USING SAMPLE SURVEY RESULTS TO ADDRESS REGIONAL RESEARCH DESIGNS: AN EXAMPLE FROM JOSHUA TREE NATIONAL PARK

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ABSTRACT

In 1991 and 1992, the University of Nevada, Las Vegas, conducted a sample survey of Joshua Tree National Monument (now National Park). Surface collection was conducted at all sites identified during the survey. Animal remains were recovered from 24 archaeological sites. Analysis of the collection focused on addressing a regional research design for Joshua Tree and on additional questions suggested by the collection itself. The analysis provided important information regarding widespread dependence on ungulates and potential overexploitation of desert tortoise during the Late Period.

Fifty years ago this year, Gordon Willey performed the Virú Valley survey in Peru, initiating the concept of settlement pattern archaeology, now a mainstay of North American archaeological method. Research design and sampling theory have since been added to settlement pattern archaeology's standard approaches.

A basic assumption of using regional survey in settlement pattern archaeology is that archaeological sites in the surveyed region will have surface manifestations. Another important assumption is that surface materials can contribute important information to the development and testing of a research design.

This paper addresses the ability of one material class – faunal remains – to contribute both to addressing and refining regional research design. The results of analysis of surface faunal remains from 24 archaeological sites in Joshua Tree National Park are presented here. The faunal remains were collected by the University of Nevada, Las Vegas as part of a 1991-1992 field effort carried out under a cooperative research agreement with the National Park Service.

The cooperative research agreement provided for preparing a research design and conducting a sample surface survey of the park. The research design was prepared by Claude N. Warren and Joan S. Schneider (1991). It uses as its basis the Deep Desert Model developed by Warren for use at Fort Irwin (Warren 1994). This model addresses settlement and subsistence shifts in the central Mojave during the entire prehistoric period, starting around 10,500 years ago and extending through the protohistoric period. The model correlates habitation sites with water resources and hypothesizes shifts in site locations, settlement patterns, and subsistence foci through time as the climate of the central Mojave Desert changed. Table 1 summarizes information pertaining to the Deep Desert model.

The Joshua Tree research design presents 31 hypotheses derived from the Deep Desert Model which are appropriate to a large-scale research program, as well as several hypotheses which were to be addressed by a sample survey of the park. These latter

hypotheses focused on predicting locations of sites relative to water resources and elevation.

The sample survey consisted of 98 0.1 km^2 transects. Within these, 80 archaeological sites were recorded. All were surface collected.

Twenty-four of these site collections contain faunal remains. The bones were identified and analyzed, and the results were applied to the following research questions:

1 What can the collection contribute to addressing or refining the Deep Desert Model?

2. Does the archaeological record indicate that desert tortoise was harvested in a sustainable fashion?

3. Is it possible to infer desert tortoise cooking practices from the archaeological record? If so, how do cooking practices at the Joshua Tree sites compare to those in other parts of the desert, and what do differences or similarities in practice tell us about the cultures which left the remains?

The number of animal bones recovered from the surface of the sites ranged from a low of 2 to a high of 2140. One site was determined to contain only modern bones; another had no surface chronological markers. These two sites are not considered further in this paper.

The remaining 22 sites all contained ceramics and several contained small projectile points. Therefore, all could be assigned to the Protohistoric Period of Late Times. This period extended from 900 to 100 years B.P.

Because the sample survey recovered animal bone only from Protohistoric sites, the diachronic aspects of the Deep Desert Model cannot be addressed with these materials. However, those aspects of the model relating to the Late Times can be addressed.

It is hypothesized by Warren and Schneider that, during Late Times, procurement of bighorn sheep was intensified over the earlier period and that it required traveling long distances owing to the reduction of herds. To compensate for this dwindling resource, seed procurement grew to major importance and low-ranked animal resources, including jackrabbit, desert tortoise, pack rat, and chuckwalla, supplemented the vegetal diet.

Table 2 summarizes the content of the faunal assemblages of the 22 sites. Rare finds, such as coyote or badger bone, and unidentified bone counts are not included. As seen in the table, the sites containing animal bone come from three areas of Joshua Tree National Park. Twenty of the sites are located in the Lost Horse/Queen region at elevations ranging from 3030 feet to 4560 feet AMSL. One site occupies the 2200-foot contour in the Cottonwood Area; and one site is located in the West Pinto Area, at an elevation of 2420 feet.

Six sites contain bones identified as bighorn sheep. An additional 5 sites contain unspecified artiodactyl bone, and 9 others contain unidentified large mammal bone. The artiodactyl and large mammal bone could be bighorn sheep, deer, or pronghorn. [The latter has not been confirmed for Joshua Tree, but was observed historically in other high desert locales in the larger region. In addition, it has been identified archaeologically at Tahquitz Canyon near Palm Springs (Christenson 1995) and in rock art in the Coachella Valley (McCarthy 1995)].

Based on these results, it is concluded that 18 of the 22 sites have evidence of large mammal exploitation, most of which could be bighorn sheep. These sites range in elevation from 2200 feet to 4560 feet. These results tend to support the model of intensive exploitation of bighorn sheep in Late Times.

Desert tortoise is noted at 13 of the 22 sites, from the lowest at 2200 feet to the second highest at 4450 feet. At 8 sites, it occurs with both large and small mammal. At 2 others, it occurs only with large mammal, and at 3, it is the only species identified at the site. These facts indicate that desert tortoise was a regularly

exploited species and was part of a diverse meat diet.

Eleven sites contained small mammal remains. The only species identified were cottontail (at 4 sites) and blacktail jackrabbit (at 3 sites). Although not identified in the collection, it is highly probable that various species of rodents would be recovered in archaeological excavations at these sites.

All in all, the Joshua Tree faunal collection supports the model for Late Times of intensive bighorn sheep exploitation over a broad area, with regular supplementation of the diet with tortoise and small mammal meat.

The RIV-1950 collection has other implications for the Deep Desert Model. As Roger Kelly has pointed out (1996), tortoises are easily captured by anyone, including children and the elderly. Therefore, their prominence at the site strongly suggests a family or band occupation. The presence of bighorn sheep bones at RIV-1950 suggests the presence of male hunters.

Park staff have informed me that bighorn sheep currently make springtime use of the drainage just east of RIV-1950, crossing the highway less than a mile away. Bighorn sheep are also known to inhabit low areas during summer dry months, as there is generally more water in low areas (DeForge 1996). While acknowledging a need for caution in extrapolating back to a time before watering holes were enhanced by ranching, mining, and conservation interests, it is suggested that RIV-1950 may have been occupied during springtime. Although tortoises could be captured year-round [including from winter hibernation dens using long hooked sticks (Schneider and Everson 1989)], their large numbers at RIV-1950 suggest a time of year when they were most readily available, which would have been the spring breeding season.

Thus, it is suggested that RIV-1950 was occupied by a family or band as it moved in the springtime from the Colorado Desert to the higher, and cooler, Mojave Desert to the north. The presence of *Glycymeris sp.*, a Gulf of California marine shell, on the surface of the site also suggests travel from the southeast.

With regard to whether desert tortoise was harvested in a sustainable fashion, there is evidence from RIV-1950 to indicate that this species was being exploited in a manner which could result in its depletion. A total of 1654 fragments of desert tortoise was identified. The large majority of these were highly fragmented pieces of carapace or plastron. An MNI of 7 is probably a conservative estimate of the actual number of individuals left on the site's surface.

A number of extremely small bones was noted during the analysis. These compare favorably with a 12.3 cm desert tortoise specimen at the San Diego Natural History Museum.

Female tortoises reach sexual maturity at the age of 15 or 20 years and at that time have shells approximately 18 cm in length (Berry 1994). Clutches range from 1 to 12 eggs which are laid between mid-April and mid-July. The clutch size depends on food supply in the two immediately prior years and upon the size of the female, with small females producing smaller clutches (Stebbins 1985:104).

Based on the late age of sexual maturity and the evidence from RIV-1950, it is suggested that desert tortoise populations may have been overexploited with consequent local depletions.

Existing literature does not make frequent mention of tortoise size or overexploitation. Exceptions are Douglas's (1981) Valley of Fire State Park report, which mentions the lack of small tortoise bones in the collection; and Sutton and Yohe's (1989) Afton Canyon analysis, which identified one small tortoise bone among a total of 496 bones of that species. Langenwalter *et al.* (1983) speculate that the population at Oro Grande (near modern-day Victorville) may have exceeded the carrying capacity for tortoise, evidenced by a paucity of tortoise remains at 1 of 3 site loci investigated.

The topic of intensification and overexploitation of desert tortoise is worthy of further examination as the Deep Desert Model undergoes testing.

With regard to desert tortoise cooking practices, Table 3 summarizes the results of an extensive ethnographic, historic, and archaeological literature search performed by Schneider and Everson (1989) and additional information gathered by the author. As proposed in the third column of the table, it should be possible to infer cooking practices from the archaeological record. It also may be possible to make inferences regarding the cultural identity of the cooks.

The RIV-1950 collection contains 142 pieces of tortoise shell positively identified as carapace. Fifty-nine of them, or 41.5 percent, evidence burning. Plastron is represented by 115 specimens, of which 36, or 31 percent, are burned.

Forty-seven pieces of interior bone were also burned. These would be unlikely to burn during cooking. Therefore, it is concluded that these bones were thrown into the fire while the meat was being consumed or that they were burned by later campfires.

The aforementioned practice results in a distortion of the evidence pertaining to cooking methods. However, if we assume that carapace and plastron would be thrown into the fire with equal frequency, the larger percentage of burned carapace bones (41.5% vs. 31% for plastron) would indicate burning occurred as part of the cooking process. The percentage of carapace bone which has been burned is significantly greater than that of plastron, permitting the conclusion that desert tortoise was cooked on its back in coals at RIV-1950.

A search of literature revealed that Douglas (1981:3) concluded that the Valley of Fire Atlatl Rockshelter inhabitants cooked tortoise on either the dorsal or ventral side. Langenwalter et al. (1983:131) stated that the Oro Grande inhabitants roasted tortoise on its back; and Yohe (1987:143) suggested that the occupants of the Denning Springs Rockshelter (SBR-3829) butchered tortoise before cooking it, because the shell fragments were generally unburned. Thus it is possible to state that the RIV-1950 occupants appear to have cooked tortoise in a manner similar to the inhabitants of Oro Grande rather than to the inhabitants of Denning Springs in Fort Irwin. There are currently insufficient data to determine whether differentiating cultures might really be possible on the basis of tortoise cooking practices, but the fact that different patterns have been observed indicates some promise in this area.

In summary, the analysis of faunal remains from 22 Joshua Tree archaeological sites has provided evidence confirming intensive regionwide exploitation of bighorn sheep during the Protohistoric period. The diet was regularly supplemented with tortoise and small mammal meat. The Deep Desert Model proposes reductions in bighorn sheep herds during Late Times as a result of intensification of use. The current work suggests that tortoise populations may also have been affected. It also suggests springtime occupation of the low desert by family groups travelling from the southeast. Because of the known presence of pronghorn in the general region during prehistory, research into when and to what extent pronghorn were exploited by prehistoric populations could provide information pertinent to the Deep Desert Model.

Finally, the sites hold promise to elucidate ethnic identities and trade relations through careful analysis of tortoise cooking practices.

Notes

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Table 1. Deep Desert Model (adapted from Warren 1994)

Period	Dates B.P.	Climate	Settlement	Subsistence
EARLY TIMES				
Mojave-Pinto 1	10,500-8500	Moist to drying	Lower	Foraging; large game lake marshes, riparian
Mojave-Pinto 2	8500-6500	Drying	Springs, higher washes	Few to many tortoise; Artiodactyl, Small mammals; Milling, collector.
Mojave-Pinto 3	6500-4000	Arid; harshest	Springs	Low ranked resources
MIDDLE TIMES				
Early Middle	4000-2500	Moister	Well-watered basins, valleys	Artiodactyl and mesquite focus
Late Middle	2500-1500	Arid	Lower mesquite, higher springs	Intensified earlier pattern; more diversity
LATE TIMES				
Saratoga Springs	1500-900	Slightly moister	Small groups at mesquite, pinyon, springs	Intensified sheep; pine nuts added; low ranked animals (Reptiles, small mammals)

Table 2. Protohistoric site faunal remains at Joshua Tree National Park

Site No.	Elevation	Tortoise	Cotton-tail	Jack rabbit	Bighorn sheep	Artio-dactyl	Small Mammal	Medium-Large and Large Mammal
QUEEN/LOST HORSE AREA								
RIV-4890	3030	3			2	1	2	18
RIV-4858/H	3035		2		1			2
RIV-4851	3480							2
RIV-931	3510	36		1			2	8
RIV-4808	3560		1					
RIV-4893	3590					1		4
RIV-934	3600		1		1		1	
RIV-4895	3620	2					1	2
RIV-3888	4130	2				2	1	13
A-1-1	4160	3					1	17
RIV-4841	4190	1		1	1		2	15
SBR-7189/H	4200	3				1	2	25
RIV-4917	4290						1	4
SBR-7183	4360	1				3		21
SBR-7190	4380					1	2	7
SBR-7197	4400	1						6
SBR-7182	4440	2						
RIV-4841	4450	2						
SBR-7445	4560				1			6
COTTONWOOD AREA								
RIV-1950	2200	1634	1	7	8	4	64	181
WEST PINTO AREA								
RIV-4899	2420	6						

Table 3. Recorded Tortoise Cooking Practices in the American Southwest

Group	Cooking Method	Archaeological Implications
Cahuilla	Roasted.	Unknown.
Papago	Removed plastron, packed interior with hot pebbles, roasted in ashes (presumably on back).	Unburned plastron; carapace with greatest burning on dorsal side and/or core.
Yavapai	Baked in earthenware oven.	Equal burning of carapace and plastron.
19th-Century Euroamerican	Roasted on back in glowing embers.	Unburned or lightly burned plastron; carapace burned on dorsal side and/or core.
20th-Century Euroamerican	Removed from shell, boiled.	Unburned carapace and plastron.
Archaeological contexts	Interpreted as roasted on back.	Charred dorsal side of carapace.
Archaeological context (Kroesen & Schneider 1991:59)	Interpreted as roasted in agave pit.	Roasting pit feature, unburned carapace (probably plastron as well).
Archaeological context (Douglas 1981:3)	Interpreted as roasted whole on either dorsal or ventral side.	Burned carapace and plastron, burned phalanges.