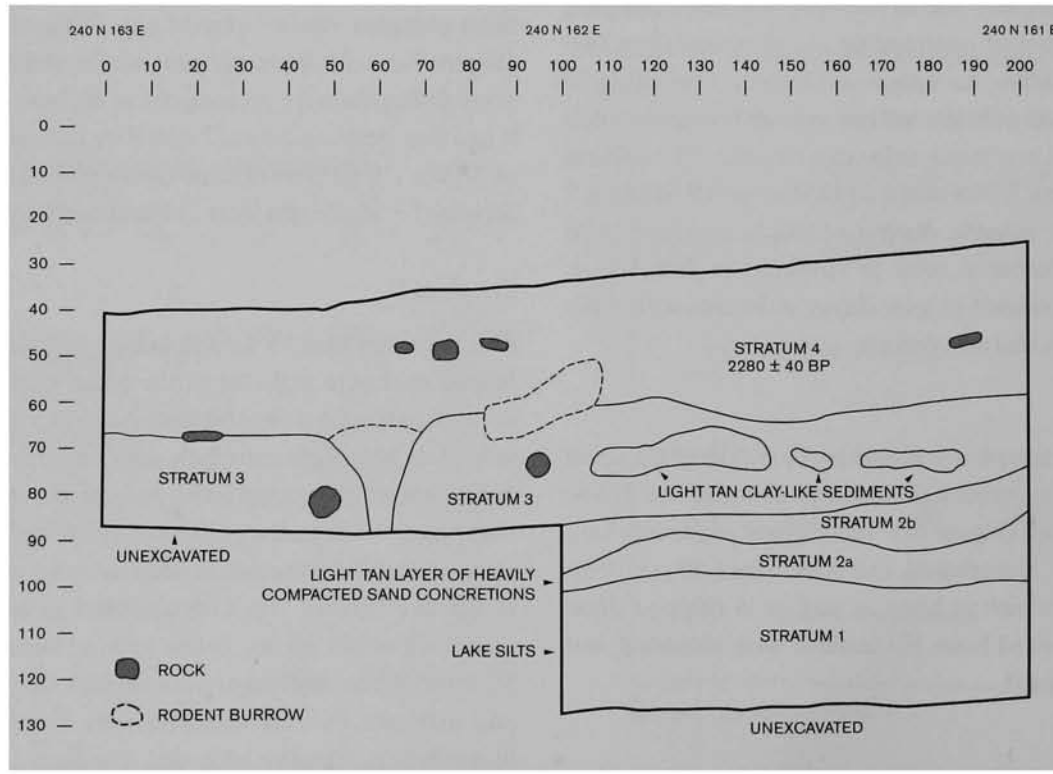


Figure 7. Profiles of Test areas: (a) Test Area 5, (b) Test Area 6.

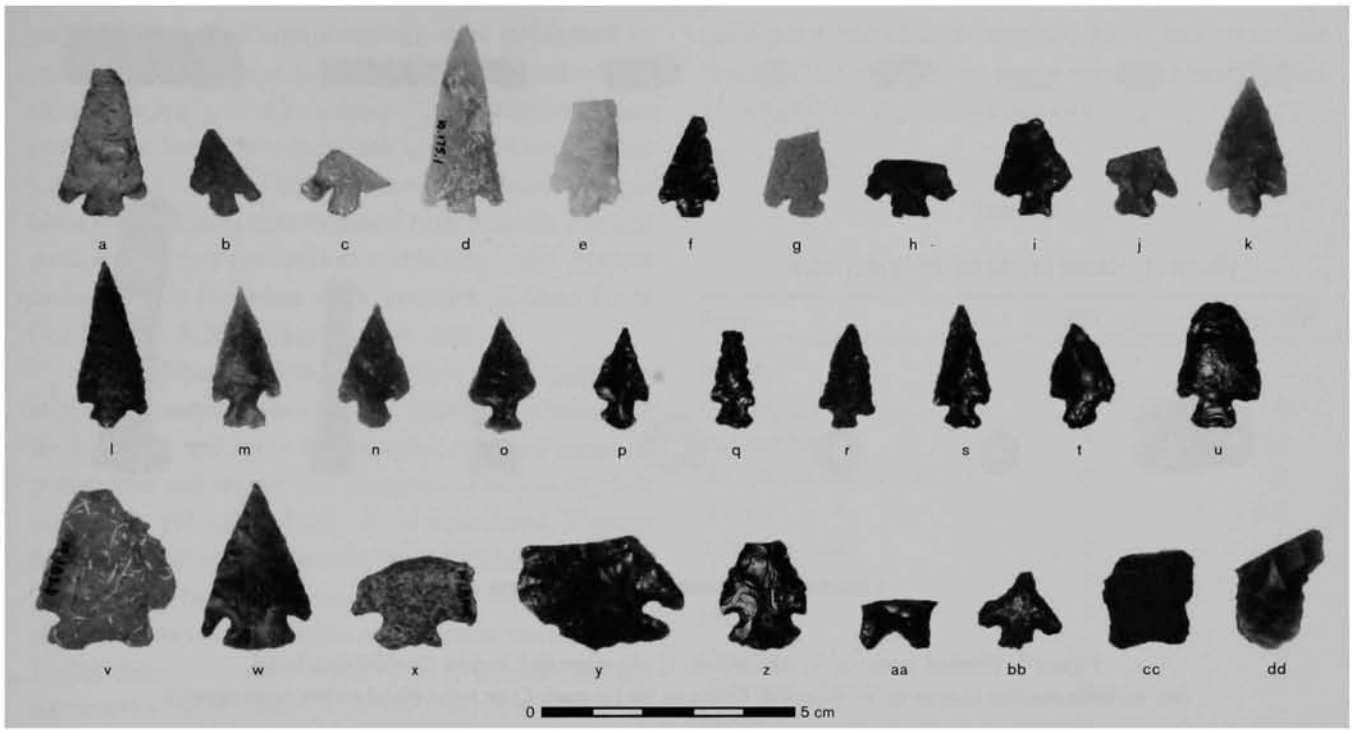


Figure 8. Projectile points from Mosquito Willie: a–bb recovered from the 2003 tests; cc–dd collected by Air Force personnel. (a–d) Eastgate, (e–f) Rose Spring, (g–u) Rosegate, (v–z) Elko Corner-notched, (aa) Gatecliff Split-stemmed, (bb) untyped corner-notched, (cc) untyped shallow side-notched, (dd) stemmed.

DATING

Five radiocarbon samples were processed from the 2003 test excavations. The dates fall into an early (~400 B.C. to A.D. 100) and a later (~A.D. 650 to A.D. 900) cluster (Table 2), and extend the period of site use several centuries beyond that documented by Johnson and Arkush (1997) who obtained dates of A.D. 362–719 and A.D. 1397–1439. Taken together, the dates suggest a fairly continuous occupation from about 2,200 years ago to about A.D. 900, followed by a hiatus of several centuries, and then a reoccupation that continued up to the present (including the historic occupation). Additional work in other portions of the site could potentially fill this temporal gap.

MATERIALS RECOVERED

Ceramics

In contrast with the work done by Johnson and Arkush (1997), no ceramics were recovered in the 2003 test excavations, although four sherds were collected from the surface of the debris pile in front of Mosquito Willie's cave (Locus 1). Two of these were fairly typical of Late Prehistoric ceramics or Shoshone brownware (Johnson and Arkush 1997:24). The other two were smoothed, and seem to fit most comfortably in Fremont types, Great Salt Lake Gray (quartz tempered) and Sevier Gray (volcanic temper).

Chipped Stone

Projectile points were common in the 2003 test pits, with 52 recovered. The majority were arrow points, dominated by Rosegate (n = 19), Eastgate (n = 4), and Rose Spring (n = 2) types. Atlatl points were present but scarce, and included Elko series points (n = 5) and a Gatecliff Split-stem base (Figure 8). The basal portion of a small, stemmed obsidian point (Figure 8*dd*) was collected by Air Force personnel prior to our visit. It resembles Great Basin Stemmed points morphologically, and although it is not edge ground, it could suggest earlier occupations at the site (e.g., see Arkush and Pitblado 2000).

Other tools included a large number of bifaces (n = 86), mostly late stage, probably distal projectile point fragments, and three drills. Bifaces were most abundant in

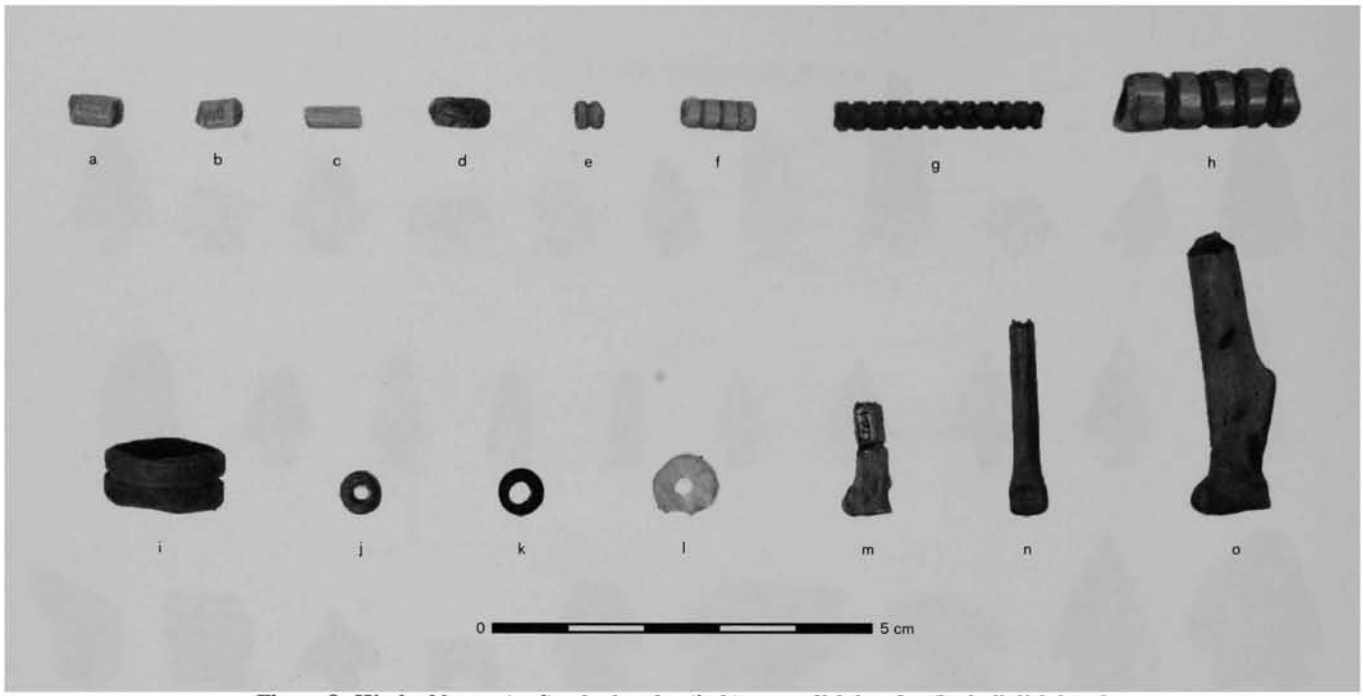


Figure 9. Worked bone: (a–i) tube beads, (j–k) stone disk beads, (l) shell disk bead, (m–o) bone residue (*Lepus* sp. metapodial, *Lepus* sp. metatarsal, *Lynx rufus* distal radius respectively).

Test Area 6. Likewise, debitage was most common in Test Area 6, with 3,472 flakes/m^3. This is nearly 3.5 times the quantity of debitage from Test Area 1, which contained the next highest density of debitage with 957 flakes/m^3. Obsidian (51%) was the most common material for both stone tools and debitage, followed by variously colored cherts (45%). Flakes with cortex were scarce (less than three percent of the assemblage) and small (less than one cm. on one dimension), and internal flakes and bifacial thinning flakes greatly outnumbered larger flakes. No cores were found in the 2003 tests.

Ground Stone

Ground stone was scarce in the 2003 tests. No manos and only four small, thin metate fragments were recovered in the excavations. Two manos were found in a niche near the upper cave, probably placed there by collectors. The metate fragments were, as noted, small (two were 12 cm. on a maximum dimension) and thin (all were less than 2.5 cm. thick). The scarcity of ground stone in Locus 3 would suggest a diminished role of plant foods at the site, although Johnson and Arkush (1997) report four manos and four metate fragments in Locus 2. These finds tend to contrast with the scarcity of these tools in Locus 3 and add to the differences between these two areas.

Worked Bone, Shell, and Stone

A number of worked bone artifacts, mostly beads and bead residue, were recovered during the 2003 field work (Figure 9). The beads were made from small mammal metapodials and bird long bones. Bone residue (n=6), presumed to be discard from bead manufacture, included a distal bobcat (*Felis rufus*) radius, a proximal coyote (*Canis latrans*) metatarsal, hare (*Lepus* sp.) metapodials, and bird long bones. Bead types included tube beads (n=18), some with multiple circumference cuts and high polish, and a barrel bead. Other worked bone pieces from Mosquito Willie included one awl and three fragmented specimens of unknown function, one of which was most likely an awl.

Three disk beads were also found during the test excavations, two of stone and one of shell (Figure 9j–l). The stone beads are made of lignite and an unidentified dark brown stone; the shell bead is made from freshwater clam (*Anadonta* sp.).

Unmodified Faunal Bone

Bone was expected to be well preserved at the site, given the experience of Johnson and Arkush, and we were not disappointed; over 4,000 pieces of bone were recovered. The taxa represented included mammals, birds, reptiles,

and fish (Table 3). Mammal remains were dominated by jackrabbits (*Lepus* spp.), followed by cottontail rabbits (*Sylvilagus* spp.), mountain sheep (*Ovis canadensis*), and canids. The latter included *Canis* spp. and *Canis latrans* (coyote), as well as *Vulpes macrotis* (kit fox). A single bison (*Bison bison*) tibia fragment from Stratum 4 in Test Area 6 reinforces the conclusion that bison were present during the late Holocene in the east-central Great Basin (see Buck et al. 2002; Grayson 1988, 1990).

The bird bones consisted mostly of small fragments, although twenty-four bones were identified as belonging to *Anas* spp. and three to Anatidae. A broad range of post-cranial and cranial bird elements, as well as eggshell fragments (41 specimens), were recovered. Reptile remains were all Colubridae from Stratum 3 of Test Area 2; they likely represent one individual that died of natural causes, since none of the bones were burned. Eighty chub (*Gila* spp.) bones (plus 12 unidentified fish elements) were recovered from the site. All the elements were quite small, and these fish were most likely caught in the small ponds at Mosquito Willie, which (as noted) still supports a small population of Utah chub. The assemblage is quite rich, with 12 taxa represented. The presence of both marsh (waterfowl and fish) and upland species (rabbits, hares, squirrels, mountain sheep, and bison) suggests that the site occupants were wide ranging.

Botanical Remains

The macrobotanical data provide some additional insights into diet and season of site use. Botanical analysis suggests that Cheno-am seeds, such as goosefoot, saltbush, and/or greasewood, were processed in Test Areas 1, 2, 3, and 5 (Cummings et al. 2004), although the most important food plant may have been bulrush. *Scirpus* seeds were found in all six areas tested, although they were most abundant in the sample from Stratum 3 of Test Area 6. Other plants that were probably used for food were grasses and pinyon. These findings are consistent with previous work done by Heath (1997), who also reported *Scirpus*, Chenopod, and *Opuntia* seeds from the site.

The broad array of plant and animal resources present in the deposits is evidence of broad spectrum hunting and gathering. The season of site use is assumed to have been spring, based on the recovery of eggshell, as well as late summer into early fall, as suggested by bulrush seeds found in several of the tests; they could have been gathered in the adjacent marshes. More data, especially faunal data, could expand the seasons of occupation (see Heath 1997 for similar conclusions).

Table 3

NISP TABLE FOR MOSQUITO WILLIE (42TO137)

TAXON	NISP	Percent NISP
Mammalia		
Small Artiodactyl	27	4.43
Bison bison (bison)	1	0.16
Ovis canadensis (mountain sheep)	10	1.64
Canis spp.	1	0.16
Canis latrans (coyote)	5	0.82
Vulpes macrotis (kit fox)	2	0.33
Leporidae	6	0.98
Lepus spp. (jackrabbit)	314	51.48
Sylvilagus spp. (cottontail)	24	3.93
Cricetidae	12	1.97
Microtus spp. (vole)	7	1.15
Neotoma spp. (woodrat)	2	0.33
Sciuridae	1	0.16
Spermophilus spp. (ground squirrel)	4	0.66
Small Rodent	2	0.33
Aves		
Anatidae	3	0.49
Anas spp. (duck)	24	3.93
Pisces		
Gila spp. (chub)	80	13.11
Reptilia		
Colubridae	85	13.93
TOTAL NISP	610	100.00

Unidentified Fauna	QTY
large mammal	673
medium mammal	29
small mammal	953
unidentified mammal	784
large bird	4
medium bird	26
small bird	17
unidentified bird	50
unidentified fish	12
unidentifiable bone	886
Total bone	4,044

Table 4

COMPARISON OF EARLY AND LATE ARTIFACT ASSEMBLAGES FROM THE 2003 TEST EXCAVATIONS MOSQUITO WILLIE

Test Area	Strata	Rose Spring	Eastgate	Rosegate	Elko Corner-notched	Gatecliff Split Stem	Unknown Points	Drills	Bifaces	Debitage	Worked Bone	Beads	Metates	Totals
Late														
Area 1	Stratum 5, 10 - 50 cm	–	–	4	–	–	–	2	13	1,245	–	4	2	1,270
Area 2	Strata 2 - 4, 10 - 90 cm	–	–	–	–	–	–	–	5	444	1	4	–	454
Area 3	Strata 1 - 2, 10 - 70 cm	–	1	4	–	–	–	–	10	303	2	4	–	324
Area 4	Stratum 3, 15 - 50 cm	–	–	2	–	–	–	–	8	340	–	2	1	353
Area 5	Midden, 10 - 40 cm	–	1	1	–	–	–	–	–	144	–	1	–	147
Total Late		–	2	11	–	–	–	2	36	2,476	3	15	3	2,548
Early														
Area 1	Strata 3 - 4, 50 - 90 cm	–	1	1	–	1	–	–	3	286	–	-	–	292
Area 4	Stratum 2, 50 - 90 cm	–	–	–	–	–	–	–	–	81	–	2	–	83
Area 5	Midden, 40-90 cm	–	–	–	–	–	–	–	–	187	–	2	–	189
Area 6	Strata 2 - 4, 5 - 90 cm	1	–	2	5	–	2	–	36	4,167	1	1	1	4,216
Total Early		1	–	3	5	–	2	–	39	4,721	1	5	1	4,778

DISCUSSION

A primary goal of the project was to obtain chronological information to determine the site's cultural history. The five radiocarbon dates suggest that there were two primary occupations: an earlier period from ~ 400 B.C. to A.D. 100, and another between ~ A.D. 700 and A.D. 900 (see Table 2). These dates are supported by the diagnostic projectile points recovered from the excavations, which were used—along with the dates—to sort artifacts and faunal remains into early and late components, although some mixing had clearly occurred (Tables 4 and 5). The quantities of Rosegate and other arrow points versus the much smaller numbers of atlatl points in the recovered assemblage suggest that the most intensive site use was during the later period. Johnson and Arkush (1997) found good evidence for an occupation of the site at ~ A.D. 500 and a much later occupation at about A.D. 1400. Taken together, these dates suggest that the human occupation of Mosquito Willie occurred over a long period of time, although it was likely sporadic and seasonal. Significantly (as noted below), these findings also demonstrate that occupation was spatially sporadic; that is, people used different portions of the site at different time periods. For example, despite placing six test pits scattered across Locus 3—a rather large area—we found no evidence of the late occupation (post A.D. 1300) demonstrated by a date and diagnostics in the Johnson and Arkush tests in Locus 2. The occupation about 2,200 years ago, however, appears to have been widespread across the site, as dates from this period were found in Test Areas 4, 5, and 6.

Additional chronological data were obtained from the marsh coring. The dates stemming from this work demonstrate that marshes were present east of the site at least 7,000 years ago. In contrast to expectations, however, there is currently no evidence of a human presence at that time period. Given that occupations were spatially sporadic, however, early remains could be present in areas not yet tested.

A final point related to chronology that is worth noting is that the early occupation at the site falls into a period (between 400 B.C. and A.D. 100) that is often missing in other sites (especially caves) in the Bonneville Basin of the northeastern Great Basin. Some time ago, Madsen and Berry (1975:401) observed that deposits dating between 2,500 to 1,500 years ago are seldom represented in cave sites; they interpreted this hiatus as a time with a low regional population, and concluded that the resurgence of population at the end of the hiatus was a result of an influx of Fremont farmers. This issue has been recently revisited by Madsen and Schmitt (2005:40), who

Table 5

COMPARISON OF EARLY AND LATE UNMODIFIED FAUNAL ASSEMBLAGES FROM THE 2003 TEST EXCAVATIONS AT MOSQUITO WILLIE

Test Area	Strata	Large Mammal	Small Artiodactyl	Sheep	Bison	Canid	Leporidae	Lepus	Sylvilagus	Small Mammal	Birds	Fish
Late												
Area 1	Stratum 5, 10 - 50 cm	17	3	0	0	1	0	57	1	163	10	5
Area 2	Strata 2 - 4, 10 - 90 cm	30	1	0	0	0	0	51	8	188	9	22
Area 3	Strata 1 - 2, 10 - 70 cm	55	0	0	0	0	6	99	11	260	17	25
Area 4	Stratum 3, 15 - 50 cm	12	0	0	0	1	0	52	1	90	10	5
Area 5	Midden, 10 - 40 cm	0	0	1	0	0	0	3	0	5	24	11
Total Late		114	4	1	0	2	6	262	21	706	70	68
Early												
Area 1	Strata 3 - 4, 50 - 90 cm	1	1	0	0	2	0	17	0	41	2	2
Area 4	Stratum 2, 50 - 90 cm	0	0	0	0	3	0	4	0	37	2	16
Area 5	Midden, 40 - 90 cm	3	0	0	0	0	0	6	2	18	0	0
Area 6	Strata 2 - 4, 5 - 90 cm	532	22	9	1	0	0	0	0	11	1	2
Total Early		536	23	9	1	5	0	27	2	107	5	20

note that dates between ~1,500 and 1,700 calendar years ago and ~2,000 calendar years are still scarce in this area. For example, Buzz Cut Dune, an open site to the south and east of Mosquito Willie, contained no occupations from this time period (Madsen and Schmitt 2005:37). Madsen and Schmitt are cautious about proposing that the scarcity of dates represent a regional population reduction, although that is an enticing explanation. The scarcity of dates of this era from caves could suggest that an as yet poorly understood strategy shift occurred at this time, and cave/sheltered sites were less attractive than open sites. It is more likely that the hiatus is largely a function of sampling bias, since numerous sites dating to the above interim are known in other parts of the eastern Great Basin and on the Colorado Plateau (e.g., Janetski 1993). Bonneville Estates Rockshelter, for example, has yielded dates of 1,710 ± 35 B.P. and 1,900 ± 40 B.P. (Rhode et al. 2005:225), and Crab Cave and Hogup Cave are dated to ~1,800 radiocarbon years ago (see Appendix A in Madsen and Schmitt 2005:137), which suggests that there was some human presence in the area during this period. Nonetheless, dates from this time period remain few in number. The explanation for this pattern remains a focus for future research in the Bonneville Basin.

In addition to chronology, site function was an initial research topic that became an important issue at the site given the sharp differences between Test Area 6 in Locus 2 and the other five test areas, all in Locus 3. These differences can be seen in the faunal remains, as well as in the worked bone and chipped stone assemblages. For example, nearly all identifiable small artiodactyl bone came from Test Area 6, while the test pits in Locus 3 contained primarily rabbit, hare, fish, and bird bone, to the virtual exclusion of small artiodactyls (Table 5). Furthermore, the small mammal, bird, and fish bone tended to occur in the upper levels in all test pits except Test Area 6. The dates from the test areas, combined with the diagnostics (projectile points), are evidence that Test Area 6 faunal remains were deposited during the early occupation of the site. This pattern raises an interesting issue regarding faunal change through time; i.e., following the logic of optimal foraging (e.g., Broughton 1999; Janetski 1997), the assemblage suggests that large game was less abundant during the later period of occupation (A.D. 700 to A.D. 900). Padgette (n.d.) has explored this issue in some depth and has found that the trend of diminishing numbers of artiodactyls from early to late holds even when the faunal remains recovered by Johnson and Arkush (1997) are included in the equation. She points out, however, that there are significant concerns with small excavations such as those carried out in 2003. Most importantly, it is possible that

the sample recovered in Test Area 6 was biased toward large mammals for functional reasons. Specifically, this could be an area where large animals were butchered and bones discarded. Until further work is done at the site, that issue will remain unresolved.

There are also differences between Loci 2 and 3 in the distribution of bone beads and other ornaments (Table 4). All of the bone beads and two of the disk beads came from the south area (Locus 3), while only a single stone disk bead and no bone ornaments were found in Test Area 6, and Johnson and Arkush (1997) found no worked bone in their two 1 x 2 m. test pits in Locus 2. Finally, the difference in debitage density, as noted above, was significant, with Test Area 6 containing a much greater density than any test pit in Locus 3.

The reasons for these several differences across the site are not completely clear, but may be related to differences in the way the two areas were used. The presence of smaller fauna, greater quantities of ornaments, and a generally lighter scatter of chipped stone debris, combined with the flatter area of Locus 3, suggest that the south area was used more residentially, while Locus 2 was used for activities that generated either smelly (butchering) or annoying (chipped stone) residue.

Questions regarding function extend to how the site might have been occupied during the Fremont period, given the various extant models of Fremont strategies (e.g., see Madsen and Simms 1998). The 2003 test excavations found no evidence of a Fremont presence or influence, although dates and projectile point styles fall within the Fremont period. Fremont diagnostics would include ceramics, figurine fragments, perhaps anthropomorphic rock art, formal architecture (pit houses), and domesticates such as corn (Madsen and Simms 1998). Although ceramics found on the surface at the cave entrance (Locus 1) are Fremont in style, no sherds were recovered during the 2003 test excavations. Johnson and Arkush (1997), however, found a few (n = 3) Fremont sherds in their test pits. Given the small number of sherds present, the most parsimonious explanation for their occurrence would be trade or perhaps curation; that is, that there was an opportunistic collection of sherds from abandoned sites by past peoples which were then redeposited at Mosquito Willie. In other words, the conclusion here is that those who lived at Mosquito Willie during the Fremont period were more closely aligned with the Late Archaic (Elston 1986) of the central Great Basin, and connections with people living along the Wasatch Front were sporadic and brief at best. Such a conclusion seems logical, given that the Great Salt Lake Desert is and would have been a serious physiographic barrier to east-west travel.

Madsen and Schmitt (2005:40) offer a similar scenario for this time period (~1,500 to 1,000 calendar years B.P.) at Buzz Cut Dune to the south and east of Mosquito Willie. They describe a surge of use at this time by "aceramic, bow-and-arrow-using foragers" who were not Fremont people. They note that the "Classic Fremont" use of Buzz Cut Dune, marked by the appearance of thin walled, grayware ceramics, occurred after A.D. 1000 (Madsen and Schmitt 2005:37). The 2003 tests at Mosquito Willie also documented an intensive use during the earlier period (i.e., 1,500 to 1,000 years ago) by non-Fremont foragers using bow-and-arrow weaponry. The findings at both Buzz Cut Dune and at Mosquito Willie suggest that a Fremont influence or presence to the west of the Fremont "heartland" (Madsen 1989:13) may have been a late (i.e., post A.D. 1000) phenomenon (however, see Smith 1994 for earlier ceramics in Skull Valley, Utah).

The absence of Fremont ceramics or other Fremont diagnostics in Locus 3 at Mosquito Willie is somewhat surprising given that Fremont-style ceramics have been reported at Danger Cave to the north and at Scorpion Ridge (Hockett and Morgenstein 2003) and Orangeboom Cave (Buck et al. 2002) to the west. At Danger Cave, however, the sherds were mostly surface finds (Jennings 1957:181). The ceramics recovered from Scorpion Ridge appear to be contemporary with the bulk of the occupation in Locus 3, since the dates from that site fall between A.D. 660 and A.D. 910 (Hockett and Morgenstein 2003:10), which would be roughly contemporaneous with Mosquito Willie. However, the presence of a side-notched arrow point (referred to as a Nawthis Side-notched) from Scorpion Ridge could suggest a later occupation at that site, as these points are rather securely dated to post-A.D. 1000 at a number of Fremont sites (see Holmer and Weder 1980; but also Wilde 2000:117–118). The Fremont ceramics at Orangeboom Cave were directly dated (sherd residue) to between A.D. 882 and A.D. 1019 (Buck et al. 2002:108), which falls a bit later in time than

the Mosquito Willie occupation that was tested in 2003. The answer to the question of site function during the Fremont period—based on the data gathered to date (including the Johnson and Arkush excavations)—is that it was occupied by hunters and gatherers who may have had sporadic contact with Fremont farming groups to the east and/or south, although there is little evidence of that contact. Interaction may have increased at a later time, but Fremont age deposits later than A.D. 900 have yet to be found at Mosquito Willie.

A larger functional question involves the role that Mosquito Willie played in the seasonal round of those who visited the site. Was it a long-term camp or residential base from which foragers operated in logistically organized groups? Or was it a logistical site used only temporarily? What was the season of site use? If this was a temporary stop, what other locales might have been visited by those using Mosquito Willie? These are difficult questions to answer, given that our excavations were not broad horizontal exposures but vertical tests pits; consequently, inferences about site functions must come largely from artifact arrays and differences, which can suggest uses by family groups or more specialized task groups visiting the site for specific purposes. The artifact yield at the site is heavily biased toward chipped stone tools and debris. The scarcity of flakes with cortex, combined with the small flake size in the recovered assemblage, suggests that most knapping was oriented toward retooling rather than tool manufacture. The ground stone from Locus 3 conforms to the "portable type" defined by Madsen and Schmitt (2005:121) in that all pieces were less than 25 mm. in thickness. Finally, with the exception of a possible shallow structure exposed in Test Area 2, features were limited to several small hearths. All the above, along with the abundant bone scraps, suggest that site visits by Late Archaic peoples were short in duration and were focused on hunting supplemented by gathering. The presence of eggshell is good evidence of spring visits, while the abundant bulrush seeds suggest visits in the early fall. It is quite likely that those visiting these marshes also spent time at nearby Bonneville Estates Rockshelter, since dates from the upper levels there are roughly contemporary with the Late Archaic occupation at Mosquito Willie (Rhode et al. 2005:227). Comparisons of material remains from both sites would provide a basis for confirming or rejecting this possibility.

The obsidian sourcing done by Nelson (2004) and Hughes (1997) provides some insights into the direction of either socio-economic connections or travel on the part of those using the site. Both identified obsidian from Topaz Mountain to the southeast as well as from Brown's Bench to the north, which suggests rather wide connections. The sources of other materials in the chipped stone assemblage were not identified, but a great deal could be learned about travel and other connections if they could be sourced. Faunal and botanical analyses suggest a much smaller site catchment than the lithic materials do, since all of the animals and plants, with the possible exception of juniper, would have been available within a short distance of the site.

The presence of numerous bone beads (n = 19) at Mosquito Willie seems to counter somewhat the notion of short term visits. Compared to other sites in the region, such as Danger Cave (Jennings 1957), South Fork Shelter (Heizer et al.1968), Pie Creek Shelter (McGuire et al. 2003), and James Creek Shelter (Schmitt 1990), Mosquito Willie produced more than the expected number of ornaments, given the small sample excavated. Similar bone beads—bone tubes, often with multiple circumference-cut marks—were recovered from all the sites mentioned, however. The difference in the density of ornaments suggests that Mosquito Willie was used more by residential groups than was suggested above, but without additional work—especially work involving horizontal exposures in Locus 3—this issue remains unresolved. Finally, the beads found here were quite different from those typically found at Fremont sites to the east (see Janetski 2000 for a discussion of Fremont bead styles), a fact which reinforces the earlier conclusion that—during the early Fremont period from A.D. 600 to A.D. 900—Mosquito Willie (at least in Locus 3) was occupied by Late Archaic peoples of the central Great Basin with little contact with Fremont farmers to the east.

SUMMARY

Mosquito Willie is a fertile location in an arid landscape on the extreme western edge of the Great Salt Lake Desert. Dates and diagnostics from recent test excavations have pushed the direct evidence of human use of these springs to about 2,200 years ago. Dates from marsh coring

demonstrate that the south spring was flowing 7,000 years ago and continued to do so through the mid-Holocene. That date is much earlier than any evidence of human occupation obtained from the site test pits. The site thus failed to meet our expectations that people should have been using the area if the springs were flowing. There are at least three possible reasons for this disparity.

First, the expectation could be in error, and despite the availability of water, people did not frequent these springs until fairly late in the Holocene. This might have occurred despite the fact that Mosquito Willie was apparently the closest water available to people occupying nearby Bonneville Estates Rockshelter, a site that was occupied thousands of years before the earliest dates obtained from Mosquito Willie (Rhode et al. 2005). It could be that for unknown reasons, people chose to visit the Blue Lake area to the north, where there is a much more extensive wetland. However, there is no evidence as yet from the Blue Lake area to support such a conclusion.

Second, it is possible that people did visit the site early on, and the tests have simply failed to encounter the evidence. Certainly only a very small percentage of the site had been tested as of 2003. The two somewhat enigmatic projectile points (stemmed and shallow side-notched) found on the surface hint at the possibility of earlier occupations. In addition, use of the site appears to have increased through time, and recent debris could be swamping sporadic evidence of early occupations.

Third, it is also possible that earlier occupations have been destroyed by either natural processes or by site modifications made by its last occupant—Mosquito Willie. The small cave in Locus 1 would have been a prime location for visits during all time periods, but those deposits appear to have been almost totally removed and deposited outside the cave, thereby destroying the integrity of the stratigraphy.

In any case, the research reported here (see also Janetski 2004; Arkush 1998; and Johnson and Arkush 1997) found ample evidence of ongoing, if sporadic, human visitations during the Late Archaic and into the Late Prehistoric eras in the eastern Great Basin. There is little evidence of interaction with Fremont peoples to the south and east, however. This work provides useful information about pre-European strategies in this portion of the Great Basin.

NOTES

[1]The coring was done cooperatively by David Madsen of the University of Texas at Austin, David Rhode of the Desert Research Institute, and Janetski and his students from Brigham Young University. Members of the University of Nevada archaeological field school under the direction of Ted Goebel also assisted with the coring exercise. The Utah Geological Survey and Desert Research Institute provided the coring equipment. The testing was done cooperatively by Brigham Young University and Hill AFB personnel. Janetski directed the excavations but was assisted by Air Force archaeologist James D. Wilde and Hill Air Force Base archaeologists Jaynie Hirschi, Angelina Howell, and Amanda Anderson.

[2]Additional testing at Mosquito Willie was done in Locus 3 by Far Western Anthropological Research Group in 2005. The findings tended to replicate the 2003 tests (Daron Duke, personal communication 2005), although a detailed report of that work was not available at the time of this writing.

[3]This date was erroneously reported in Janetski (2004:23) as 2150 ± 110 B.P., which is the measured radiocarbon age rather than the conventional age.

REFERENCES

Arkush, Brooke S.
1998 *Archaeological Investigations at Mosquito Willie Rockshelter and Lower Lead Mine Hills Cave, Great Salt Lake Desert, Utah.* Salinas, California: Coyote Press.

Arkush, Brooke S., and Bonnie L. Pitblado
2000 Paleoarchaic Surface Assemblages in the Great Salt Lake Desert, Northwestern Utah. *Journal of California and Great Basin Anthropology* 22(1): 12–42.

Broughton, Jack M.
1999 Resource Depression and Intensification During the Late Holocene, San Francisco Bay: Evidence from the Emeryville Shellmound Vertebrate Fauna. *Anthropological Records* 32. Berkeley: University of California Press.

Buck, Paul, Brian Hockett, Kelly Graf, Ted Geobel, Gene Griego, Laureen Perry, and Eric Dillingham
2002 Orangeboom Cave: A Single Component Eastgate Site in Northeastern Nevada. *Utah Archaeology* 14:99–112.

Cummings, Linda S., Kathleen Puseman, and R. A. Varney
2004 Pollen and Macrofloral Analysis at Site 42TO137. In Joel C. Janetski, *2003 Test Excavations at Mosquito Willie (42TO137)*, Appendix C, pp. 67–88. Museum of Peoples and Cultures Technical Series No. 4–12. Provo: Brigham Young University.

Elston, Robert G.
1986 Prehistory of the Western Area. In *Handbook of North American Indians: Great Basin*: Vol. 11, W. L. d'Azevedo, ed., pp. 149–160. Washington D. C.: Smithsonian Institution Press.

Graf, Kelly R., Ted Goebel, and Brian Hockett
2004 Bonneville Estates Rockshelter: An Update on the Terminal Pleistocene Archaeology. Paper presented at the 29th Great Basin Anthropological Conference, Sparks.

Grayson, Donald K.
1988 Danger Cave, Last Supper Cave, and Hanging Rock Shelter: the Faunas. *American Museum of Natural History Anthropological Papers* 66, Pt 1. New York: American Museum of Natural History.
1990 The James Creek Shelter Mammals. In *The Archaeology of James Creek Shelter*, R. G. Elson and E. E. Budy, eds., pp. 87–98. *University of Utah Anthropological Papers* 115. Salt Lake City: University of Utah Press.

Harris, Jenny
2004 History and Biographical Information on Gilbert McCauley (a.k.a. Mosquito Willie or Skeeter Bill). In Joel C. Janetski, *2003 Test Excavations at Mosquito Willie* (42TO137), pp. 6–10. Museum of Peoples and Cultures Technical Series No. 4-12. Provo: Brigham Young University.

Heath, Kathleen M.
1997 Macro-botanical, Micro-botanical, and Micro-refuse Analysis of Flotation Samples from Sites 42TO137, 42T0701, and 26EK6384. In David F. Johnson and Brooke S. Arkush, *Results of Archaeological Test Excavations at Three Sties on the U. S. Air Force Utah Test and Training Range in Eastern Nevada and Western Utah*, Appendix B. Contract No. F42650-93-D-0053, D.O. 5005. Ms. on file, Technical Resources Laboratory, Utah State University Foundation, Utah State University, Logan, and Weber State University, Ogden.

Heizer, Robert F., Martin A. Baumhoff,
and C. William Clewlow, Jr.
1968 Archaeology of South Fork Shelter (NV-E1-11), Elko County, Nevada. *Reports of the University of California Archaeological Survey* 71:1–58. Berkeley: University of California Archaeological Research Facility.

Hockett, Brian, and Maury Morgenstein
2003 Ceramic Production, Fremont Foragers, and the Late Archaic Prehistory of the North-Central Great Basin. *Utah Archaeology* 16:1–36.

Holmer, Richard N., and Dennis G. Weder
1980 Common Post-Archaic Projectile Points of the Fremont Area. In *Fremont Perspectives*, David B. Madsen, ed., pp. 55–68. Antiquities Section Selected Papers No. 16. Salt Lake City: Utah State Historical Society.

Hughes, Richard E.
1997 Geochemical Sourcing of Obsidian Artifacts from Sites 42TO137, 42TO701, and 26EK6384. In David F. Johnson and Brooke S. Arkush, *Results of Archaeological Test Excavations at Three Sties on the U. S. Air Force Utah Test and Training Range in Eastern Nevada and Western Utah*, Appendix C, pp. 188–195. Contract No. F42650-93-D-0053, D.O. 5005. Ms on file, Technical Resources Laboratory, Utah State University Foundation, Utah State University, Logan, and Weber State University, Ogden.

Janetski, Joel C.
1993 The Archaic to Formative Transition on the Northern Colorado Plateau: A Basketmaker Perspective. In *Anasazi Basketmaker, Papers from the 1990 Wetherill-Grand Gulch Symposium*, Victoria Atkin, ed., pp. 223–242. Cultural Resource Series No. 24. Salt Lake City: Bureau of Land Management.
1997 Fremont Hunting and Resource Intensification in the Eastern Great Basin. *Journal of Archaeological Science* 24:1075–1088.
2000 Worked Bone. In Joel C. Janetski, Richard K. Talbot, Deborah E. Newman, Lane D. Richens, and James D. Wilde, *Clear Creek Canyon Archaeological Project: Results and Synthesis*, pp. 83–94. Museum of Peoples and Cultures Occasional Paper No. 7. Provo: Brigham Young University.
2004 *2003 Test Excavations at Mosquito Willie (42TO137)*. Museum of Peoples and Cultures Technical Series No. 4–12. Provo: Brigham Young University.

Jennings, Jesse D.
1957 Danger Cave. *University of Utah Anthropological Papers* 27. Salt Lake City: University of Utah Press.

Johnson, David F., and Brooke S. Arkush
1997 *Results of Archaeological Test Excavations at Three Sites on the U. S. Air Force Utah Test and Training Range in Eastern Nevada and Western Utah*. Contract No. F42650-93-D-0053, D.O. 5005. Ms on file, Technical Resources Laboratory, Utah State University Foundation, Utah State University, Logan, and Weber State University, Ogden.

Madsen, David B.
1989 Exploring the Fremont. *Utah Museum of Natural History Occasional Papers* 8. Salt Lake City: Utah Museum of Natural History.

Madsen, David B., and Michael S. Berry
1975 A Reassessment of Northeastern Great Basin Prehistory. *American Antiquity* 40(4):391–405.

Madsen, David B., and David Rhode
1998 Pine Nut Use in the Early Holocene and Beyond: The Danger Cave Archaeobotanical Record. *Journal of Archaeological Science* 25:1199–1210.

Madsen, David B., and David N. Schmitt
2005 Buzz Cut Dune and Fremont Foraging at the Margin of Horticulture. *University of Utah Anthropological Papers* 124. Salt Lake City: University of Utah Press.

Madsen, David B., and Steven R. Simms
1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12:255–336.

McGuire, Kelly R., Michael G. Delacorte, and Kimberly Carpenter
2003 *Archaeological Excavations at Pie Creek and Tule Valley Shelters, Elko Country, Nevada.* Ms. submitted to Bureau of Land Management Elko Field Office, Contract No. 1422-N660-C97-3079, by Far Western Anthropological Research Group, Inc., Davis, California.

Nelson, Fred W.
2004 Obsidian Sourcing. In Joel C. Janetski, *2003 Test Excavations at Mosquito Willie (42TO137)*, Appendix B, pp. 66. Museum of Peoples and Cultures Technical Series No. 4–12. Provo: Brigham Young University.

Padgette, Sherri
n.d. Trends in Foraging Efficiency at Mosquito Willie in the Eastern Great Basin. Ms. on file, Department of Anthropology, Brigham Young University.

Rhode, David, Ted Goebel, Kelly E. Graf, Bryan S. Hockett, Kevin T. Jones, David B. Madsen, Charles G. Oviatt, and David N. Schmitt
2005 Latest Pleistocene-Early Holocene Human Occupation and Paleoenvironmental Change in the Bonneville Basin, Utah-Nevada. In *Interior Western United States: GSA Field Guide 6*, Joel L Pederson, and Carol M. Dehler eds., pp. 211–230. Boulder, Colorado: Geological Society of America.

Schmitt, David N.
1990 Bone Artifacts and Human Remains. In *The Archaeology of James Creek Rockshelter*, R. G. Elson and E. E. Budy, eds., pp. 117–128. *University of Utah Anthropological Papers* 115. Salt Lake City: University of Utah Press.

Smith, Shelley J.
1994 Fremont Settlement and Subsistence Practices in Skull Valley, Northern Utah. *Utah Archaeology* 7:51–68.

Wilde, James D.
2000 Lithics. In Joel C. Janetski, Richard K. Talbot, Deborah E. Newman, Lane D. Richens, and James D. Wilde, *Clear Creek Canyon Archaeological Project: Results and Synthesis*, pp. 95–120. Museum of Peoples and Cultures Occasional Papers No. 7. Provo: Brigham Young University.