ARCHAEOLOGY AND ENVIRONMENT ON THE DRY LAKES PLATEAU, BODIE HILLS, CALIFORNIA: HUNTER-GATHERER COPING STRATEGIES FOR HOLOCENE ENVIRONMENTAL VARIABILITY

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ABSTRACT

An assessment of the archaeology and paleoenvironment of the 2,469 m high Dry Lakes Plateau indicates that this upland micro-habitat played a significant role in hunter-gatherer land use in the Bodie Hills throughout the Holocene. Prehistoric use of the Plateau spans 8,000 to 10,000 years, represented by the entire western Great Basin projectile point sequence. Woodrat midden analyses place pinyon *(Pinus monophylla)* in the area by 4,980 B.P. and indicate that a mesic flora survived on the Plateau during the last 5,260 years B.P. This analysis shows that two remnant, seasonally flooded, Pleistocene lake basins and perennial springs were the focal point of human occupation and provided a persistent resource base for hunter-gatherer groups through much of the Holocene.

INTRODUCTION

This paper outlines thesis research that was conducted on the Dry Lakes Plateau, located in the Bodie Hills along the California/Nevada border (Figure 1). For the past four years I have been conducting archaeological and environmental investigations on the Plateau. My thesis (Halford 1998) focuses on the integration of these data to examine how climatic change may have affected hunter-gatherer use of this particular landscape. On a broader perspective, I am interested in the relationship between climate change and human adaptation to environmental variability and unpredictability. Following Weide (1976), Elston (1982), Meltzer (1995), and others this examination elucidates the importance of micro-habitats, such as the Dry Lakes Plateau, in hunter-gatherer land use strategies and adaptive behavior.

RESEARCH AREA

The Dry Lakes Plateau is located on the northeastern edge of the Bodie Hills region. Floristically, the Plateau is characterized as an upland sagebrush-steppe community type (Cronquist et al. 1972; Messick 1982). Located on the western edge of the Great Basin physiographic province and the fringe of the eastern Sierra Nevada piedmont, the Bodie Hills are a uniquely well-watered habitat within the Great Basin. The 11-square-kilometer study area is characterized by a Pliocene age volcanic landscape formed by the eruption of Beauty Peak 2.8 million years ago (Figure 2). Elevations within the research area range from roughly 2,460 meters, at the lowest point, to 2,749 meters at the top of Beauty Peak. The Plateau takes on the characteristics of a mesa or an island in the sky. The north, west, and southern boundaries fall away steeply by as much as 152 m to 305 m to the drainages below. Two remnant Pleistocene lake basins, which are seasonally flooded, and two perennial spring sources are salient hydrologic features which are located on the south end of the Plateau. Ethnographically, the Plateau is located within Northern Paiute territory.

One hundred and fifty-two meters below the northern rim of the Plateau an existing sedge bog known as Hidden Lake has formed and contains important paleoenvironmental information. A small cave, formed in a rhyolitic matrix, is located to the east of the bog and 122 m below the Plateau. Five woodrat middens were discovered in the cave during the 1995 field season.

THE RESEARCH PROBLEM

A goal of this research was to reveal the seasonal persistence of the Dry Lakes Plateau as an upland economic resource area and to suggest that other such predictable or reliable environments provided critical habitat for hunter-gatherer groups, especially during periods of resource uncertainty. It is hypothesized that the

Plateau was an important locality for human exploitation of subsistence resources throughout much, if not all, of the Holocene. During drought periods, when lowland habitats were particularly stressed, resilient upland habitats such as the Plateau would have become especially important resource bases or patches.

METHODS

To test the research hypotheses, the 1,093-hectare study area was subdivided into 100 50-meter spaced transects. Forty transects were surveyed, comprising 120 linear kilometers of surface inventory (Figure 3). As illustrated, the east, central, west central, and northern portions of the Plateau were sampled. A random sample of lithic debitage within each site assemblage was recorded along with all tool types. The analysis of flaked stone and ground stone assemblages and site features (e.g., hearths, rock rings, blinds) provides the context from which hunter-gatherer activities on the Plateau can be understood.

The research area is located in proximity to and between two major obsidian sources, the Bodie Hills, 8 kilometers to the west, and Mount Hicks, 13 kilometers to the east. A sample of projectile points was sourced using X-ray fluorescence (XRF) to determine the mobility patterns of groups utilizing the Plateau. The projectile points and obsidian hydration provide the main chronometric controls for this analysis. The woodrat midden locality was revisited during the 1996 field season. Five separate middens were mapped and three of the middens were sampled.

RESULTS

Woodrat Midden Analysis

Plant macrofossils extracted from ancient woodrat (Neotoma spp.) middens provide information concerning vegetative and climatic histories on a habitat specific level. Five samples from the midden locale were radiocarbon dated (Table 1). These data were utilized in conjunction with other regional proxy paleoclimatic indicators to reconstruct the paleoenvironment on the Dry Lakes Plateau. The dated midden samples range in age from 540 to 5,260 years B.P. Although species composition is variable from sample to sample, the continuity revealed is particularly important. In general, taxon persistence is indicated. Sagebrush and juniper occur in each sample, while pinyon occurs since 4,980 B.P.

With the exception of the anomalous occurrence of shadscale, the species content of the various samples indicates that more mesic Great Basin taxa have predominated at the site during the past 5,260 years. By modern analogue this indicates that effective precipitation during this period has been relatively high and winter conditions were mild enough to support pinyon at this site.

The occurrence of pinyon in the Bodie Hills at this early date is significant. The earliest date for pinyon to the north, and in relative proximity to the study area, comes from Slinkard Valley, 40 kilometers to the northwest, where pinyon is dated to 2,150 ± 75 B.P. (Nowak et al. 1994). Pinyon occurs to the south in the White Mountains by 8,790 B.P. These data suggest that the Bodie Hills may have been an intermediate refugia for pinyon before it served as a corridor for its later migration to its current northern ranges.

From the woodrat midden plant macrofossil evidence it can be hypothesized that during warm dry periods the effective precipitation on the Dry Lakes Plateau was high enough to sustain more mesic species as well as to seasonally flood the lake basins. This can be further substantiated by other factors related to the elevation and the geographic location of the Plateau. Today three-quarters of the Great Basin receives less than 250 mm of precipitation per year (Wharton et al. 1990) as compared to the average of 369 mm in the Bodie Hills. The modern adiabatic lapse rate in this region is -0.6° C/100 m elevation, and precipitation increases by 15 mm/100 m, while potential evaporation decreases at a linear rate of -18 mm/100 m (Major 1977:44-66). These factors considered together with the paleobotanical evidence indicate that the precipitation necessary to maintain an effective hydrological input on the Plateau has been relatively high throughout the Holocene. From these analyses it can be inferred that the Dry Lakes Plateau was a favorable habitat, in terms of humanly edible and economic species, throughout much of the Holocene.

Archaeological Analysis

Sixty sites and 97 isolated finds were recorded in the 4.7-square-kilometer sample area. Sites cluster in the southern end of the Plateau near the hydrologic features, with the largest and most complex sites occurring at the perennial

spring sources. Site numbers drop off significantly to the north. All of the sites over 600 meters from water contain assemblages or features that are characteristic of small task specific loci such as hunting blinds and small, late stage reduction/retooling locations. A full range of activities is indicated in the sites located on the south end of the Plateau, ranging from task specific blinds, to petroglyph sites, to single activity areas, and multi-component sites with a broad scope of activities and periods represented.

An analysis of diagnostic projectile points shows that the entire Great Basin temporal sequence, from Paleoindian to the late Archaic, is represented (Figure 5). Based on the projectile point data, the early to mid Archaic appear to be the periods of most intensive use of the Plateau.

Most importantly, these data indicate that the Plateau was visited by hunter-gatherers throughout the Holocene. Also of significance is human utilization of the Plateau during the Altithermal (ca. 8,000-5,500 B.P.) drought period as evidenced by the occurrence of Little Lake, Pinto, and Fish Slough Side-Notched projectile points.

The flaked stone and tool stone profiles of the 60 sites indicate that late stage biface thinning and tool production were the main reduction activities that occurred on the Plateau. Primary reduction was not a major activity. These data indicate that hunter-gatherer activities on the Plateau centered on the procurement of edible resources rather than the acquisition of raw (tool stone) material.

Plant processing was an important activity as indicated by the 15 locations at which milling equipment was found. All of the milling sites are located within 450 m of extant water sources. All cultural periods are represented at the milling sites, suggesting that plant processing was an important activity on the Plateau throughout the Holocene. In general, the milling sites represent multi-period and/or multi-activity locations, and are the largest and most complex sites on the Plateau.

Obsidian X-Ray Fluorescence and Hydration Analyses

The XRF analysis (Skinner and Davis 1996) indicates that 85% of the tool stone obsidian imported to the Plateau is derived from the Bodie Hills (41%) and Mt. Hicks (44%) obsidian sources (Figure 5). These data suggest that travel to and from the Plateau may have been mainly along an east/west corridor. The obsidian hydration data (Origer 1997) support the cultural chronology derived from the projectile points by indicating a variety of periods of human activity on the Plateau. The formal tools (n=28) analyzed fall into the general pattern indicated by the projectile point data (Figure 6). The mid Archaic (ca. 3,150-1,350) appears to be the period of most intensive utilization of the Plateau, although all other periods are represented as well.

LAND USE PATTERNS ON THE DRY LAKES PLATEAU

Hunter-gatherer use of the landscape on the Plateau involved exploiting the widest range of resources available. This is indicated by the spatial distribution of sites and isolates completely across the sample area. But most importantly, with respect to the research hypotheses, long-term land-use was focused around the hydrologic features. This is illustrated by a double axis graph of site sizes in relation to distance from extant water sources (Figure 7). Fifty-three (88%) of the sites are within 600 meters of water. The largest and most complex sites are located near the springs and on the old shoreline. A linear regression (Figure 8) of site frequency and distance to water shows a strong inverse relationship, that is, site frequencies decrease as distance to water increases. At the 95% confidence level, the p value of < 0.01 is highly significant.

COMPARISON TO OTHER BODIE HILLS RESEARCH

Three other major research projects have been conducted in the Bodie Hills, including Hall 1980, Kobori et al. 1980, and Rusco 1991. Figure 9 compares the average number of sites per square kilometer reported for these studies to the findings on the Plateau. This comparison shows that the number of sites on the Plateau is higher than the other areas investigated. If the 3 northern outliers are trimmed, the sample mean increases to 15.6 sites per square kilometer. Using the trimmed mean, a Student's paired comparison t-test shows that the mean number of sites on the Plateau (15.6) is highly significant at a 99% confidence interval ($t = 14.824$, $df = 2$, $p = < 0.005$). These analyses not only show the measurably higher number of sites per square kilometer on the Plateau, as compared to other

Bodie Hills research, but also further substantiate that a statistically significant number of sites cluster around the hydrologic features.

CONCLUSIONS

Together, the archaeological, paleoenvironmental, and modern environmental analyses provide strong evidence for the persistence of the Plateau as an important habitat for hunter-gatherers. They indicate that the water resources, and the flora and fauna dependent upon their existence, were seasonally available. These features of the Plateau's effective environment provided the main incentive and attraction for recurrent hunter-gatherer use of this upland habitat. During periods of climatic stress, persistent micro-habitats would have provided an alternative for hunter-gatherers to cope with unproductive and unreliable resources in other areas. It can be predicted that the relatively high-altitude (2,460 m) Plateau provided such an alternative.

In conclusion, it can be suggested that the dearth of evidence for early Archaic human habitation in the Great Basin may be a result of archaeological investigations which have focused, generally, on highly unstable habitats easily influenced by climatic change, such as marshes and lake basins located in lowland habitats. Perhaps a change of focus to environments such as the Dry Lakes Plateau will serve to address questions concerning Great Basin human response to periods of extreme climatic stress, and could provide more conclusive evidence of human activities during these periods. More resilient resource bases, such as the Plateau, would have been particularly important to humans during periods of environmental pressure. We can predict that such habitats offered a reliable and stable option for hunter-gatherers who were compelled to cope with and adapt to the variable and often extreme environments within the Great Basin.

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Figure 1. Research Area Location Map.

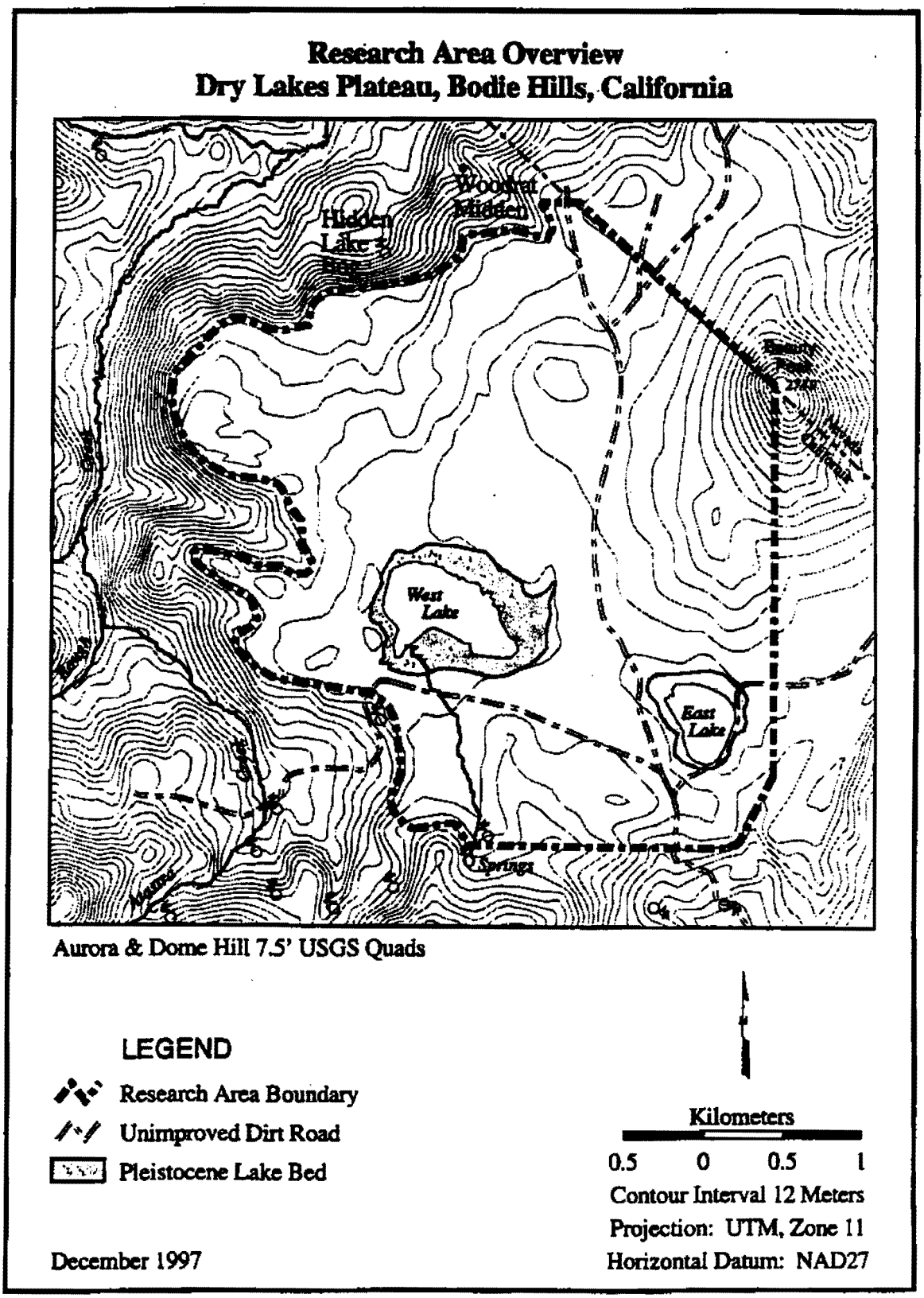

Figure 2. Dry Lakes Plateau Research Area.

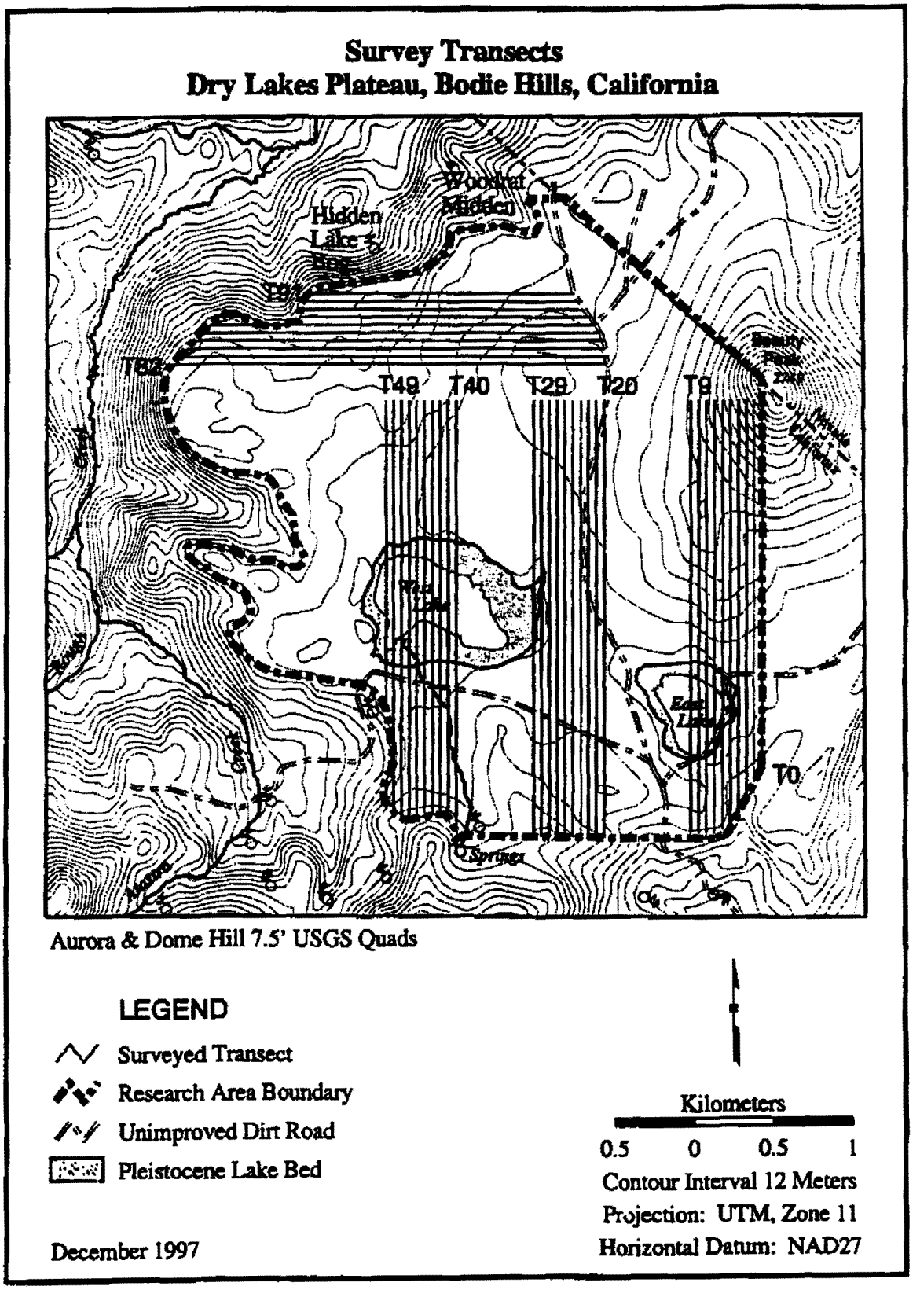

Figure 3. Dry Lakes Plateau Survey Transects, Fifty Meter Spacing.

Dry Lakes Plateau
Woodrat Midden Data

Midden #	DLP150896PEW1(3,2)	DLP150896PEW1(4,1)A	DLP150896PEW1(4,1)B	DLP150896PEW1(2,3)	DLP150896PEW1(2,2)
Lab #	Beta-106614 (AMS)	Beta-106612 (AMS)	Beta-106613	Beta-106615	Beta-106616
Material	Juniper	Pinyon	Juniper	Juniper	Dung
C14 Age	540 ± 40 B.P.	3,120 ± 50 B.P.	4,060 ± 110 B.P.	4,980 ± 80 B.P.	5,260 ± 60 B.P.
Calibrated Age	cal AD 1,415 intercept	cal BC 1,400 intercept	cal BC 2,580 intercept	cal BC 3,770 intercept	cal BC 4,045 intercept
2 σ calibrated range	cal AD 1,390 to 1,440	cal BC 1,490 to 1,265	cal BC 2,895 to 2,290	cal BC 3,960 to 3,640	cal BC 4,240 to 3,960
C13/C12	-22.00	-25.10	-22.70	-23.00	-24.40
Midden Contents					
Artemisia (sagebrush)	X	X	X	X	X
Juniperus (juniper)	X	X	X	X	O
Pinus monophylla	O	X	X	O	
Chrysothamnus (rabbitbrush)		X		X	X
Ceanothus velutinus		X			
Populus tremuloides	O				X
Ribes (currant)					X
Sambucus (elderberry)					X
Symphorocarpus (snowberry)		X			
Purshia (bitterbrush)				X	
Grayia (hopsage)				X	
Atriplex confertifolia (shadscale)		X		X	
Rosa woodsii (wild rose)				X	
Chenopod	X			X	X
Atriplex sp.		X			
Lupinus (lupine)					X
Amsinckia (fiddleneck)					X
Cryptantha (forget-me-not)				X	
Acnatherum hymenoides (ricegrass)				X	
Gramminae (grasses)		X		X	X
Cactaceae (cactus)				O	X

Table 1. Dry Lakes Plateau Woodrat Midden Plant Macrofossil Data (X=Present; O=Rare [e.g., 1-2 specimens recovered]).

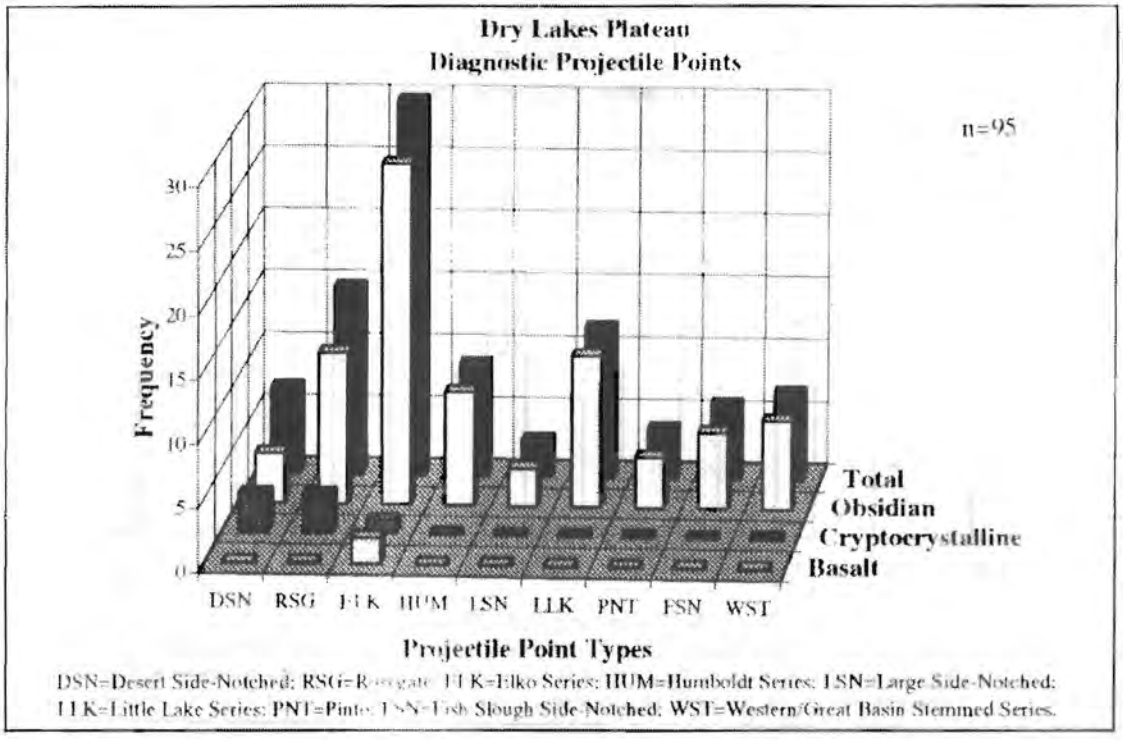

Figure 4. Dry Lakes Plateau Projectile Point Frequency

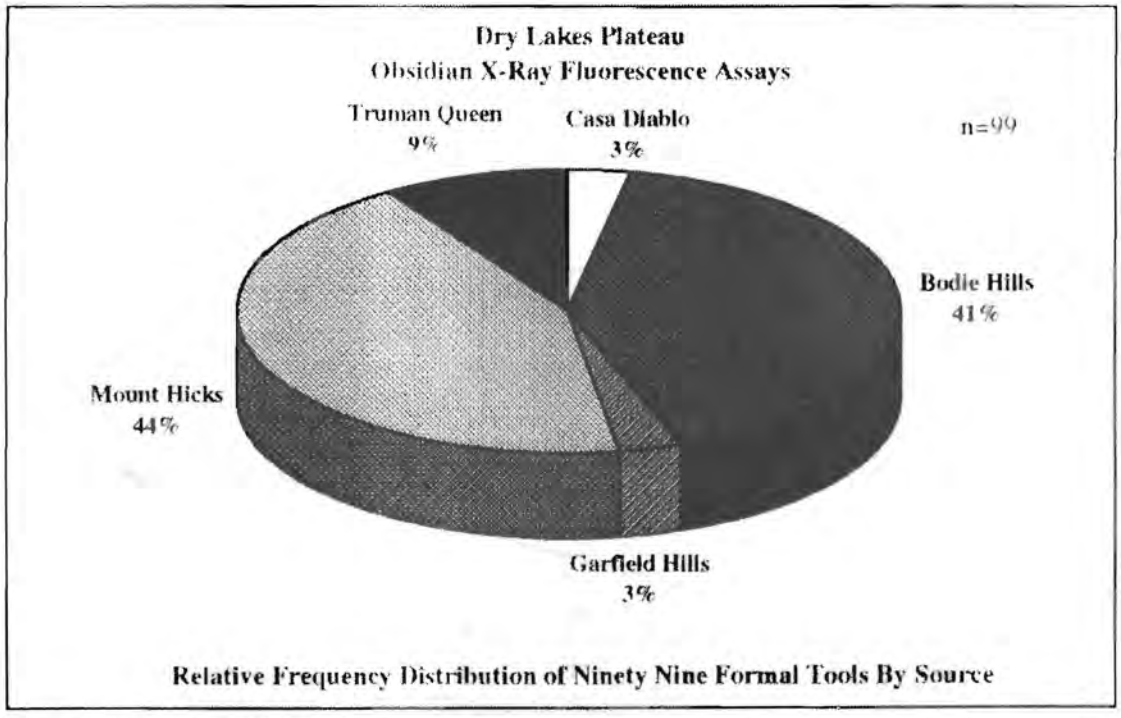

Figure 5. Dry Lakes Plateau Relative Frequency of Ninety Nine Chemically Sourced Tools

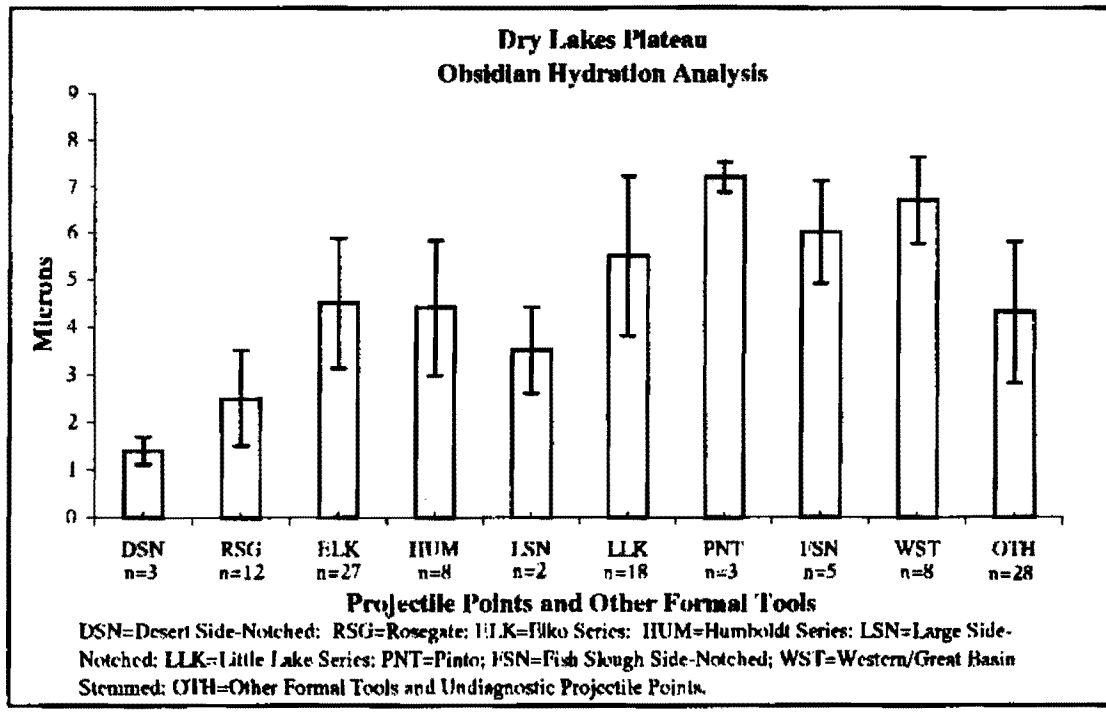

Figure 6. Dry Lakes Plateau Obsidian Hydration Analysis of Projectile Points and Formal Tools (n=114 hydration readings)

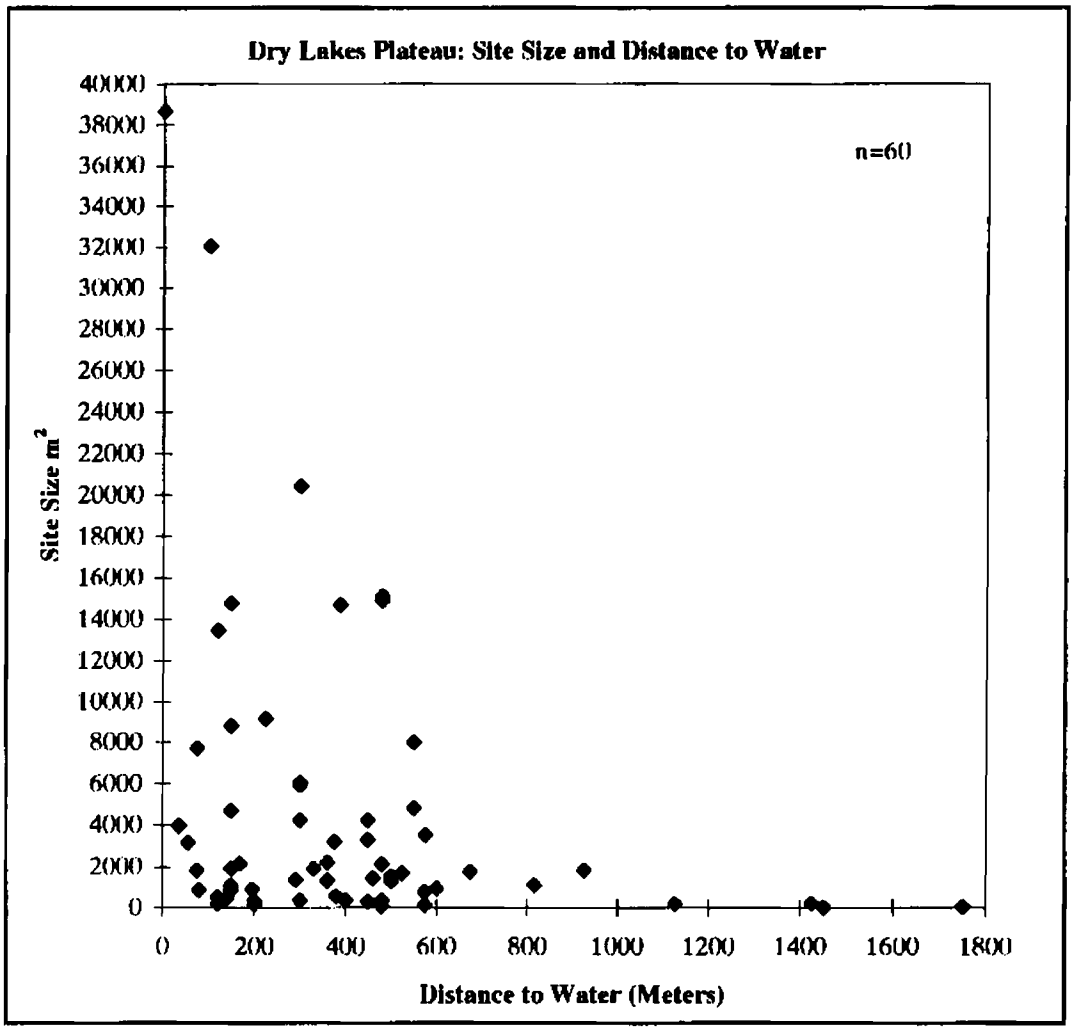

Figure 7. Dry Lakes Plateau XY Scatterplot of Site Size and Distance to Water

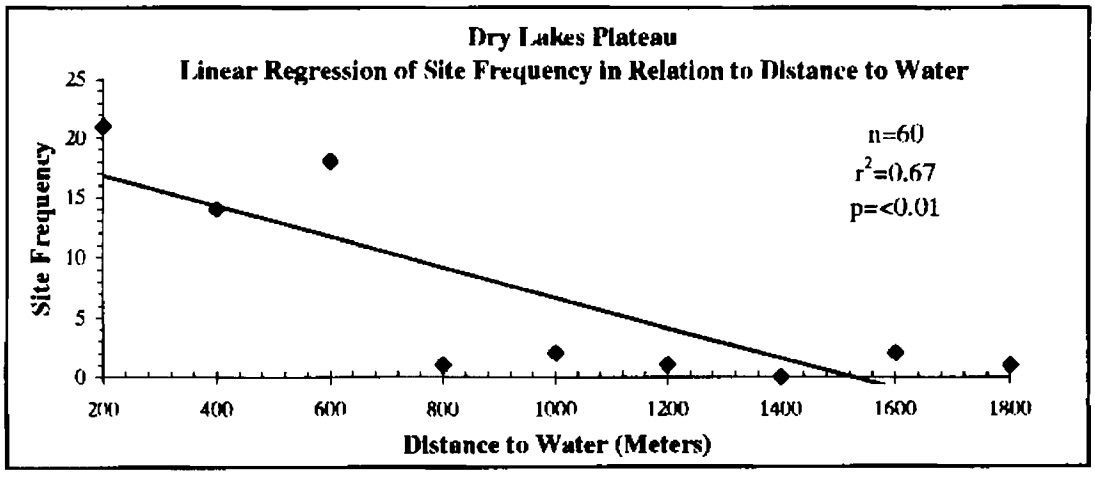

Figure 8.Linear Regression of Site Frequency in Relation to Distance to Water

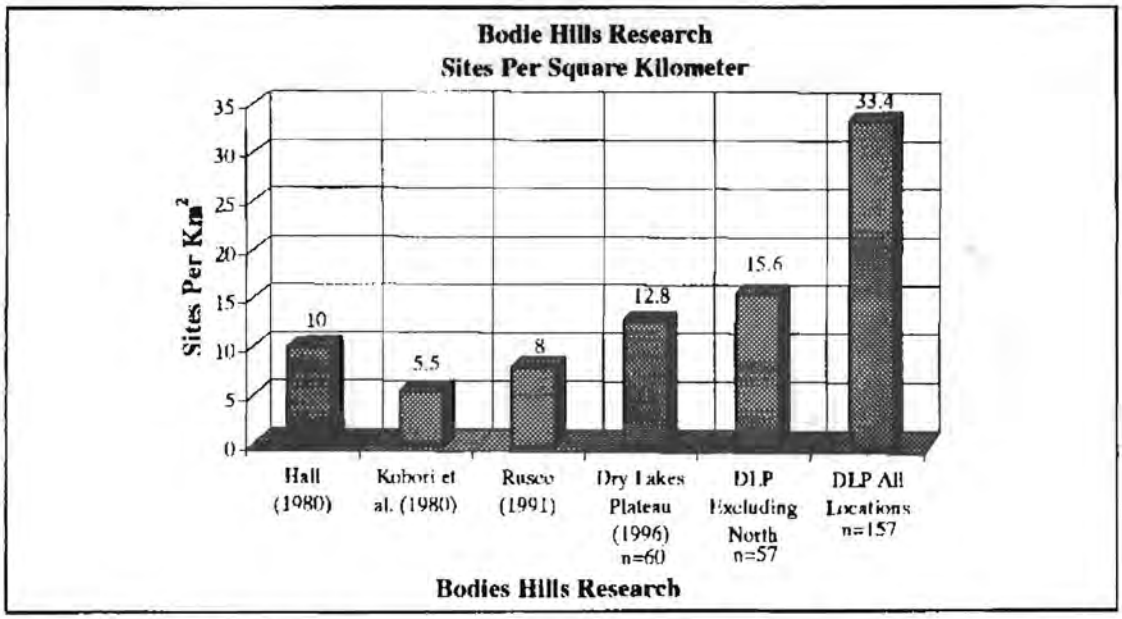

Figure 9. Bodie Hills Research Average Number of Sites Per Square Kilometer