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The Desert Tortoise (*Xerobates agassizii*) in the Prehistory of the Southwestern Great Basin and Adjacent Areas

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THE importance of the desert tortoise (*Xerobates agassizii*)[1] to the aboriginal peoples of the southwestern Great Basin and adjacent areas has not been fully recognized. This lack of recognition can be attributed to several factors, including meager information regarding the biology and ecology of the species, confusion of terminology and the overlapping of ranges of members of the order Testudines, meager archaeofaunal data and a lack of a synthetic view of the data that are available, and a paucity of ethnographic information.

The generic name "turtle" (order Testudines) incorporates 12 families of turtles and tortoises living today. Of these, seven are represented on the North American continent. The 18 genera (see Note 1) comprising these seven families have 48 species (Behler and King 1979). Several species are represented in faunal collections from archaeological sites in the geographical area with which this paper is concerned. These include the desert tortoise, the western pond turtle (or Pacific pond turtle), the western box turtle, and several species of mud turtles. All the turtles (with the exception of the western box turtle) require a year-round source of water; the desert tortoise is entirely terrestrial. These ecological requirements have far-reaching archaeological and ethnological implications.

FOCUS OF THIS STUDY

This study is focused on the desert areas of California and Nevada. The ranges of the western pond turtle and the desert tortoise overlap in portions of this region so that specific attention is directed to these two species in the first part of this paper. Similar archaeological problems may exist in other areas where species ranges overlap (e.g., Hohokam sites in Arizona).

Faunal analysts should be aware that both turtle and tortoise remains can occur at archaeological sites in areas where their ranges overlap or where there is a possibility that these animals, or objects derived from them, were exchanged. Environmental and cultural interpretations that are based in part on faunal remains should consider that while turtle and tortoise elements may be confused, ecological requirements and seasonal availability generally are very different for the two reptilian genera.

The second part of this paper narrows the focus to the desert tortoise, the remains of which are present in many sites in the southwestern Great Basin and adjacent eastern areas (Tables 1-3; Fig. 1). The major portion of the ethnographic literature search and the synthetic discussion is focused on this animal.

DISTRIBUTION AND BIOLOGY

Western Pond Turtle (*Clemmys marmorata*)

The western pond turtle inhabits ponds and marshes, slow-moving streams, brackish water, and lakes with abundant vegetation. The general range of the southwestern sub-

Table 1
CHRONOLOGICAL PLACEMENTS OF ARCHAEOLOGICAL SITES WITH REMAINS OF *XEROBATES AGASSIZII* (DESERT TORTOISE)

^{14}C YBP[a]	Temporal Association	Site	Reference	Comment[b]	Site Type
9,470 ± 115		CA-SBR-4562, Awl site	Douglas et al. 1988	Locus A	Open, alluvial slope
9,410 ± 115		CA-SBR-4562, Awl site	Douglas et al. 1988	Minimal remains	Open
8,470 ± 370	Lake Mojave, Pinto	CA-SBR-4966, Henwood site	Douglas et al. 1988	Component 1, moderate	Open, wash terrace
7,400 ± 280		CA-SBR-4966, Henwood site	Douglas et al. 1988	Component 2, frequent	Open, wash terrace
7,150 ± 290		CA-SBR-4966, Henwood site	Douglas et al. 1988	Component 2, frequent	Open, wash terrace
	7,000-4,000 B.P.[c]	CA-SBR-5300, Clark Mountain	Douglas 1987		Roasting pit
5,200 ± 100		26-CK-243, Corn Creek Dunes	Williams and Orlins 1963	Minimal remains	Deflating dunes
4,400 ± 100		26-CK-243, Corn Creek Dunes	Williams and Orlins 1963	Minimal remains	Deflating dunes
4,050 ± 300		Stuart Rockshelter	Shutler et al. 1960	Most frequent fauna	Hearth, rockshelter
3,870 ± 250		Stuart Rockshelter	Shutler et al. 1960	Most frequent fauna	Hearth, rockshelter
3,765 ± 100 to 2,970 ± 250		CA-SBR-199, Newberry Cave	Davis and Smith 1981	Carapace bowl (Smith 1963)	Cave
	Atlatl I preceramic	26-CK-1345, Atlatl Rockshelter	Warren 1982; Douglas 1982	Very frequent remains	Rockshelter
3,190 ± 695		CA-SBR-3801, Owl Canyon	Sutton 1986	Date questionable	Open, hearth
2,550 ± 120	Atlatl II preceramic	26-CK-1345, Atlatl Rockshelter	Warren 1982; Douglas 1982	Very frequent remains	Rockshelter
	Atlatl II preceramic	26-CK-1383, South Shelter	Warren 1982; Douglas 1982	Frequent remains	Rockshelter
	Atlatl II preceramic	26-CK-1384, Turtle Bone site	Warren 1982; Douglas 1982	Very frequent remains	Open dunes, "tinajas"
2,450 ± 155		26-CK-1987, Quail Point	Ellis et al. 1982	Minimal remains	Roasting pit
2,430 ± 305		26-CK-1091, Roadside Roast	Blair 1986	Very frequent remains	Roasting pit
2,400 ± 80		26-CK-1992, Quail Point	Ellis et al. 1982	Mimimal remains	Burial
2,305 ± 155		26-CK-2130, Low Way Back	Blair 1986	Moderate remains	Roasting pit
2,200 ± 250		Willow Beach, AZ	Schroeder 1961		
1,855 ± 275		26-CK-1088, Pestisite	Blair 1986	Moderate remains	Roasting pit
1,705 ± 135		26-CK-1088, Pestisite	Blair 1986	Moderate remains	Roasting pit
1,690 ± 100		26-CK-1091, Roadside Roast	Blair 1986	Very frequent remains	Roasting pit
1,685		26-CK-300, Mule Springs	Turner 1978		Rockshelter, high elevation
1,640 ± 70		CA-SBR-798, Clark Mountain	Kroesen and Schneider n.d.	Minimal remains	Limestone ring midden
1,625 ± 100		26-CK-1, Bird Springs	Clewlow and Wells 1980	25% of faunal remains	1,220 m. elevation
1,540 ± 100		26-CK-1, Bird Springs	Clewlow and Wells 1980	25% of faunal remains	1,220 m. elevation
1,540 ± 70		CA-SBR-4889, Clark Mountain	Rafferty and Blair 1987	Frequent remains	Open, midden
1,540 ± 70		CA-SBR-4449, Drinkwater Basin	Reynolds and Shaw 1982[d]	Moderate remains	Open
1,520 ± 180		CA-SBR-207, West Camp	Leonard and Drover 1980	Minimal remains?	Halloran Springs District
1,420 ± 70		CA-SBR-798, Clark Mountain	Kroesen and Schneider n.d.	Minimal remains	Limestone ring midden
1,410 ± 50		CA-KER-875, Koehn Lake	Sutton 1988		Locus 6, open, dune
1,390 ± 50 to 690 ± 50		AZ AA:16:49, Dakota Wash	Johnson 1989	Minimal remains	?
	1,350-650 B.P.[e]	AZ T:8:19, Terrace Garden	Bayham and Hatch 1985	MNI = 2	Rockshelter
	1,250-1,050 B.P.[e]	AZ U:10:6, Siphon Draw	Szuter 1984	MNI = 3, also *Kinosternon*	?
	1,250-970 B.P.[e]	AZ AA:12:18, Hodges	Yoshikawa 1986	Minimal remains, burned	Housepit
1,395 ± 140		26-CK-1, Bird Springs	Clewlow and Wells 1980	Frequent remains	Open
1,245 ± 145		26-CK-1098, Basic site	Brooks and Larson 1975	100% faunal remains, all skeletal	Rockshelter
1,215		26-CK-300, Mule Springs	Turner 1978		Rockshelter, high elevation
1,190 ± 110		CA-SBR-4483, No Name West Basin	Douglas 1985[f]	Very frequent remains	Open
1,180 ± 40		CA-SBR-875, Koehn Lake	Sutton 1988		Locus 1, open, dune
1,130 ± 100 to 775 ± 100		CA-SBR-72, Oro Grande	Rector et al. 1983	Moderate remains	Open, riparian
	1,150-250 B.P.	CA-SBR-288, Rustler Rockshelter	Davis 1962	Ceramics	Rockshelter
1,127 ± 175		AZ AA:12:484, Hawk's Nest	Gillespie 1989	MNI = 3	Farmstead, house fill
1,125		26-CK-300, Mule Springs	Turner 1978		Rockshelter, high elevation
1,110 ± 70		CA-KER-875, Koehn Lake	Sutton 1988		Locus 10, open dune
1,070 ± 50		AZ EE:2:105	Glass 1984	MNI = 1, burned carapace	Pithouse
	1,050-850 B.P.[e]	AZ U:15:48, Jones Ruin	Szuter 1984	MNI = 2, *Kinosternon*, *Terrapene*	
1,040 ± 150		CA-SBR-4449, Drinkwater Basin	Reynolds and Shaw 1982[d]	Moderate remains	Open
970 ± 70		CA-SBR-875, Koehn Lake	Sutton 1988		Locus 1, open dune

920 ± 70		CA-SBR-85, Afton Canyon	Sutton and Yohe 1989	Very frequent remains	Hearth, open riparian
910 ± 70 to 650 ± 50		NA:18:003, Brady Wash	Ciolek-Torrello et al. 1988	Minimal remains in each of 6 loci	Domestic refuse, burned
880 ± 100		CA-SBR-207, West Camp	Leonard and Drover 1980	Minimal remains?	Halloran Springs District
880 ± 85		AZ BB:13:14, San Xavier Bridge	Gillespie 1987	Minimal remains, *Kinosternon* pendants	Pithouse
880 ± 60		26-CK-1081, Rattlesnake site	Brooks and Larson 1975	All skeletal remains	Roasting pit, rockshelter
870 ± 100		CA-SBR-85, Afton Canyon	Sutton and Yohe 1989	Very frequent remains	Hearth, open riparian
	ca. 850 B.P.	26-LN-418, O'Malley Shelter	Fowler et al. 1973	Carapace pendant, ceramics	Unit VI, rockshelter
	850 B.P.[c]	AZ AA:3:48 (NA:18:001), Whip It	Ciolek-Torrello et al. 1988	Minimal remains	Field house
825 ± 75		26-CK-1112, Tranquility site	Brooks and Larson 1975	100% of faunal remains	Roasting pit, rockshelters
	800-650 B.P.[e]	AZ U:15:76, Dust Bowl	Szuter 1984	MNI = 2, *Terrapene*	Gila River drainage
	650-500 B.P.[e]	AZ T:12:37, Casa Buena	Hatch and Howard 1988	Minimal remains	Field house
	650-100 B.P.	CA-SBR-4170, Lakeshore site	Basgall et al. 1988	Beads, points	Open, Drinkwater Basin
605 ± 75		AZ T:3:20, Agua Fria	James 1989a	Minimal remains, *Kinosternon*	Ramada
570 ± 150		CA-SBR-260, Cronese Lakes	Drover 1979; Langenwalter 1978a	Very frequent remains	Associated with burial
560 ± 100		CA-SBR-259, Cronese Lakes	Drover 1979; Langenwalter 1978a	3rd most frequent remains	Open, lacustrine
560 ± 60		CA-SBR-4483, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus XI, open
510 ± 65		26-CK-1081, Rattlesnake site	Brooks and Larson 1975	All skeletal remains	Roasting pit, rockshelter
480 ± 100		CA-SBR-117, Mitchell Caverns	Pinto 1989	Rare remains	Caves, passageways
470 ± 155		CA-SBR-3829, Denning Springs	Sutton 1987; Yohe 1987	Very frequent remains	Rockshelter
415 ± 140		CA-RIV-881, Wadi Beadmaker	Wilke 1978		Open, Lake Cahuilla
380 ± 130		CA-SBR-4483, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus I, open
380		26-CK-300, Mule Springs	Turner 1978		Rockshelter, high elevation
365 ± 140		CA-RIV-1766, Myoma Dunes	Wilke 1978	Infrequent remains, in coprolites	Open dunes, marsh
360 ± 100		CA-SBR-4483, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus XIII, open
340 ± 100		CA-SBR-85, Afton Canyon	Sutton and Yohe 1989	Very frequent remains	Hearth, open riparian
290 ± 60		CA-SBR-4504, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus V
280 ± 80		CA-SBR-5384, Tiefort Basin	Kent 1985[f]	Frequent remains	Locus 2, hearth
265 ± 155		CA-SBR-3829, Denning Springs	Sutton 1987; Yohe 1987	Very frequent remains	Rockshelter
260 ± 60		CA-SBR-4504, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus V
260		26-CK-1164, Shelf site	Brooks and Larson 1975		
250 ± 75		26-CK-1081, Rattlesnake site	Brooks and Larson 1975	All skeletal remains	Roasting pit, rockshelter
235 ± 150		CA-RIV-1766, Myoma Dunes	Wilke 1978	Moderate, in coprolites	Open dunes, marsh
230 ± 85		CA-SBR-334, Southcott Cave	Sutton et al. 1987	Modified, unmodified carapace	Cave
220 ± 50		CA-SBR-4446, Northshore site	Reynolds and Shaw 1982[d]	Rare remains	Open, Drinkwater Basin
< 340		CA-SBR-4483, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus III, open
< 170		CA-SBR-4504, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus IV, open
< 150		CA-SBR-4483, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus XIII, open
< 150		CA-SBR-4499, No Name West Basin	Douglas 1985[f]		
< 150		CA-SBR-259, Cronese Lakes	Drover 1979; Langenwalter 1978a	Frequent remains	Shellfish oven
< 150		CA-SBR-260B, Cronese Lakes	Drover 1979; Langenwalter 1978a	Frequent remains	Hearth
modern		CA-SBR-4457, No Name West Basin	Gilreath et al. 1987	Very frequent remains	Open
modern		CA-SBR-4504, No Name West Basin	Douglas 1985[f]	Very frequent remains	Locus V

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[a] Years Before Present. Radiocarbon dates are presented here only when they were considered valid by the various investigators, i.e. confirmed by contextual orientation. Omitted are radiocarbon dates considered to be invalid for one reason or another by the investigators of each study. [b] Indications of the frequencies or proportions of *Xerobates agassizii* remains are in relation to the total faunal assemblage in most cases. "Few" or "rare" means <5 specimens; "moderate" means up to 20% of the assemblage; "frequent" means 25-35% of the asssemblage; "very frequent" means 35-75% of the assemblage. In some cases, only the presence of tortoise is noted. "MNI" refers to minimum number of individuals. [c] Cross-dated with reference to faunal remains at other sites. [d] Radiocarbon dates from Basgall et al. 1988. [e] Archaeomagnetic dates. [f] Radiocarbon dates from Gilreath et al. 1987.

Table 2
CERAMIC ASSOCIATIONS OF ARCHAEOLOGICAL SITES WITH *XEROBATES AGASSIZII* (DESERT TORTOISE) (NO RADIOCARBON DATES)

Site	Reference	Site Type	Ceramic Type[a]	Comments
Mesa House, Nevada	Hayden 1930	Structure	Virgin Anasazi	Carapace filled with hematite
Paiute Cave, Nevada	Harrington 1930	Cave	Virgin Anasazi	Carapace
East Camp, California	Rogers 1929	Turquoise mine	Pueblo	Carapace scoops
Lost City, Nevada	Shutler 1961	Structure, burials	Virgin Anasazi	Carapace and skeletal remains
Stuart Rockshelter, Nevada	Shutler et al. 1960	Rockshelter	Pueblo	
CA-SBR-334, Southcott Cave	Sutton et al. 1987	Cave	Anasazi	Lower midden
26-CK-1345, Atlatl Rockshelter	Warren 1982; Douglas 1982	Rockshelter	Anasazi	Atlatl III level, frequent remains
26-CK-1384, Turtle Bone site	Warren 1982; Douglas 1982	Open, dune	Anasazi	Atlatl III level, very frequent remains
26-CK-1526, Berger site	Rafferty, pers. comm. 1988	Open, wash	Virgin Anasazi	Extremely frequent remains
CA-SBR-288, Rustler Rockshelter	Davis 1962	Rockshelter	Anasazi	
26-CK-948, Big Spring	Warren et al. 1972	Open	Anasazi	
CA-SBR-2226, Half Moon Cave	Jensen MS	Cave	Pueblo/Paiute	Burned carapace
Paiute Cave, Nevada	Harrington 1930	Cave	Paiute	Carapace
West Camp, California	Leonard and Drover 1980	Turquoise mine	Paiute	Carapace fragments
Stuart Rockshelter, Nevada	Shutler et al. 1960	Rockshelter	Paiute	
26-CK-1345, Atlatl Rockshelter	Warren 1982; Douglas 1982	Rockshelter	Paiute	Atlatl IV level, frequent remains
26-CK-1383, South Shelter	Warren 1982; Douglas 1982	Rockshelter	Paiute	Atlatl IV level
26-LN-418, O'Malley Shelter	Fowler et al. 1973	Rockshelter	Shoshonean	Unit VII, protohistoric
Black Canyon, California	Howe 1980	Caves 1, 2	Shoshonean basketry	Carapace, modified, painted
26-CK-1528, Berger site	Rafferty, pers. comm. 1988	Open, wash	Paiute	Extremely frequent remains
CA-SBR-288, Rustler Rockshelter	Davis 1962	Rockshelter	Paiute	
Ventana Cave, Arizona	Haury 1950	Upper cave	Hohokam	Levels 1,2,3, moderate remains
AZ U:13:1, Snaketown	Haury 1938		Hohokam	
AZ AA:3:126, Lovely site	James 1986	Pithouse, hearth	Hohokam	Moderate remains, burned
AZ U:6:37, Blue Point Bridge	James 1989b	Pithouse, trash pit	Hohokam	Frequent remains, ca. 50% burned
AZ U:5:3, Pinnacle Peak	James 1989c	Pithouses, trash	Hohokam	MNI = 2, *Kinosternon* pendant (?)

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[a] Pueblo/Anasazi: ca. 1,450 B.P. to 800 B.P.; Paiute: ca. 950 B.P. to 200 B.P.; Desert Hohokam: ca. 1,150 B.P. to 550 B.P.

Table 3
SITES WITH *XEROBATES AGASSIZII* (DESERT TORTOISE) REMAINS
UNKNOWN CHRONOLOGICAL PLACEMENT

Likely Time Period	Site	Reference	Site Type	Comments or Association
Pueblo/Late	Gypsum Cave	Harrington 1933	Cave	Carapace bowls
Late	CA-SBR-51,-52,-53, Seep Spring	Peck and Smith 1957		
Late	Twenty-nine Palms oasis	Campbell 1931	Open	Plastron and carapace
Late	Joshua Tree National Monument	Goodman, pers. comm. 1989	Cremations	Carapace, plastron, skeletal remains
Late	CA-KER-147, Red Rock Canyon	Yohe, pers. comm. 1988	Rockshelter	
Very late	CA-KER-495, Edwards A.F.B.	Sutton and Tremblay 1977	Temporary camp	Burned and butchered
Late	CA-KER-517, California City	Sutton 1988	Open, base of cliff	Cottonwood point, glass bead
Late	CA-KER-2211, Cantill	Yohe, pers. comm. 1988	Open, two components	Tortoise in upper component
Late	CA-SBR-4509, No Name Basin	Douglas 1985	Open	Very frequent remains
Late	CA-SBR-363B, Soda Spring	Schroth 1983		
Late and Modern	CA-SBR-4040, Soda Lake	Douglas 1980	Hearths in dunes	
Late	CA-SBR-4450, Drinkwater Basin	Basgall et al. 1988		Desert Side-notched points
Late	CA-SBR-4441, Drinkwater Basin	Basgall et al. 1988		Tizon brownware
Late	41-56, Bennetts Well	Hunt 1960	Mesquite dunes	Probably Death Valley IV
Late	126-56, Furnace Creek Fan	Hunt 1960	Open camp	Probably Death Valley IV
?	CA-SBR-5545, Saratoga Springs 3	Wallace 1986	Open, marsh	Large percentage of few faunal remains
?	CA-SBR-90, Saratoga Springs 1	Wallace and Taylor 1959	Open, marsh	"Preceramic," frequent remains
?	CA-SBR-2343	Macko et al. 1982	Rockshelter	Tortoise carapace, modified (?)
?	26-CK-1528, Berger site	Rafferty, pers. comm. 1988	Open, wash	"Preceramic," frequent remains
?	26-CK-1113	Brooks and Larson 1975		
Late	26-CK-1482, Barbeque site	Brooks et al. 1982	Roasting pits	Skeletal and shell fragments
Late	26-CK-1481, Happy Face site	Brooks et al. 1982	Roasting pits	Skeletal and shell fragments
?	26-CK-3023, Scout Shelter	Douglas 1986	Rockshelter	Frequent remains
Late	26-CK-415, Flaharty site	Connolly and Eckert 1969	Rockshelter	Frequent skeletal and shell remains
Late	26-CK-303, Out-of-Site	Connolly and Eckert 1969	Rockshelter	Frequent skeletal and shell remains
Late	26-CK-304, R and K site	Connolly and Eckert 1969	Rockshelter	Frequent skeletal and shell remains
?	AZ AA:7:32 (NA:18:030), Rock Terrace	Ciolek-Torrello et al. 1988; Weaver 1988	?	MNI=10, Hohokam
?	AZ AA:7:15 (NA:18:031), McClellan Wash	Ciolek-Torrello et al. 1988; Weaver 1988	?	MNI=2, Hohokam
?	NA:18:037	Ciolek-Torrello et al. 1988; Weaver 1988	Field house	Minimal remains, Hohokam
?	CA-SBR-316, Schuiling Cave	Smith 1963	Rockshelter	MNI=2, Pleistocene fauna

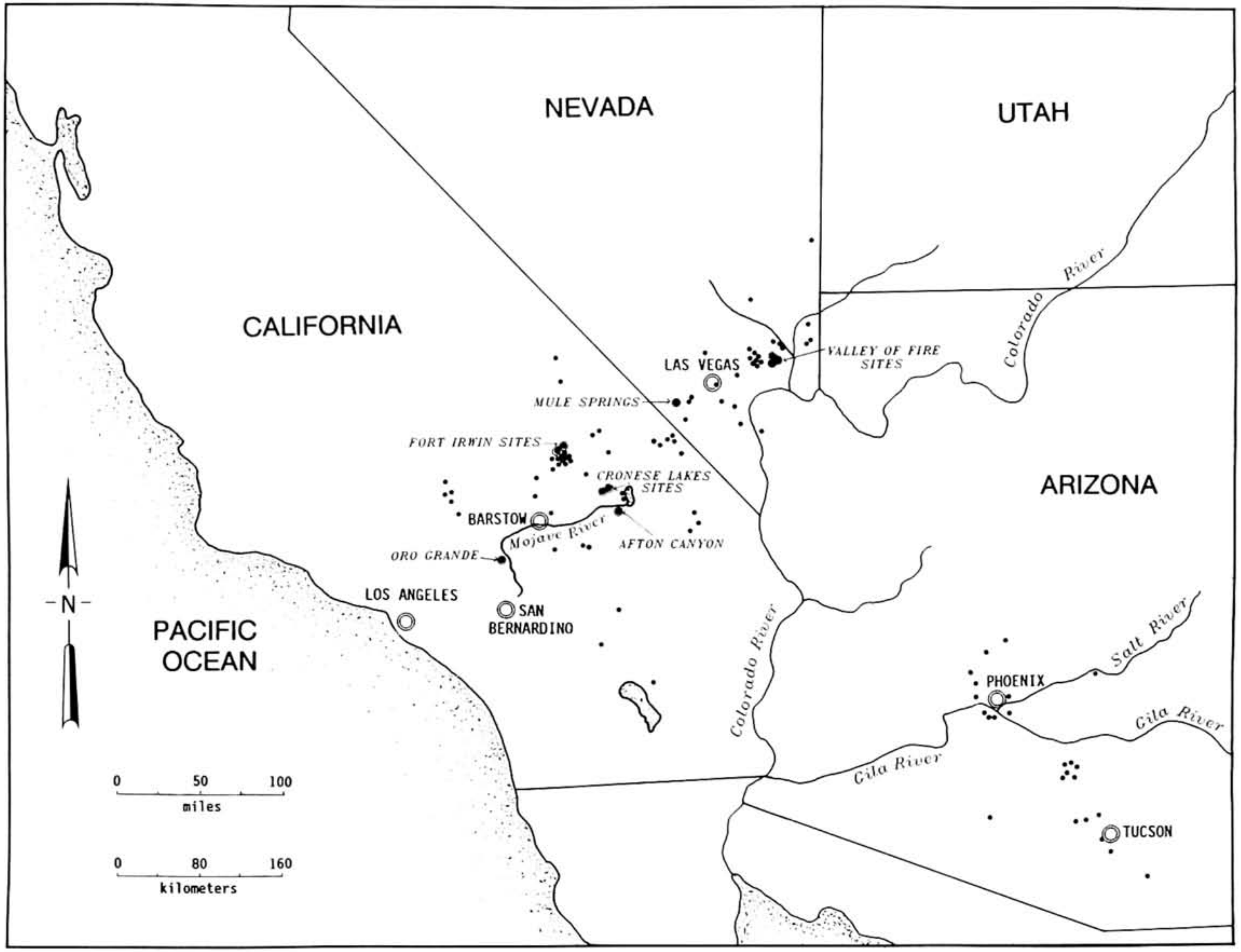


Fig. 1. Locations of archaeological sites from which the remains of *Xerobates agassizii* have been recovered. Each small dot represents one site. The larger encircled dots that are labelled represent sites specifically discussed in the text.

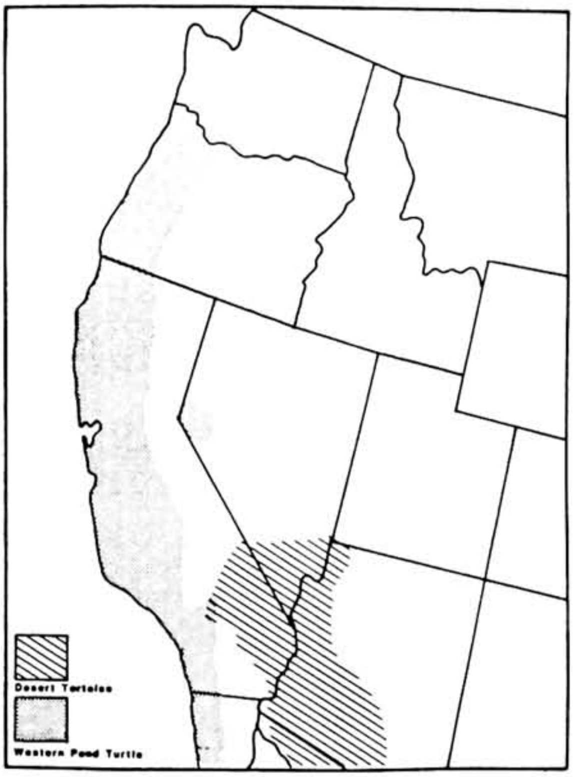


Fig. 2. The present ranges of desert tortoise (*Xerobates agassizii*) and western pond turtle (*Clemmys marmorata*) in southwestern North America. Adapted from Stebbins (1966).

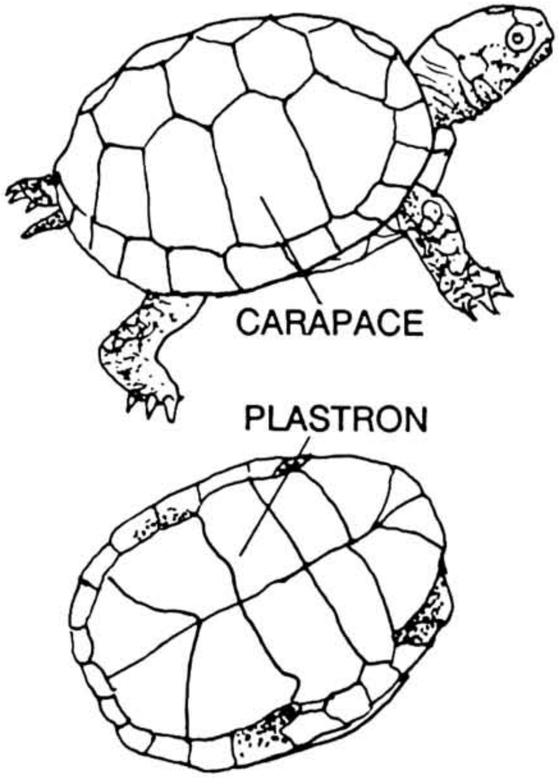


Fig. 3. General schematic representation of tortoise/turtle indicating portions discussed in text. Adapted from Stebbins (1966).

species (*C. m. pallida*) lies west of the Sierra Nevada crest from San Francisco Bay south into northwestern Baja California (Fig. 2). There are a few eastern extensions of the range, including one running north and then east along the course of the Mojave River, and other isolated populations along the Carson and Truckee rivers in western Nevada.

Western pond turtles are from 8.9 to 17.8 cm. in diameter. The smooth, broad, and low-profile carapace (dorsal shell, Fig. 3) is olive to dark brown in color. The plastron (ventral shell, Fig. 3) is pale yellow and on males is concave. As with other aquatic turtles, *C. marmorata* enjoys basking in the sun and feeds mostly on aquatic plants, insects, and carrion. Females lay from three to 11 oval, hard-shelled eggs in an earthen chamber next to or near water, sometime between April and August (depending upon latitude). The incubation period is about 12 weeks (Behler and King 1979). Western pond turtles hibernate in mud for approximately six months during the colder part of the year (Stebbins 1966).

Desert Tortoise (*Xerobates agassizii*)

The desert tortoise is strictly terrestrial (Fig. 4). The high, domed carapace is oblong and brown; the plastron is yellowish, the male plastron being concave (Behler and King 1979). The front pair of the round, stumpy, elephantine legs are adapted for digging. The tortoise can reach a length of more than 35 cm., but most average about 25 cm. (Dodd 1986).[2]

The desert tortoise now is an inhabitant of the Mojave, Colorado, and Sonoran deserts

Fig. 4. The desert tortoise (*Xerobates agassizii*).

and ranges from extreme southwestern Utah, southern Nevada, southern and western Arizona, and southeastern California to northern Mexico (Stebbins 1966; Dodd 1986; Fig. 2). It is found associated with a variety of desert plant communities, including Creosote Bush Scrub, Cactus Scrub, Shadscale Scrub, and Joshua Tree Woodland (Luckenbach 1982).

Evidence from packrat middens (which document the association of desert tortoise remains with *Pinus edulis*, *Quercus pungens*, and *Juniperus* sp. at about 12,000 B.P.) in New Mexico and Texas attest to a more ecologically diversified and expanded range in the past (Van Devender and Moodie 1977). Late Pleistocene fossils of desert tortoise range as far west as coastal California and as far east as Dry Cave, near Carlsbad, New Mexico (Van Devender and Moodie 1977). Beginning approximately 8,000 B.P. the range appears to have contracted to its modern configuration.

The desert tortoise is a vegetarian, feeding on grasses, young and tender plant shoots, and flowers during the cooler hours of the day. During the heat of the desert day, the tortoise retreats to a burrow. Hibernation in burrows or dens was thought to occur from about October to early March (Stebbins 1966), but new information indicates that it is variable, depending on individuals and environmental conditions (see Dodd [1986] for a summary of new data).

The female desert tortoise lays from three to seven leathery-shelled eggs in a six-inch-deep nest often located at the mouth of a burrow (Behler and King 1979; Dodd 1986). Local environmental conditions may result in variation of clutch size and number of clutches per year, ranging from none to two (Dodd 1986) or three (Behler and King 1979).

Tortoise burrows also vary in their configuration depending on season of use and latitude (Woodbury and Hardy 1948; Dodd 1986). Burrowing habits have major implications for the cultural use of the desert tortoise by aboriginal peoples (see below). Woodbury and Hardy (1948) studied the desert tortoise on Beaver Dam Slope in Utah and differentiated between summer and winter burrows (dens). More recent work (Burge 1978) has shown that the differentiation is somewhat less definite and variable. Woodbury and Hardy (1948) reported that winter dens generally are permanent excavations, and are reused year after year for winter hibernation (Fig. 5). These winter dens usually are found in small clusters in compact gravel banks and run horizontally into the bank for distances up to 10 m. (Woodbury and Hardy 1948). Often up to a dozen tortoises will share a winter den. The dens are large, most with a characteristic half-moon-shaped entrance (Fig. 6). Other animals, notably packrats, mice, rabbits, lizards, and snakes, make use of tortoise dens. The debris of these animals often fills the tunnel entrances. Old twigs and cactus spines, which are the nesting materials of rodents, may offer the tortoises some measure of protection from intruders, but the activity trails of the rodents can indicate the presence of a tortoise den (Woodbury and Hardy 1948). Some winter dens are large enough to be entered by a grown man (Woodbury and Hardy 1948). Winter dens also can be natural features such as a deep niche in a rock wall (Fig. 7).

In contrast, summer shelters are temporary retreats, constructed annually, and used by individual tortoises during the active season (Fig. 5). These burrows are dug from 1 to 1.5 m. into the ground at an angle of 20° to 40°. The tortoises pass the heat of the day in these shelters. Rarely is a hole reused the following year, for weather and rodent activity usually cause them to be filled in between seasons (Woodbury and Hardy 1948).

Sources of biological, ecological, behavioral, paleontological, and taxonomic information on the desert tortoise have been gathered in an annotated bibliography (Hohman et al. 1980). A comprehensive compendium of information on the desert tortoise has been prepared by Berry (1984).

OVERLAPPING OF RANGES AND TERMINOLOGY

The present range of the desert tortoise overlaps that of the western pond turtle in portions of the southwestern Great Basin, especially along the Mojave River in southeastern California and at locations in extreme western Nevada (Fig. 2). The co-occurrence of these species leads to potentially confusing archaeological faunas. There often is difficulty in distinguishing between the two taxa from fragmented specimens. This is especially troublesome when species identity is used to make inferences about seasonality of site use and environmental conditions. The western pond turtle is an aquatic animal and requires a year-round water source while the desert tortoise is a dweller of arid lands. Differing ecological requirements and species-specific hibernation patterns have important implications for the archaeologist both in cultural and paleoenvironmental reconstruction.[3]

Adding to the confusion from the overlap of ranges is confusion of terminology in the ethnographic, archaeologic, and zoologic literature. "Turtle" often is used generically with little attempt at identification of species; sometimes "turtle" and "tortoise" are used interchangeably to refer to the same animal (e.g., Ebeling 1986).

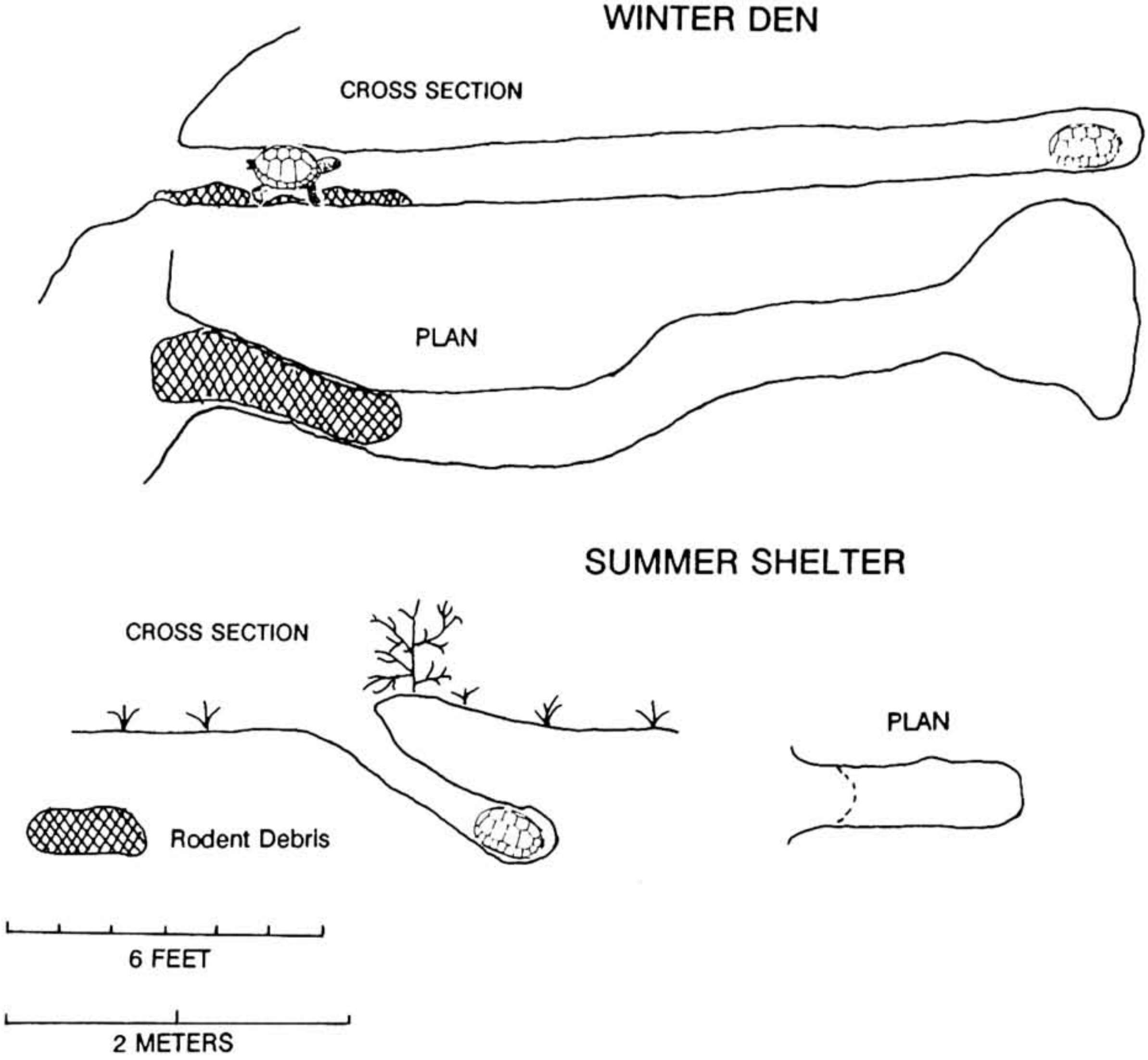


Fig. 5. Plan of winter dens and summer shelters (adapted from Woodbury and Hardy 1948).

THE DESERT TORTOISE IN ETHNOGRAPHIC CONTEXT

The use of the desert tortoise by aboriginal people has been poorly documented in the ethnographic literature, in spite of a wide distribution of remains in the archaeological record. Relevant information is considered under five categories: subsistence, ceremonial or ritualistic use, medicinal use, technological and household use, and symbolic and mythical associations. However, much of the literature does not distinguish between tortoise and turtle, leading to confusion.

Subsistence

Ethnographic documentation of desert tortoise as a subsistence item is sparse. Culture Element Distribution (CED) lists, a prime source of ethnographic information, often provide only "yes" or "no" answers to

Fig. 6. A desert tortoise burrow entrance. Note the characteristic half-moon-shaped entry. Suburban Las Vegas, Clark County, Nevada.

Fig. 7. A desert tortoise winter den beneath a rock overhang, Joshua Tree National Monument, San Bernardino County, California.

questions posed about various foods eaten. Tortoises were eaten by many desert-dwelling aboriginal groups, including the Cupeño, Southern Diegueño (Ipai), Chemehuevi (Drucker 1937); the Southern Paiute of Ash Meadows and the Shoshoni of Beatty, Nevada (Steward 1941); the Taviwatsiu Ute (Stewart 1942); the Yokuts, Owens Valley Paiute, Mono, Tübatulabal, and Panamint Shoshoni (Driver 1937); the Yuma (McGuire and Schiffer 1982; Trippel 1984); the Maricopa (Castetter and Bell 1951); the Papago (Castetter and Bell 1942); the Yavapai (White and Stevens 1980); and the Cahuilla (Bean 1972). Informants from other groups either denied, or were uninformed, about the use of tortoise as food. The Mohave, however, had a great aversion to eating tortoise and spoke in a derogatory manner about groups that did eat the animal (Kroeber 1925; Laird 1976). Drucker (1941:171) reported that among the Yuma and Pima groups from which he gathered information any "turtle" was considered poisonous. In historic times, Paiute and Chemehuevi camps were considered ethnically distinctive because of the abundance of cast-out tortoise shells littering the fringes of settlements (Mollhausen 1858:287; Battye 1934a). Southern Paiutes near the Great Bend of the Colorado River ate tortoises until the late 1860s (Stejneger 1893).

Nutritional analysis has shown that 100 g. of tortoise meat provides slightly fewer calories than the same amount of squab (Connolly and Eckert 1969). Tortoise meat was described as "delicious" (James 1906; Battye 1934a, 1934b) and as delicate in taste, similar to chicken, but slightly coarser in texture (Connolly and Eckert 1969). However, an 1862 traveler in Nevada tried eating a desert tortoise and noted (Fairchild 1933:14):

> Though there was considerable meat upon the carcass of the reptile, I admit that I did not relish it as well as I did the ordinary plain "jerky"–perhaps on account of the manner of cooking.

Mexican traders reportedly recognized the potential for a readily portable and storable source of protein and water and carried live tortoises on their journeys (Pepper 1963).

The preparation of tortoise meat is not well documented in the ethnographic literature. The Cahuilla roasted the tortoise (Bean 1972). The Papago removed the plastron, packed the interior with hot pebbles, and roasted the tortoise in its shell in the ashes of a fire (White and Stevens 1980). The Yavapai baked tortoise in an earthenware oven (White and Stevens 1980). Historical accounts describe placing the live tortoise on its back on the glowing embers of a fire, roasting it in its own shell (Mollhausen 1858: 287); killing the animal, removing the shell and skin and boiling the flesh with seasonings (James 1906:199); and breaking open the plastron, inserting a hot stone in the body cavity and roasting on a fire (Felger et al. 1981). The Seri Indians of the west coast of mainland Mexico first twisted off the legs and ate them before the rest of the meat was consumed (Felger et al. 1981).

Charring on the dorsal side of carapace fragments found in some archaeological contexts suggests that the animal often was placed on its back while being roasted (e.g., Connolly and Eckert 1969; Langenwalter et al. 1983). Tortoise fragments have been found in the excavation of limestone ring middens identified as roasting pits for agave and other plant foods (Blair 1986; Rafferty and Blair 1987; Kroesen and Schneider n.d.). Agave and tortoise may have been gathered, cooked, and eaten together in the early spring in the Clark Mountain area of eastern California (Kroesen and Schneider n.d.).

Tortoise procurement also is poorly documented. A search of the literature pertaining to groups living in the study area had negative results (Steward 1933, 1938, 1941; Drucker 1937; Stewart 1941, 1942; Bean 1972; Laird 1976). The best account of hunting practices comes from the Seri (Felger et al. 1981) and has important archaeological implications for the southwestern Great Basin.

Although faunal analysts have used the presence of desert tortoise remains as an indication of spring, summer, and/or early fall site seasonality, this is not necessarily a valid inference. Seri women, using dogs specially trained to locate tortoises by smell, hunted that animal during its active season. Three or four tortoises were placed in a basket that was carried on the head. Tortoises were lured out of their burrows with water placed near the entrances. The tortoise sensed the presence of the water, came out of the burrow, and was seized by the hunter (Felger et al. 1981). The Seri also obtained tortoise during the winter months when the animal was in hibernation. Wire hooks at the ends of long poles were thrust into dens (winter burrows) to drag tortoises out (Felger et al. 1981).

It is our view that tortoises may have been used by aboriginal peoples of the Great Basin year-round. Winter dens as well as summer shelters certainly could have been recognized by desert people as places where tortoises predictably were available. Field observation by the senior author established that winter hibernation locations are readily recognizable and that tortoises within these dens or burrows can be observed directly in some cases. Our view is substantiated by a recent report describing a technique that biologists have used to capture tortoises when they are within their burrows. "Tapping" on the carapace or on the floor or roof of the burrow, with a pole or stick, and then retreating a short distance usually resulted in the tortoise emerging to the burrow entrance (Medica et al. 1986). If burrow locations were known, a simple technique such as this would have made tortoise procurement more reliable than procurement based on chance encounter. In addition, desert tortoise behavior reportedly includes aspects of homing and reuse of winter burrows (Woodbury and Hardy 1948; Berry 1986); these characteristics would add to the likelihood that aboriginal people knew where to find tortoises during all seasons of the year. If this were the case, the desert tortoise was not only available, but had the additional benefit of self-storage, i.e., that it was in a known location where it could be used when needed, but did not require the preservation methods used in the storage of other subsistence items (i.e., drying, parching, storage containers).

The possibility that tortoises were used as living reservoirs of water has been suggested (James 1906; Woodbury and Hardy 1948). The urinary bladder of an adult tortoise can yield up to one-half pint of potable water. Waste materials are concentrated in the form of solid uric acid, which is less toxic than urea. When picked up, frightened, or molested, the tortoise will discharge this water. This mechanism may have provided life-saving water to desert travelers.

Ceremonial or Ritualistic Use

The use of rattles made of turtle or young tortoise shell has been recorded for the Cupeño, Luiseño, and various Diegueño groups. These rattles were used for specific ceremonies such as mourning, first fruits, and girls' puberty ceremonies (Du Bois 1908; Kroeber 1908; Sparkman 1908; Waterman 1909; Drucker 1937). Steward (1933, 1938, 1941) and Stewart (1941, 1942) did not report any ceremonial use of turtles or tortoises. The use of ceremonial rattles seems to be more prevalent on and near the Pacific coast. Specimens were recovered at Oro Grande (CA-SBR-72) in the Mojave Desert (Rector et al. 1983), but they may represent trade goods or coastal influences. A tortoise-shell rattle is in the collections of the Palm Springs Desert Museum (Cheryl Jeffrey, personal communication 1989) and possibly may have been used by Cahuilla groups in that area.

The ceremonial use of tortoises or turtles by aboriginal Mesoamerican groups may be represented in the various codices and architectural motifs compiled by Seler (1939). These include use as a rattle, a drum beaten with an antler, and ceremonial garb.

Medicinal Use

Medicinal use of the tortoise has been recorded by only one ethnographer (Gifford 1936). The Yavapai pulverized the shell and rubbed it on the belly to relieve stomach problems. The same group mixed the pulverized shell with boiled tortoise urine and drank the mixture as a cure for urinary problems (Gifford 1936).

Technological and Household Use

The Cahuilla used tortoises for household utensils (Bean 1972). The Chemehuevi used the carapace as a ladle and as a container in which seeds were parched with hot coals (Drucker 1937), and sometimes used tortoise shell fragments as spoons for children (Kelly MSa). The Southern Paiute of Ash Meadows, Nevada, used a dipper of "turtle shell" (Steward 1941), as did the Shivwitz Southern Paiute and the Wimönuntci Ute (Stewart 1942).

Tortoise carapace fragments were found at aboriginal turquoise mines in the vicinity of Halloran Springs. Malcolm Rogers (1929) thought that these had been used as hand scoops to "muck out" excavations (Heizer and Treganza 1944). An account of a Mohave-Chemehuevi battle includes the use of "turtle shells" to dig a grave for a victim wrapped in buckskin (Van Valkenburgh 1976).

The Shivwitz Paiute of southern Utah made coiled pottery and used a piece of "turtle shell" to smooth both the interior and exterior surfaces of a vessel (Lowie 1924:225-226). Tortoise shell bowls in the possession of Paiute and Gosiute groups probably were obtained in trade (Fowler and Matley 1979).

During the Carleton campaign against the Paiute in June of 1860 "terrapin shells full of salt mixed with a yellowish kind of earth . . ." were found near planted and irrigated gardens at what was probably Cornfield Spring (Casebier 1972:34).

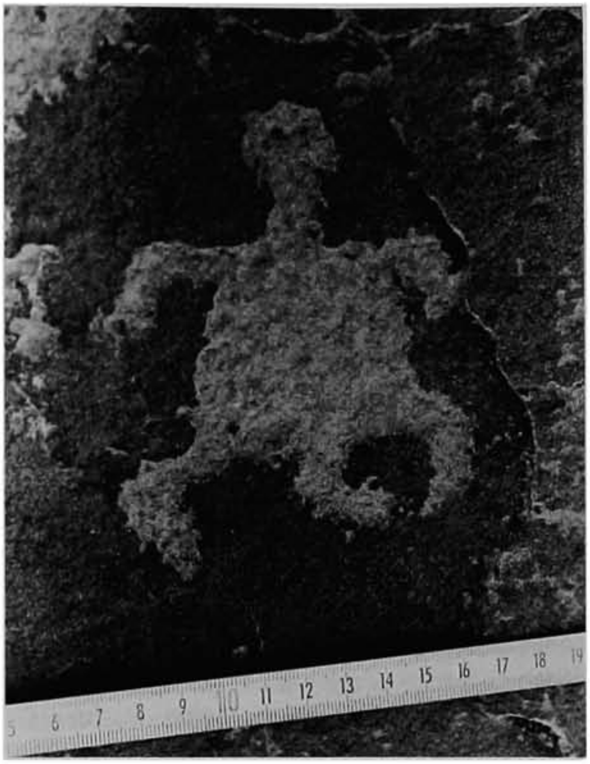
Symbolism and Myth

The incorporation of turtle or tortoise motifs or themes in aboriginal design and oral tradition suggests that spiritual values and symbolic significance were connected with these reptiles. Representational tortoise/turtle elements were thought originally to be absent at Mojave Desert rock art sites (Rector 1981) and those at central Baja California sites were reported to be sea turtle (Rector and Ritter 1978). Investigations of Nevada petroglyph sites in the Valley of Fire by the senior author have resulted in the recording of eight tortoise/turtle motifs (Fig. 8). Similar motifs are reported to be present at other sites in the Valley of Fire (Eileen Green, personal communication 1986); at Piute Creek, Piute Spring, and the Rodman Mountains (Arda Haenszel, personal communication 1986); and at Cow Cove (Daniel McCarthy, personal communication 1986). Although many of these sites have not been visited by the authors, it does appear that tortoise/turtle motifs have a wider occurrence in the desert regions than originally was recognized. Interpretations of rock art remain hypothetical; animal motifs have been related to sympathetic "hunting magic" and have been attributed to clan symbolism (Eileen Green, personal communication 1986).

A finely made basket that incorporates a tortoise or turtle motif in its base is in the collections of the Palm Springs Desert Museum (Cheryl Jeffrey, personal communication 1989).

A tortoise/turtle design has been reported on Mohave pottery (Kroeber and Harner 1955). The tortoise food taboo practiced by the Mohave (Kroeber 1925; Laird 1976) and the characterization of "Turtle" in Mohave myth (see below) suggest special significance for the tortoise/turtle in Mohave symbolism.

The Las Vegas band of the Southern Paiute fed "turtles" (as well as chuckwalla and rabbit) to eagles that were taken from their nests when young and raised in cages for ceremonial use (Kelly MSb).



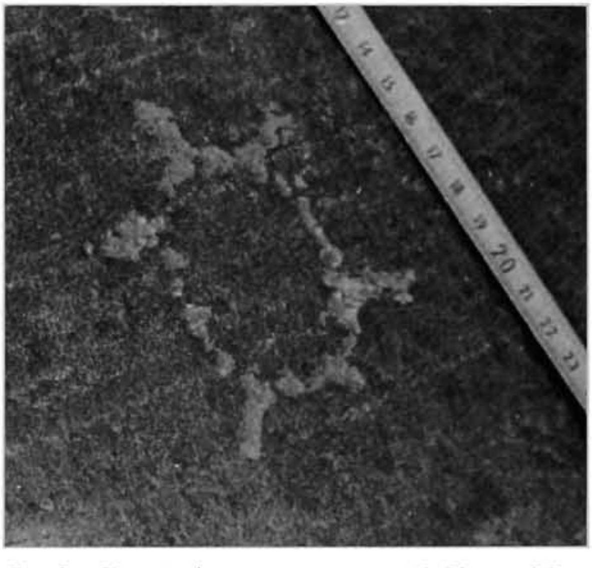


Fig. 8. Tortoise/turtle petroglyph motifs, Valley of Fire, Nevada.

Tortoise/turtle symbolism is a widespread cultural phenomenon. Some common symbolic interpretations include that of long or eternal life, revered old age (a recognition of the longevity of tortoises) and a base or form of the earth. Mayan symbolism in this respect has recently been discussed by Taube (1988) in his report on Mayan Katun wheels and ceremonial bloodletting receptacles. Seler (1939) collected a wide variety of tortoise/turtle motifs from codices and other representational media and discussed their possible symbolic meanings.

"Turtle" appeared to represent a characterization of both tortoises and turtles in a number of myths (at least those myths translated to English in the literature of the Desert Southwest), for the term is used interchangeably in regions where one or the other or both of the animals are present. Among the Chemehuevi, the "turtle" was a symbol of the spirit of the people and had an aura of sacredness (Laird 1976). In one myth, "Turtle" had the role of a lesser chief in a tale of a violated food cache. At the end, "Turtle" accepted inevitable doom and died with great dignity. "He thus expresses the Chemehuevi ideal: patience to endure, strength to survive, courage when all hope is lost" (Laird 1976:277). Other myths portrayed the "turtle" as both a semi-villain (Beals 1945) and as a stranger (Gifford 1936). A Mohave song called "Turtle" recalled a westward journey in the direction of the Chemehuevi who ate turtle (Kroeber 1925). A coyote tale called "Iron-Clothes" related how the "land turtle" came to be used as food and how it was cooked and eaten (Sapir 1930). The unique character of the tortoise/turtle including its physical form, longevity, speed of locomotion, and other behavioral patterns represented a sharp contrast to many other animals and thus, perhaps, qualified it for a place in the symbolism and myth of aboriginal peoples.

ARCHAEOLOGICAL DATA

Desert tortoise and western pond turtle remains have been recovered at numerous archaeological sites in the southwestern Great Basin and adjacent areas (Fig. 1). These remains include unmodified fragmental specimens (both burned and unburned) identified in faunal analyses, tortoise eggs, portions of turtle and tortoise carapace bearing traces of asphaltum, and tortoise carapace "bowls" and "scoops" scraped on the interior and ground on one or more edges.

The problem of distinguishing naturally occurring tortoise and turtle remains from culturally modified ones in archaeological sites is not confined to these species, but extends to faunal remains in general. There is no question that ground, drilled, decorated, or otherwise modified specimens are an indication of cultural use. However, burned specimens, often accepted as indicators of cultural activity also could be a result of accidental burns such as brush fires. Conversely, a lack of burning does not necessarily mean that the presence of faunal remains is a natural occurrence (see ethnographic descriptions of tortoise preparation given above). The subjective judgement of the investigator should be recognized.

Data relating to the occurrence and frequency of desert tortoise and various turtle remains have been collected from a variety of reports of archaeological investigations within the southwestern Great Basin and adjacent areas (Tables 1-3). Data indicate that high frequencies of tortoise and/or turtle remains occur in a number of sites including Afton Canyon (Sutton and Yohe 1989); Oro Grande (Langenwalter et al. 1983); Cronese Lakes (Drover 1979); Fort Irwin sites in Drinkwater Basin (Reynolds and Shaw 1982), Tiefort Basin (Kent 1985), and No Name West Basin (Douglas 1984, 1985); and Atlatl Rockshelter (Douglas 1982). Archaeologists should be aware that, especially when dealing with turtles and tortoises, over-representation in numerical totals may occur when MNI (Minimum Number of Individuals) analysis is not used. Theoretically, if the entire animal was carried to the site (as is the case with most small animals) all skeletal elements may be represented in the assemblage. Larger animals butchered elsewhere may be represented by fewer elements since only those animal parts with greater economic value would be selectively transported to a habitation site (Binford 1978). Cooking methods such as roasting in the shell also may result in over-representation of tortoise and turtle in faunal collections because carbonization improves preservation of carapace and plastron fragments. In addition, the unique characteristics of the carapace and plastron make even fragmentary specimens more easily identified than bone fragments of some other animals.

Selected Archaeological Sites with Tortoise/Turtle Remains

With the above qualifications in mind, selected archaeological sites in the Mojave Desert (Fig. 1) with high frequencies of desert tortoise and/or western pond turtle remains will be discussed. It is beyond the scope of this paper to consider individually all sites with reported tortoise or turtle remains. However, all the sites that the authors have identified from published (and some unpublished) literature are presented in Tables 1-3 with appropriate references for the interested reader. A synthetic discussion of the archaeological incidence of desert tortoise considers the data from all of these sites.

Oro Grande (CA-SBR-72). At Oro Grande, a seasonal camp on the Mojave River just north of Victorville, dated to ca. A.D. 1000, Rector et al. (1983) reported both turtle and tortoise remains. Although tortoise egg shell fragments (even those that were burned) and whole sterile eggs were dismissed as noncultural, the tortoise skeletal remains were considered cultural (Langenwalter et al. 1983). Tortoise remains were distributed in all of the three areas of the site with greater frequencies in the two more heavily utilized areas (Rector et al. 1983).

The specimens of western pond turtle were artifactual and probably represented the remains of two or more rattles. Several of the turtle shell fragments were drilled and some were stained with asphaltum. Both characteristics are indicators that the shell was used as a rattle. One specimen of desert tortoise shell also bears traces of asphaltum, possibly indicating that tortoise shell also was used for rattles (Langenwalter et al. 1983).

Afton Canyon (CA-SBR-85). Analysis of the faunal collection from the Afton Canyon site on the Mojave River indicated high frequencies of desert tortoise (Sutton and Yohe 1989). The desert tortoise apparently was an important source of protein during the time this site was occupied (ca. 1,000 B.P.). Identified specimens of tortoise remains (mostly plastron fragments) were the second most frequent (after bighorn sheep), and more frequent than lagomorphs. Western pond turtle remains were absent although this site is located within the present range of that animal.

Drinkwater Basin (CA-SBR-4213, -4446, -4449, -4450). Excavations in Drinkwater Basin yielded frequent specimens of both desert tortoise and western pond turtle at sites where Rose Spring and Cottonwood Triangular projectile points also were recovered. The presence of pond turtle is interesting because the aquatic habitat required by this species has not been present at this location for more than 10,000 years according to paleoenvironmental reconstructions (Jefferson 1968; Reynolds and Shaw 1982). There was evidence that these animals were cooked and eaten here, apparently after having been roasted (Reynolds and Shaw 1982).

The identification of pond turtle remains at these sites has been questioned (Basgall et al. 1988). There is a possibility that there may have been some confusion between pond turtle and juvenile tortoise specimens. Resolving this faunal question is important because of the environmental and seasonal implications involved.

Cronese Lakes (CA-SBR-259, -260B). The Cronese Lakes are two dry lake beds at the terminus of the Mojave River that occasionally are filled by the flood waters of that river during periods of heavy precipitation. Drover (1979) studied two sites there and found the remains of both western pond turtle and desert tortoise. The pond turtle specimens indicate that either year-round water of suitable quantity was available at Cronese Lakes in the past or that the turtle was imported from the Mojave River (Langenwalter 1978a).

Tortoise was the third most frequent animal identified in the faunal collection. Forty-two of the 530+ (MNI=7) elements collected were burned or calcined. Clustering of the tortoise remains may indicate that the tortoise shell was intact when discarded (Langenwalter 1978a).

Mule Springs (26-CK-300). Substantial tortoise remains were recovered from this southern Nevada site situated at a fairly high elevation (ca. 1,250 m.). The authors noted that the site is at least 152 m. above the 1,067 m. upper elevational range of desert tortoise (Connolly and Eckert 1969). This suggested that tortoises were transported from lower elevations. The presence of charred specimens suggested that tortoises were cooked directly in the fire.

New information from recent studies of modern tortoises indicate that their upper elevational range is greater than 1,067 m. and that the desert tortoise ranges from below sea level to above 2,200 m., although most are found below 1,500 m. (Dodd 1986). These new data indicate that it is not unusual for tortoise remains to occur at sites at higher elevations.

Valley of Fire (26-CK-1345, -1383, -1384). Faunal remains from three sites (Atlatl Rockshelter, South Shelter, and Turtle Bone site [Warren 1982]) near natural water catchments in sandstone outcrops in southern Nevada had high proportions (up to >83% of faunal remains) of desert tortoise elements. Many of the elements, including carapace, plastron, and especially terminal phalanges, were charred. There were no butchering marks. Douglas (1982) interpreted the data from these sites to mean that the tortoise probably was cooked whole over a fire.

These sites were stratified and also showed changes over time in the importance of the various fauna represented in the collection (to be discussed below).

California Coastal Sites. As might be expected from the known range of western pond turtle, remains of this aquatic reptile have been recorded in many coastal southern California archaeological sites including those in Ventura County (Langenwalter 1978b), Long Beach (Wallace 1980), San Clemente and San Miguel islands (Heye 1921), Santa Barbara County, and the Channel Islands (Gifford 1940).

Southern Arizona Sites. Both desert tortoise and turtle (*Kinosternon* spp.; *Terrapene ornata*) have been recovered at Hohokam sites in Arizona (Tables 1-3). Here, as in the Mojave and Colorado desert sites, tortoise and turtle ranges overlap. Frequency of remains and proportions of faunal assemblages are quite low at most of these sites. James (1989b), however, noted that both desert tortoise and Sonoran mud turtle (*Kinosternon sonoriense*) were more important in the Hohokam diet than previously thought, comprising over 29 percent of the faunal assemblage at one site. Although the Hohokam were horticulturalists, they supplemented their diet by hunting and gathering (Szuter 1989).

Patterns of Archaeological Incidence of Desert Tortoise

Archaeological data from portions of the Great Basin in California, Nevada, Arizona, and Utah support our view that desert tortoise was an important resource to the aboriginal hunter-gatherers and to some extent the horticulturalists of the desert regions of the North American Southwest. These data indicate that tortoise was used throughout a major portion of the Holocene and that certain environmental, cultural, and temporal patterning in the use of this resource can be demonstrated.

Chronological and contextual data for excavated archaeological sites with remains of *Xerobates agassizii* within California, Nevada, and Arizona are presented in Tables 1-3.[4] Compilations of archaeological data of this type are hampered by several factors. First, it is only relatively recently that faunal remains have been routinely analyzed as part of site investigation and reporting. Therefore, it is certain that a good deal of information has been lost from sites excavated in the past. Second, some confusion in the identification of desert tortoise and western pond turtle and other turtle species may exist, especially in a few areas where their present or past ranges may overlap. Third, the interpretation of any unmodified faunal material as cultural, rather than naturally occurring, is always problematic. Fourth, tortoise (and other small animals) may be overrepresented in frequencies in faunal analyses because the bones of larger animals, macerated and splintered in the process of obtaining nutrient-rich marrow, may be difficult to identify. Fifth, tortoise may be further overrepresented in species identification data because the unique characteristics of carapace and plastron fragments make them relatively easy to identify. Sixth, faunal remains from early sites in most of the present range of desert tortoise are rare. Often archaeological deposits of this period are surface or very shallow phenomena and faunal remains are subject to extreme taphonomic processes. With these cautionary statements in mind, compilations of *Xerobates agassizii* data (Tables 1-3) suggest some interesting patterns.

Environmental Patterns. Desert tortoise was widely used prehistorically throughout large portions of its present range. Tortoise remains have been recovered at a variety of site types and features, including open sites with and without midden development, caves and rockshelters, pithouses and trash accumulations, roasting pits and hearths, and in cremation associations (John Goodman, personal communication 1989).

Tortoise remains are found in a wide variety of geographical locations, including rockshelters and open sites in proximity to washes or extinct water courses, such as at the Henwood site (Douglas et al. 1988) and the California Wash sites (Blair 1986); at high elevations such as Mule Springs (Connolly and Eckert 1969; Turner 1978) and Clark Mountain (Rafferty and Blair 1986; Kroesen and Schneider n.d.); at lacustrine sites such as Wadi Beadmaker (Wilke 1978), Koehn Lake (Sutton 1988), and Cronese Lakes (Drover 1979); near natural water catchments such as the Turtle Bone site (Warren 1982); at marsh-side sites such as Myoma Dunes (Wilke 1978) and Saratoga Springs (Wallace and Taylor 1959; Wallace 1986); at extant and extinct springs such as Rogers Ridge (Douglas et al. 1988), Big Spring (Warren et al. 1972), and Soda Springs (Schroth 1983); and in riparian environments such as Afton Canyon (Schneider 1989), Oro Grande (Rector et al. 1983), and Willow Beach (Schroeder 1961).

A study of faunal remains from early sites (i.e., Lake Mojave/Pinto Period sites) at Fort Irwin (Douglas et al. 1988) presents a model relating intersite variability in faunal representation to site location, i.e., elevation, catchment area, and topography of the surrounding area. This model was tested using artiodactyl and leporid remains only. It certainly seems reasonable that fauna would be more available and thus more frequent in faunal assemblages in archaeological sites close to the habitats of particular species.

What then, would be the most likely geographic area to have high frequencies of desert tortoise in archaeological assemblages? Above and beyond what was already known, recent studies of desert tortoise range, habitat, and behavior (given impetus by the endangered status of this species) have added information on population locations. For example, a recent study of tortoise habitat at Twentynine Palms, California, found a higher correlation between the locations of tortoise burrows and the edges of galleta grass (*Hilaria rigida*) stands, than with washes, previously cited most often as prime habitat area (Baxter and Stewart 1987).

Other recent studies have shown that slopes between mountain ranges are prime habitat but that dry lake playas are devoid of tortoises (Berry 1984; Dodd 1986). Mixed ecotonal settings may have a correlation with tortoise habitat, and thus with high frequencies of tortoise remains at archaeological sites.

Patterns of Cultural Use. Desert tortoise remains in archaeological sites show several different patterns: carapace fragments only, skeletal fragments only, both carapace/plastron and skeletal elements, and carapace elements modified for technological, ornamental, or ceremonial use. Presence or absence of burned elements (as discussed in the ethnographic section above), especially differential burning of carapace/plastron fragments, has been used by faunal analysts to infer various methods of cooking. Analysis of intersite variability in the patterns of remains has the potential for obtaining significant information about cultural practices, food preferences, and exchange.

Temporal Patterns. Changes in subsistence patterns over time sometimes can be recognized by differences in frequencies of various species making up faunal assemblages and the *relative* importance of one resource compared to others (e.g., artiodactyl and leporids [Douglas et al. 1988]; artiodactyl, leporids, and tortoise [Sutton and Yohe 1989]; tortoise and artiodactyl [Warren 1982]).

Douglas et al. (1988) noted that data from sites at Ft. Irwin indicate that after the Pinto Period tortoise became an important component of faunal assemblages and that high frequencies of tortoise remains may be indicative of more recent cultures (i.e., cultures dating after the Lake Mojave/Pinto Period).

Warren (1982) presented data from three culturally stratified sites in the vicinity of Atlatl Rock in the Valley of Fire, Nevada, that showed an increase in the proportion of desert tortoise over time, as the proportion of artiodactyl remains dramatically decreased (in the Atlatl IV Period [ca. 1200-1880 A.D.]) and the proportion of leporids remained constant. It was hypothesized that this reciprocal phenomenon may be related to the decimation of the bighorn sheep population due to the widespread use of the bow and arrow during the Atlatl IV (Paiute) Period (Warren 1982:38). At Afton Canyon, near the terminus of the Mojave River, artiodactyl/leporid/tortoise proportions remained the same over time (i.e., stratigraphically) with a suggestion that artiodactyl may actually have increased over time (Sutton and Yohe 1989). However, the increase in artiodactyl most likely was a reflection of the specialized use of this campsite as a bighorn sheep watering/hunting location (Schneider 1989).

The data compiled in Tables 1-3 indicate that, over time, there was a significant increase in the number of sites with identified desert tortoise remains. Whether this increase is related to changes in subsistence patterns remains problematic. When summarizing extensive chronological data from the Ft. Irwin Archaeological Project, Gilreath et al. (1987) noted that the vast majority of radiocarbon dates fall within the last 2,500 years. Thus, an increase in desert tortoise frequencies may well be due to larger aboriginal populations later in time or may be an artifact of taphonomic processes and/or site visibility rather than an expression of subsistence change. Among the Hohokam horticulturalists of Arizona, tortoise remains are present, but generally in consistently low frequencies. This may indicate that tortoise was only a supplementary resource.

SUMMARY

Faunal specimens of western pond turtle and other turtles can be confused with those of desert tortoise, especially in areas where ranges overlap. This confusion extends to the terminology used very commonly in archaeological, ethnographic, and biological literature. Because of the widely divergent ecological requirements of these species and paleoclimatic reconstructions based on these requirements, it is important that correct identification be made.

Biological and ecological evidence, much of it newly discovered, indicates that desert tortoise was more abundant in the past, had a wider range, and was a dependable and predictable resource. Faunal remains in archaeological sites, historic accounts of the use of tortoise, and direct nutritional analysis of tortoise meat suggest that the desert tortoise was an important subsistence resource to many of the aboriginal peoples of the Desert Southwest, especially hunters and gatherers. With a few exceptions, ethnographic sources provide only vague and/or incomplete references to methods of procurement, extent of exploitation, and uses of the desert tortoise.

At least one ethnographic study, tortoise behavioral characteristics, and field observations indicate that the desert tortoise was available on a year-round basis. For this reason, it is unwise to attempt to establish site seasonality based on the presence of tortoise remains in faunal assemblages.

From the data presented here (Tables 1-3) it does seem reasonable to conclude that the use of *Xerobates agassizii* by aboriginal hunters and gatherers of the Desert Southwest has increased over time. Although desert tortoise is represented in the faunal assemblages from a few early Holocene sites, frequencies are not great, yet tortoise remains are, by virtue of their physical characteristics and common cultural modifications, relatively easily identified and relatively resistant to taphonomic processes. The number of archaeological sites having frequent and very frequent remains increases over time.

Tortoise was readily available, apparently year-round, over a wide geographical range. It was readily portable and could be stored in live condition. Its habitats at ecotonal boundaries were favored locations for the procurement of other resources (both plant and animal) as well as tortoise. Although certain cultural groups reportedly avoided eating tortoise and other reptiles, tortoise was important economically and ideologically to many aboriginal groups in the Greater Southwest.

NOTES

1. A revision of the taxonomic classification of the gopher tortoises recently has been published (Bramble 1982; Lamb et al. 1989). This generic revision is based on skeletal, evolutionary, and

mtDNA evidence. Under the revision, there are two tortoise genera: *Xerobates* and *Gopherus*. The previously used taxonomic nomenclature for desert tortoise was *Gopherus agassizii*, and this is the designation used for this species in most literature up to the present time. This paper uses the revised taxonomic identification for desert tortoise, *Xerobates agassizii*. The bases of the generic revision have important implications for archaeologists in terms of soil types and paleoclimatic reconstructions.

2. Very little was known about the desert tortoise until the early 1970s when concern about the endangerment of the species was first voiced (Berry 1984). Since then, a good deal of information has been gathered from biological and ecological studies supported by the U.S. Government, many a direct result of the development of the 1980 California Desert Plan. Dodd (1986) has summarized much of the newly acquired information from a monumental review of desert tortoise work by Berry (1984).

3. Reptiles, in particular, are valuable in paleoenvironmental reconstruction because they are particularly sensitive to temperature due to their "cold-blooded" metabolism. Reptiles also have a relatively slow rate of evolutionary change; response to climatic variation more likely is a move to a more desirable environment rather than the relatively rapid adaptation of mammalian species (Voorhies 1977).

4. Communications with a number of faunal analysts and archaeologists at universities, the Bureau of Land Management, National Park Service, and U.S. Forest Service had negative results regarding the presence of desert tortoise faunal remains in excavated archaeological sites in southwestern Utah.

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