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# The Current Status of Archaeological Research in the Mojave Desert

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*This paper provides a brief outline of the current understanding of the prehistory of the Mojave Desert, a broad framework of culture history, an outline of diachronic environmental change, and a summary of some of the research directions in Mojave Desert archaeology.*

**MORE** than 12 years ago, a comprehensive overview of the California deserts (including the Mojave Desert, Fig. 1) was provided by Warren (1984). That synthesis was current up to about 1982, and although a variety of regional studies has been produced, no general summary of Mojave Desert prehistory has appeared since<sup>1</sup> (but see Ritter and Coombs 1990). This paper attempts a brief review of the "state of the art" in Mojave Desert prehistory and an examination of current research issues in Mojave Desert archaeology.

The archaeological record in the Mojave Desert is long, diverse, and variable, and is applicable to a variety of important research questions. An understanding of Pleistocene archaeology in this region is poor, and although the majority of archaeological work conducted in the Mojave Desert has centered on the Archaic, the Early to Middle Archaic is not well understood. More is known of later prehistory. There is evidence of considerable population growth and a significant increase in social complexity within the last several thousand years. Groups practicing agriculture (e.g., the Virgin Anasazi) occupied portions of the eastern Mojave Desert late in time, then apparently were replaced by hunter-gatherers (the Southern Paiute), suggesting interesting models of cultural replacement.

All of the chronological periods in the Moja-

ve Desert have "marker" projectile point forms (Fig. 2) commonly used to place sites in time. This practice continues, although it has been argued that due to rejuvenation, atlatl dart points (e.g., Pinto, Elko, Gypsum forms) have no real temporal significance within dart point times (Flenniken and Wilke 1989; Wilke and Flenniken 1991). While this position is not accepted by many archaeologists (e.g., Bettinger et al. 1991; O'Connell and Inoway 1994), it is clear that greater chronometric control of the record is needed.

The expansion of peoples speaking Numic languages across the Great Basin, of Takiic language groups into southern California, and of the Hopi to the Southwest poses major questions in the understanding of the prehistory and ethnography of western North America. The Mojave Desert (particularly the western Mojave and the Owens Valley to the north) seems to be the region where the Northern Uto-Aztecan language family developed and differentiated (see Fowler 1972; Sutton 1987a, 1994a; Madsen and Rhode 1994), and where the aforementioned population movements originated (but see Aikens and WITHERSPOON 1986).

A full understanding of the environmental history of the Mojave Desert is elusive, although major strides have recently been made (see below). Still more elusive is an understanding of

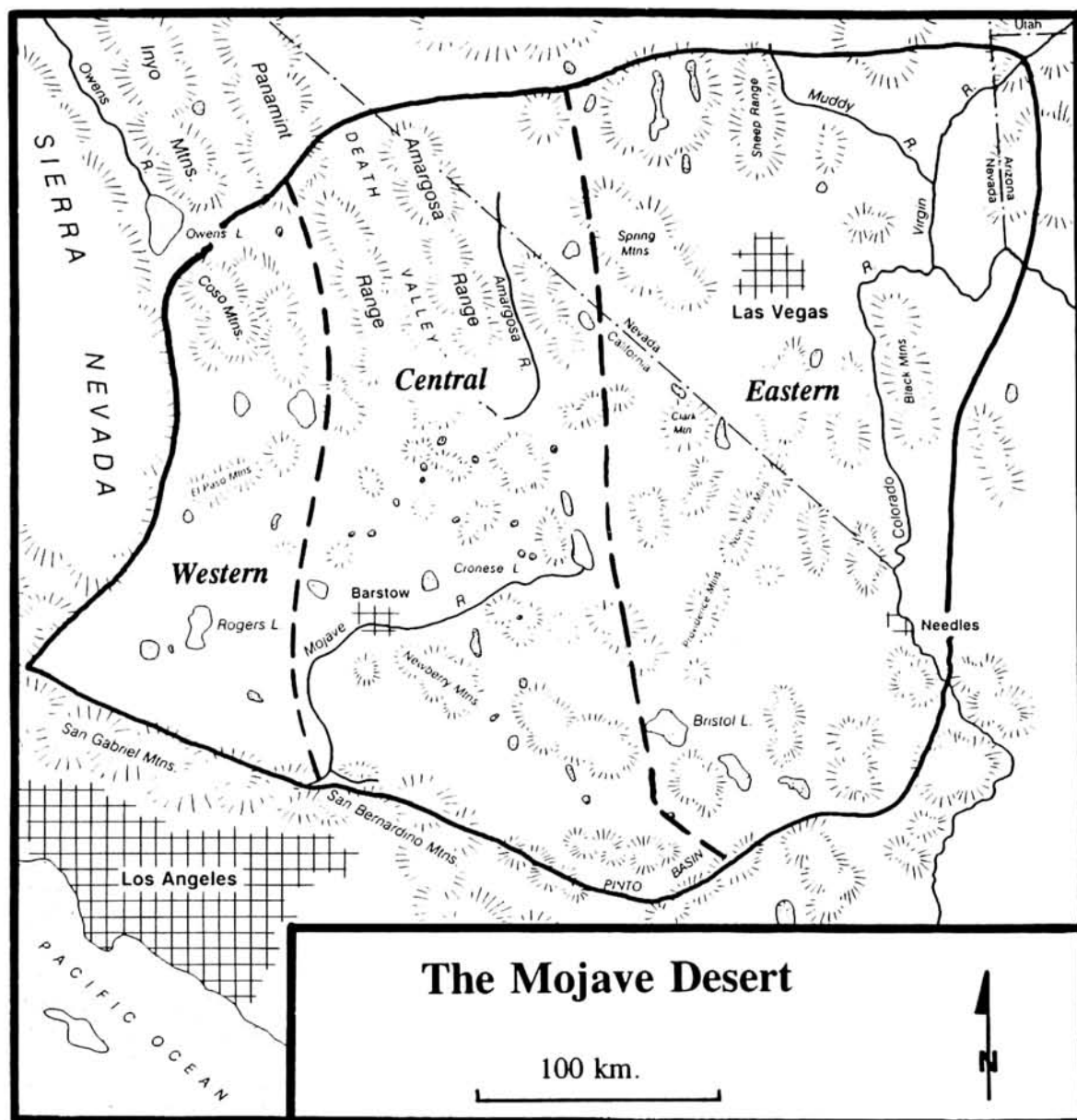


Fig. 1. The modern Mojave Desert, showing general western, central, and eastern geographic divisions.

the cultural adjustments made to those changing conditions. While a broad outline of archaeological times and cultures has been established, few specific details of social structure, economy, religion, etc., are known of the prehistoric peoples of the Mojave Desert. Such answers await us.

### THE MOJAVE DESERT

The Mojave Desert (Fig. 1) occupies much of southeastern California and extends into portions of Arizona and Nevada. The Mojave Desert is usually defined using bioenvironmental cri-

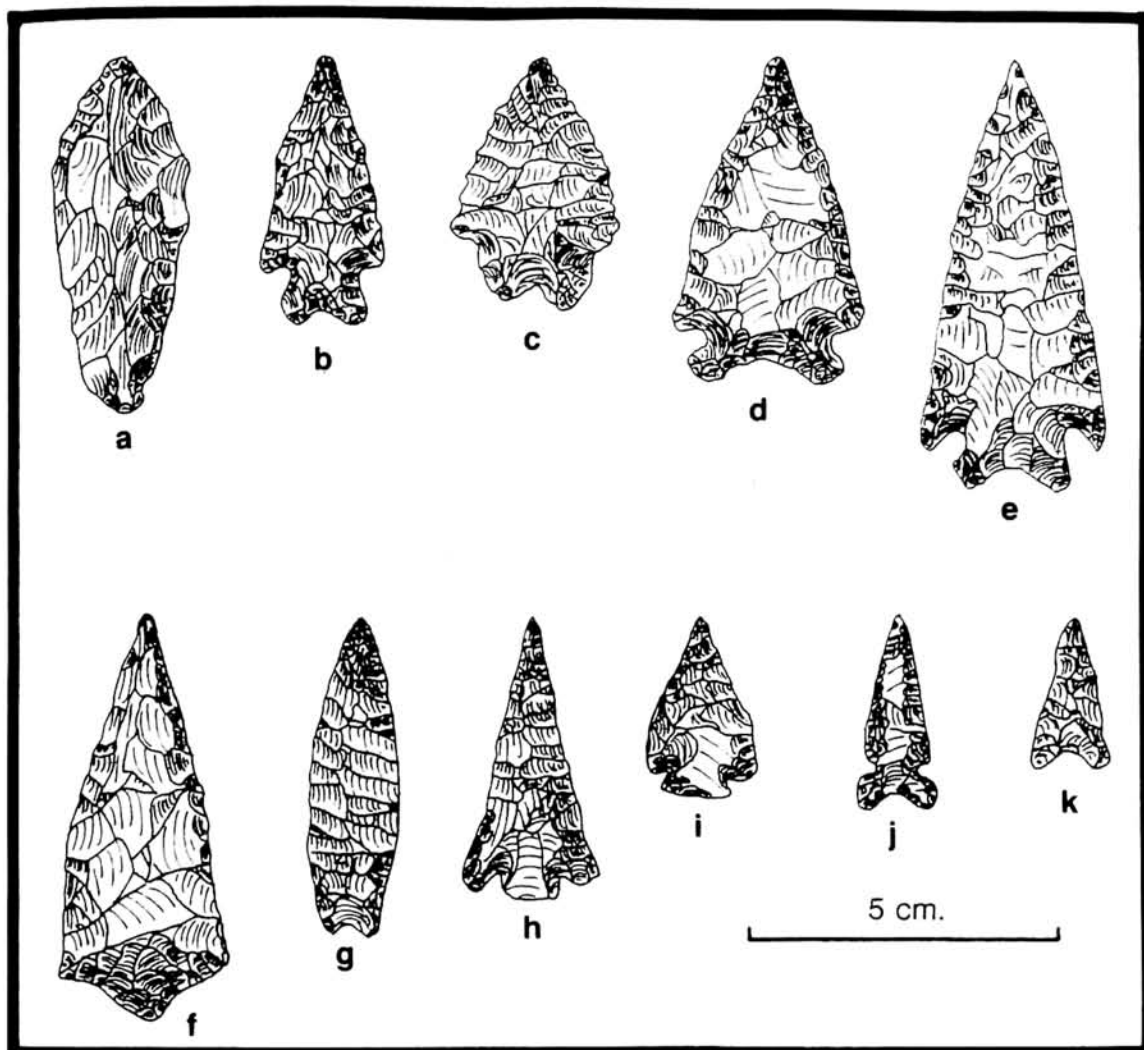


Fig. 2. Common projectile point forms in the Mojave Desert: (a) Lake Mojave; (b-c) Pinto; (d-e) Elko; (f) Gypsum; (g) Humboldt Concave Base; (h) Eastgate; (i) Rose Spring; (j) Desert Side-notched; (k) Cottonwood Triangular (redrawn from Heizer and Hester 1978).

teria (i.e., climate and vegetation). It is a warm-temperature desert lying between the subtropical Sonoran Desert to the south and the cold-temperature Great Basin Desert to the north (Jaeger 1965; Rowlands et al. 1982). The Joshua tree (*Yucca brevifolia*) is often used as the common vegetative marker of the Mojave Desert, although the correspondence of its range with the limits of the Mojave Desert in the lower elevations to the south is not precise. The Transverse Ranges and the southern California

coast lie to the southwest, the Colorado Desert is to the southeast, the southern Sierra Nevada and the San Joaquin Valley are to the west, and the Great Basin Desert (including the Owens Valley) is to the north. For purposes of discussion in this paper, the Mojave Desert is divided into three regions; western, central, and eastern (Fig. 1). It is important to remember that the boundaries of the Mojave Desert, however they are defined, could not have been static through time, and the imposition of the current bound-



aries on prehistoric cultures may be misleading (particularly since the "desert" designation carries with it certain preconceived notions).

### Past Environment

Environments change through time, and in order to understand a cultural adaptation in the past, it is necessary to understand the associated environment so that models of adaptation can be formulated and tested. Thus, an understanding of the changing environment within the area currently defined as the Mojave Desert is critical to a comprehension of the evolving cultural adaptations in the Mojave Desert (see Spaulding 1990 for a more detailed discussion); however, as noted by Basgall and Hall (1993:4), environment is not the only factor in evolving adaptations in the Mojave Desert and, as a determinant in cultural adaptation, should not be "overplayed." Much of the information related to paleoenvironment is based on proxy data and therefore subject to a variety of interpretations. Nonetheless, a general picture of the Late Pleistocene/Holocene environment has emerged.

The Pleistocene (glacial) climate of the Mojave Desert was cooler and effectively wetter than today (Weide 1982), although perhaps warmer and drier than conventional models maintain (Spaulding 1990:196). Several major lake systems, smaller isolated lakes, and associated lacustrine zones were present and, while vegetation was similar in character to the Great Basin Desert of today, it was distributed very differently (Spaulding 1990), with pinyon-juniper woodlands extending well into the valleys.

The Holocene is traditionally divided into three major sections (Early, Middle, and Late, following Spaulding 1994), even though such a simple division belies considerable climatic fluctuations. The environmental transition from the Pleistocene to the Early Holocene (10,000 to 7,500 B.P.) appears to have been gradual, as

juniper and mesic desert scrub species persisted at low elevations well into the early Holocene,

dating from 10,000 to 7,500 B.P. . . . [and that] early Holocene environments, while more arid than the Late Wisconsin, were substantially more mesic than those of the middle and late Holocene [Cleland and Spaulding 1992:3].

Basgall and Hall (1992:4), citing data from the north-central Mojave Desert, argued that drier conditions existed earlier, perhaps by 10,000 B.P. Changes in biotic communities occurred at different rates in various locations and included the retreat of woodlands and the expansion of desert scrub (Spaulding 1990:194). Modern vegetation communities were established beginning after 8,000 B.P. (Spaulding 1990:194-195).

The Middle Holocene (ca. 7,500 to 4,000 B.P.) was warmer and drier than modern conditions. During the Middle Holocene, a number of oscillations in climatic patterns, from somewhat wetter to drier, appears to have occurred (Weide 1982:23; Cleland and Spaulding 1992:4). Some have argued (e.g., Wallace 1962:175; Shutler 1967:305) that the Mojave Desert was largely abandoned during the Middle Holocene, although this seems not to have been the case (see below).

In the Late Holocene (after 4,000 B.P.), the climate was generally somewhat cooler and wetter than modern times. However, as the data on past climate improve, it is becoming clear that a series of wet and dry episodes marks the Holocene, particularly the last 2,000 years (Scuderi 1993; also see Weide 1982:23), at least in the western portion of the Mojave Desert and the southwestern Great Basin. Enzel et al. (1992) argued that the Mojave River drainage received considerably more water during the early (ca. 3,500 B.P.) and late (ca. 400 B.P.) Neoglacial episodes, resulting in lakestands and being indicative of major climatic changes in western North America. Stine (1994) suggested that at least two major (medieval) droughts impacted the Sierra Nevada (and so the western Mojave Desert) ca. A.D. 892 to A.D. 1112 and ca. A.D. 1209 to A.D. 1350 (also see Graumlich 1993). A cooler and wetter period occurred between 600

and 150 B.P. (Cleland and Spaulding 1992:4; also Enzel et al. 1992).

### **The Nature of the Archaeological Record in the Mojave Desert**

Many researchers assume that since there is less rainfall in the Mojave Desert, Holocene land surfaces have been relatively stable and well-preserved. Following this initial presumption is the working assumption that many, if not most, sites are surface rather than buried (less rainfall meaning less deposition). Since wind is a major part of the Mojave Desert environment, it is commonly believed that many deposits, even if they did exist, would have been wind-eroded such that the heavier artifacts from all time periods would now lie on a common surface. It is true that many wind-formed surfaces (e.g., desert pavements) are present in the Mojave Desert and sometimes contain very old archaeological materials. However, there are also many depositional environments, and there is a great potential for buried sites in many areas (e.g., along the Mojave River [Ross 1992; Connell et al. 1994], along lakeshores, and in cave sites).

Another assumption is that since desert peoples were "forced" to be highly mobile, few stratified midden deposits exist. Although it is true that many desert sites lack great depth, there are many whose deposits exceed two meters. Preservation is generally good, even in open sites, and perishables are not uncommon in shelters and caves. However, as is true throughout North America, rodent disturbance is extensive in most sites. Vandalism is also a chronic problem.

### **THE ARCHAEOLOGICAL RECORD OF THE PLEISTOCENE**

The Pleistocene cultural record in the Mojave Desert is relatively complex, but few new studies have been conducted in the last 15 years. There is little question that Clovis materials are present in the Mojave Desert and represent a

Late Pleistocene occupation of the region. Claims for earlier materials—that is from a Pre-Projectile Point Period—have been made but remain very controversial.

### **The "Pre-Projectile Point" Period**

There has been a variety of claims for archaeological sites, or purported archaeological sites, in the Mojave Desert dating to a Pre-Projectile Point Period. The three most notable sites or complexes are the Calico Early Man Site, Lake China, and the Manix Lake Lithic Industry. At Calico (Fig. 3), the dating of the site (about 200,000 B.P.) is generally agreed upon, but most researchers reject the claim that the broken stones recovered from the excavations are artifacts (see Budinger and Simpson 1985; Simpson et al. 1986; Patterson et al. 1987; Simpson 1989; also Payen 1982, 1983). Budinger (1996) reported the discovery of a flake in the Manix Basin which he argued was older than 200,000 years B.P.

At Lake China (Fig. 3), Davis (1978, 1982) proposed three Pre-Projectile Point "cultures," primarily flake industries (also see Davis and Panlaqui 1978a:Table 9): (1) Early and Late Core Tool Traditions (dated between 45,000 and 25,000 B.P.); (2) Late Wisconsin Cultures I (25,000 to 20,000 B.P.); and (3) Late Wisconsin Cultures II (20,000 to 15,000 B.P. and including Lake Mojave Period materials). The dating of these materials was based on the relative degree of weathering and typology, but in the absence of chronometric data, this schema is quite weak.

A number of sites containing "crude" and heavily patinated artifacts found along the old shorelines of Lake Manix (Fig. 3) were grouped together to form the Manix Lake Lithic Industry (Simpson 1958, 1960, 1964), and were thought to date to "between 10,000 and 25,000 years ago" (Simpson 1958:6). This age assignment was made partly on the dating of the lakeshore (Simpson 1964:6-7; Moratto 1984:39), on the absence of projectile points (Simpson 1958:7-8,

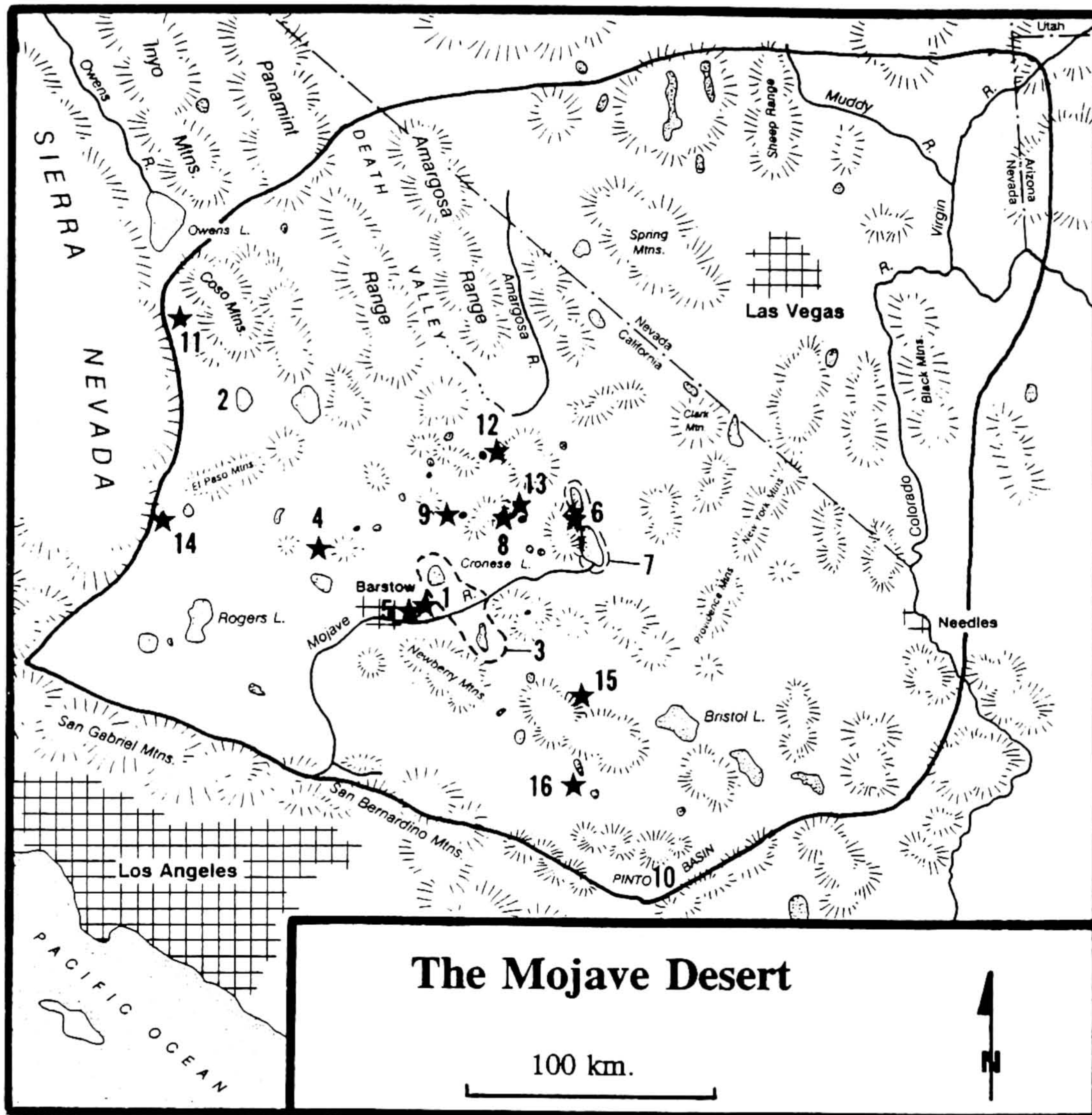


Fig. 3. Location of purported Pre-Projectile Point sites, and of Paleoindian and Early Holocene (Lake Mojave and Pinto periods) sites and localities mentioned in the text: (1) the Calico Early Man site; (2) Lake China; (3) Lake Manix; (4) Coyote Gulch; (5) East Rim; (6) the Baker site; (7) Lake Mojave; (8) Rogers Ridge (CA-SBR-5250); (9) the Henwood site (CA-SBR-4966); (10) Pinto Basin; (11) the Stahl site (CA-INY-182); (12) the Awl site (CA-SBR-4562); (13) CA-SBR-5251; (14) CA-KER-3939; (15) Ludlow Cave (CA-SBR-1887); (16) Surprise Spring (CA-SBR-424).

1960:26-27), and the apparent presence of re-touch on some of the bifaces (Simpson 1960:29). Several other sites (see Fig. 3) have been sug-

gested as representative of the Manix Lake Lithic Industry, including Coyote Gulch (Simpson 1952, 1961), the East Rim site (Alsoszatai-Petho



1975; Simpson 1976), and the Baker site (Glennan 1974; Nakamura 1991). Others (Wallace 1962:174; Glennan 1976:43) claimed the materials were late workshop debris (see Warren [1996] for a historical perspective on the Manix Lake Industry).

The claims of Pleistocene antiquity for the Manix Lake material rests on three basic arguments: (1) the location of the sites above the highest shoreline of Pleistocene Lake Manix (which drained catastrophically sometime after 14,230 years B.P. [Meek 1989:7]); (2) the artifacts being embedded in desert pavement (and thereby being old); and (3) typology. Each of these arguments is circumstantial and provide no convincing basis for dating the materials as very old. Bamforth and Dorn (1988) demonstrated that there were no correlations between either site location and shoreline or between cation-ratio age and embeddedness in desert pavement and argued that the materials were early-stage biface reduction debris dating late in time (see Dorn et al. 1986:832, Table 2; Whitley and Dorn 1993:Table 2) rather than finished (but crude) tools. Bamforth and Dorn (1988:223) did, however, identify early-stage biface reduction debris that they dated to the Late Pleistocene. The current view is that the material is workshop debris and not an old assemblage.

**Possible Pleistocene Rock Art.** Using the controversial (e.g., Harry 1995) cation-ratio technique to date desert varnish, Dorn et al. (1986 [and references therein]; also see Whitley and Dorn 1993; Whitley et al. 1996) have argued that some petroglyphs from the northern and central Mojave Desert date to the Pleistocene, several as old as 18,000 years B.P. A number of these cation-ratio dates has apparently been supported by AMS radiocarbon dates on encapsulated organics in the varnish (Dorn et al. 1986; Whitley et al. 1996). However, these techniques remain unverified and the results should be considered tentative.

**Discussion.** Several major issues must be

addressed when considering the evidence for a Pre-Projectile Point (or pre-Clovis) Period in the Mojave Desert. First, and perhaps most importantly, there has been little systematic research conducted on such sites or assemblages (the work of Davis [1978] at Lake China being a notable exception). Second, very little of the work has been adequately described in print. Third, claims of antiquity are usually based on typological grounds; that is, that the materials recovered from the sites are "crude" and therefore old. Such claims can easily be dismissed, since such typology alone cannot (usually) serve as a chronological placement technique. Whitley and Dorn (1993) argued that for there to be unequivocal pre-Clovis sites in South America (e.g., Monte Verde), there most likely had to have been a pre-Clovis migration through North America (e.g., through the Desert West, including the Mojave Desert), and that such evidence must exist, although perhaps not well-preserved (e.g., Butzer 1988). Nevertheless, if there was a pre-Clovis occupation of the Mojave Desert, it remains well hidden.

### The Paleoindian Period

The Paleoindian Period (ca. 12,000 to 10,000 years B.P.) follows the hypothetical Pre-Projectile Point Period, and Paleoindian sites contain fluted (e.g., Clovis) points and related materials (no Folsom Complex points are known from California [Moratto 1984:87]). Clovis materials typically are viewed as representing the Big Game Hunting Tradition emphasizing the exploitation of Pleistocene megafauna (e.g., Willey 1966; Davis 1978; Chartkoff and Chartkoff 1984; Moratto 1984). It is much more likely that, in addition to megafauna, Paleoindian peoples utilized a wide variety of resources, including plants and small game.

Evidence for a Mojave Desert occupation by people possessing a fluting technology is limited to relatively few finds of fluted Clovis or Clovis-like points. These finds are widely distributed

across the Mojave Desert (e.g., Warren and Phagan 1988; Basgall and Hall 1991) and rarely are dated by other than typological means. Only one Clovis "occupation" site has been identified, at Lake China (Davis 1978; Davis and Panlaqui 1978a, 1978b, 1978c). A number of fluted lanceolate bifaces associated with Rancholabrean fauna were recovered from various loci. Radiocarbon dates (from tufa) at Basalt Ridge (at Lake China, see Davis and Panlaqui 1978c:95) fall between 13,300 and 10,800 radiocarbon years B.P., but the samples were not directly associated with cultural remains.

Clovis projectile points, often found as isolates, have been documented from the (primarily central) Mojave Desert (Rogers 1939; Brott 1966; Davis and Shutler 1969; Glennan 1971; Sutton and Wilke 1984; Warren and Phagan 1988; Basgall and Hall 1991, 1994; Basgall 1993; Haynes 1996), and most have been assigned their age on the basis of their typological similarity with dated specimens from the Plains.

### THE ARCHAEOLOGICAL RECORD OF THE HOLOCENE

The environmental transition from the Pleistocene to the Holocene appears to have been relatively gradual. If cultures developed—at least partly—in response to changing natural conditions, we should not expect the transition from Pleistocene Paleoindians to Holocene (Archaic)<sup>2</sup> hunter-gatherers to be abrupt. One of the difficulties in delineating chronological periods and/or cultural traditions lies in clearly describing the transitions.

#### The Pleistocene/Holocene Cultural Interface

In the Mojave Desert, Clovis is generally viewed as being distinct from the Western Stemmed (e.g., Lake Mojave) Complex (Warren and Phagan 1988:128; Willig and Aikens 1988: 3, Table 1; Basgall and Hall 1994:65). If this is true, Clovis should have an associated technological complex distinct from Lake Mojave.

Such a complex has yet to be identified in the Mojave Desert (but see Davis 1978), and Clovis materials appear to be isolated. However, the known Clovis points are all of local materials, indicating a permanent presence. Clearly, this issue remains to be resolved (Warren and Phagan 1988:129).

The economic focus of the Paleoindian Period is presumed to have been oriented toward big game (e.g., Heizer and Baumhoff 1970; Watters 1979), based on the occasional remains of megafauna (e.g., at Lake China) and on an absence of millingstones, the inference being that plants were not important. There are few data to support this view and it is probably unwarranted. However, megafauna do drop out of the record at the beginning of the Holocene, signifying a "shift" to a more generalized economy, commonly called the Archaic. If "megafauna" was a Paleoindian focus, it may be that the earliest Holocene peoples still retained that focus (assuming cultural continuity, e.g., Warren 1986, 1991), although it was ultimately an unsuccessful one (as the species became extinct). Warren and Crabtree (1986:184) considered Lake Mojave to be "a Paleo-Indian assemblage . . . ancestral to the early Archaic cultures of the Pinto period." Thus, Lake Mojave Period materials may reflect the first phase of a transition from a Paleoindian toward an Archaic adaptation, while Pinto Period materials may represent the final phase of the transition to the Archaic (see discussion below; also see Willig and Aikens 1988). However, Chartkoff and Chartkoff (1984:99-105) included Lake Mojave in their Early to Middle Archaic periods.

#### The Early Holocene Record

**The Lake Mojave Period (ca. 10,000 B.P. to 7,000 B.P.).** At the end of the Pleistocene, a cultural change is evident throughout North America as artifact and ecofact assemblages become more diverse and generalized, implying a shift to more broadly based economies. In the

Mojave Desert, such remains typically fall under the broad designation of the Western Lithic Co-Tradition (Davis et al. 1969), the Western Pluvial Lakes Tradition (Bedwell 1973), or the Western Stemmed Tradition (Willig and Aikens 1988). Included in these definitions are the Playa and Malpais cultures (Rogers 1939), the San Dieguito Complex (e.g., Rogers 1966; Warren 1967), and the Lake Mojave Complex (e.g., Campbell et al. 1937; Wallace 1962; Warren and Crabtree 1986). The designation of Lake Mojave<sup>3</sup> is herein used to refer to this immediately post-Paleoindian cultural complex in the Mojave Desert.

Lake Mojave materials were first identified at Lake Mojave (Campbell et al. 1937) in the central Mojave Desert (Fig. 3), when several dozen sites were discovered on Terminal Pleistocene and Early Holocene surfaces along its fossil shoreline. Lake Mojave materials have since been discovered on the fossil shorelines of a number of other Pleistocene-age lakes in the southwestern Great Basin and at a few nonlake sites. Cleland and Spaulding (1992:3) argued that Lake Mojave Period sites are absent on most known Terminal Pleistocene and Early Holocene surfaces away from lake margins, supporting an association of Lake Mojave sites with lakes. If true, this is an interesting association; however, it may simply be a sampling problem (the lake margin is where archaeologists look).

The dating of Lake Mojave sites originally was based on the assumed dates of the presence and final desiccation of the Pleistocene lakes, and lacked chronometric confirmation. However, the occupation of the shoreline of Lake Mojave at about 10,000 B.P. is now reasonably well-established (Warren and DeCosta 1964; Warren and Ore 1978; also see Wells et al. [1989:118-122] for information on the hydrologic history of Lake Mojave).

The primary marker artifacts of the Lake Mojave Period are the long-stemmed Lake Mojave and the shorter stemmed and shouldered

Silver Lake projectile points (Fig. 2), presumably employed on thrusting spears. Warren and Crabtree (1986:184) included fluted points and crescents as part of their early Lake Mojave Complex (also see Tadlock 1966:668-669). However, most researchers would agree that the Paleoindian and Lake Mojave periods are technologically separate (see Warren and Phagan 1988:128), and fluted points are herein considered part of the Paleoindian Period (see above).

*Regional Expressions.* The Lake Mojave Complex itself is a regional expression of the Western Pluvial Lakes Tradition. Comparable materials are widespread in the Great Basin (e.g., Warren and Ranere 1968; Moratto 1984; Bryan 1988; Willig and Aikens 1988), suggesting the possibility, if not the likelihood, of some cultural relationships. Similar assemblages also are present in the Tulare Lake Basin of the southern San Joaquin Valley of California (Wallace and Riddell 1988), but the technological, temporal, and cultural relationships of this material have yet to be determined.

Within the Mojave Desert, there currently are no defined subregional geographic expressions of Lake Mojave. However, Lake Mojave Period sites are known in both the central and eastern Mojave Desert (e.g., Warren and Schneider 1989; Basgall and Hall 1992:5, 1994:63; Basgall 1993), but are rare in the western Mojave (Sutton 1988a), except perhaps in the Lake China/Coso area (Davis 1978; Hildebrandt and Gilreath 1988; Gilreath and Hildebrandt 1991). Whether this distribution has cultural significance is not known.

There is some reason to believe that there was cultural continuity between Lake Mojave and the following Pinto Period (or that there was at least a single technological tradition, e.g., Warren 1994:113). While there are a number of single component Lake Mojave and Pinto sites, two sites in the central Mojave Desert (Rogers Ridge [CA-SBR-5250, Jenkins 1987] and Henwood [CA-SBR-4966, Warren 1991:292]; also see

Fig. 3) contain both Lake Mojave and Pinto series points in contemporaneous context. The discovery of both Lake Mojave and Pinto series points at these sites led Jenkins (1987) to suggest that the two point series co-occur for some interval of time, at least in some places (in what Warren [1994:Table 1, 113] suggested was an interface between Lake Mojave and Pinto dating to about 8,500 B.P.). However, there are few hard chronometric data in support of the association and the possibility is not widely accepted (Basgall 1993:79-80; Basgall and Hall 1994:65).

*A Note on Lake Mojave Period Cultural Ecology.* Lake Mojave Period cultural ecology is not well understood. Warren (1967:184, 1991:332) viewed the cultural ecology of the Lake Mojave (his San Dieguito) Period as being generalized but nonetheless focused on the hunting of artiodactyls. Others (Bedwell 1973; Hester 1973) interpreted the adaptation to be related to the exploitation of lake resources, a logical premise given the geographic distribution of most known Lake Mojave sites on fossil shorelines. Davis and Panlaqui (1978b) further suggested that Lake Mojave Period peoples utilized the lakeshores as part of a larger seasonal round.

Many researchers continue to hold a series of general assumptions regarding biotic communities and human adaptations leading to the belief that Lake Mojave Period peoples subsisted primarily by hunting (see discussion in Basgall and Hall 1994:71-76). The artifact assemblages (projectile points but relatively few millingstones [but see Warren 1991:248; Basgall 1993:160, 234, 379]) create and reinforce this view. The apparent geographic association of these sites with lakeshores suggests access to at least three major ecozones (terrestrial, shoreline, lake) that are presumed to have contained a diverse resource base. However, few empirical subsistence data have been collected, as relatively few sites have been excavated (or reported) and preservation of ecofactual materials often is poor (e.g., Douglas et al. 1988).

Virtually nothing is known regarding plant usage during the Lake Mojave Period. Although the absence of millingstones is a criterion for the Lake Mojave Period, a few have been discovered at several sites (e.g., Henwood [Warren 1991] and Deception Knoll [Basgall 1994]), suggesting the possibility of plant exploitation (it is reasonable to assume that plants were utilized, even with a lack of hard data for the period). Nevertheless, hunting remains an assumed focus. Based on the work at Fort Irwin in the central Mojave Desert, a Lake Mojave Period focus on artiodactyls and lagomorphs, with some rodents and reptiles, has been proposed for some early Holocene deposits at several sites (Basgall 1993: 139, 161, 234, 1994:68; Basgall and Hall 1994: 76). Apple and York (1993:113) reported the identification of deer protein on two artifacts from a Lake Mojave Period site (CA-SBR-6566) on the northern shore of Lake Mojave, providing some evidence of game utilization. In the future, new and improved techniques, both in the field (many sites were excavated decades ago) and in the laboratory (e.g., phytolith analysis, testing for protein residues), offer important avenues for research.

**The Pinto Period (ca. 7,000 B.P. to 4,000 B.P.).** The Pinto Period follows the Lake Mojave Period and is marked by the appearance of Pinto series projectile points (Fig. 2), first defined at Pinto Basin (Campbell and Campbell 1935; also see Rogers 1939) (see Fig. 3), and presumably used on atlatl darts. The type locality at Pinto Basin (Campbell and Campbell 1935) extends for miles along a major wash, and numerous loci, now recorded as separate sites, were discovered that contained a diverse assemblage from millingstones to projectile points (Amsden 1935). The second major Pinto type locality is the Stahl site, located in the northwestern Mojave Desert (Fig. 3), and first investigated by Harrington (1957), who discovered a diverse artifact assemblage and possible structural remains.



Both of these type sites contained a diverse artifact assemblage, including millingstones, and the initial definition of the "Pinto culture" included milling equipment. This artifact diversity is not reflected in all Pinto-age assemblages, however, as millingstones are absent or rare at many sites (e.g., McGuire and Hall 1988:317), but present in some others (e.g., the Awl site [CA-SBR-4562, Jenkins and Warren 1986] and CA-SBR-5251 [Hall 1994]; see Fig. 3).

A major problem in delineating the Pinto Period is the continuing disagreement on the formal definition and dating of "Pinto" points (e.g., Warren 1980; Thomas 1981; Vaughan and Warren 1987; Schroth 1994). Both the Pinto Basin and Stahl sites were recently reinvestigated (Schroth 1987, 1994) in an effort to resolve some of the problems surrounding the classification of Pinto points. Schroth (1994:374-375) concluded that the Pinto form was not the result of a mental template and so could not be used as an "index fossil" for anything other than dart point times (ca. 10,000 to 2,000 B.P.). This conclusion rather complicates matters.

The Pinto Period was once thought to have begun about 4,000 years ago, a date that would imply an occupational "hiatus" between the Lake Mojave and Pinto periods (see Jenkins and Warren 1984). However, recent radiocarbon data from several purported Lake Mojave/Pinto sites in the central Mojave Desert now support an early date, perhaps 7,000 B.P. or even earlier (Jenkins and Warren 1986; Jenkins 1987:227-228; Warren 1991:264-267; but see Meighan 1989). Thus, as it is now understood, the beginning of the Pinto Period immediately follows (and perhaps even overlaps) the end of the Lake Mojave Period, and the occupation of the region appears to have been continuous. However, Warren and Crabtree (1986:187) suggested that Pinto Period settlement patterns may have fluctuated, with lower elevations being essentially uninhabited at some times.

Pinto appears to be a broadly generalized

cultural adaptation related to a climatic shift to an increasingly xeric environment and the final desiccation of the Pleistocene lakes (by at least 6,800 B.P., conditions were more arid than those of the present [Spaulding 1991, 1994]). As aridity increased, settlement patterns seem to have changed from lakeshore habitats in Lake Mojave times to stream and spring localities, perhaps mirroring the assumed increase in tethering of game populations to those water sources. Warren (1986, 1991) proposed that the subsistence focus of Pinto remained similar to that of the Lake Mojave Period, at least initially, and that the pursuit of "big game" (artiodactyls) remained a major goal. As game populations declined, Warren hypothesized, the effort to obtain them would have intensified with a decreasing rate of success, eventually leading to a collapse of the system and a shift to a more broadly based economy. Thus, if one were to classify Lake Mojave as Paleoindian, Pinto might be viewed as the transition to the Archaic.

Other Pinto sites include those known in the north-central Mojave (e.g., Basgall and Hall 1992:5; Hall 1994; and as noted above), none of which appears to be associated with fossil lakes. At least three buried hearth features were discovered at CA-KER-3939 (Gardner et al. 1994, 1995; also see Fig. 3) in the western Mojave Desert and were dated between  $6,968 \pm 109$  (AA-14553) and  $5,602 \pm 71$  (AA-14548) RCYBP (the earliest Holocene radiocarbon dates in that region, presumably dating the site to the Pinto Period). Although the analysis of the contents of the features is incomplete, charcoal, carbonized seeds, and one obsidian flake have so far been recovered.

Two sites containing Pinto-age human remains are known, a human cremation from Ludlow Cave (dated at ca. 6,000 B.P. [Osborne 1993]; see Fig. 3) and an inhumation from the Barstow area (ca. 7,000 B.P. [Reynolds 1980]). Recognizing the extraordinarily small sample, this may indicate that both inhumations and cre-

mations were practiced during the Pinto Period, and this dichotomy in mortuary practices might serve as a regional marker.

**Pinto Period Subsistence.** Subsistence data from the Pinto Period are primarily limited to faunal remains, with lagomorphs being the most frequent, followed by artiodactyl (including deer, sheep, and pronghorn) remains. Some reptiles and rodents are also present, and tortoise is notably absent. The same pattern is evident at the Awl site (CA-SBR-4562, Jenkins and Warren 1986:156; Basgall 1993:362-363) and at Rogers Ridge (CA-SBR-5250, Basgall 1993:361). However, a slightly different picture is reflected from the Henwood site (CA-SBR-4966, Douglas 1991), where lagomorphs dominated, but where artiodactyls were rare and tortoise was present in some number. Utilized animals were not limited to vertebrates, however, as a considerable number ( $n = 1,314$ ) of *Anodonta* shell fragments was found in association with a Pinto-age hearth (dated to  $6,640 \pm 65$  RCYBP, Beta-45611, ETH-7129 [Hall 1994:74]) at CA-SBR-5251 in the central Mojave Desert (Hall 1994:78). The vertebrate faunal assemblage from the CA-SBR-5251 site consisted primarily of lagomorphs and large mammals.

Information on plant utilization during the Pinto Period is very limited. Some evidence of pinyon processing (pinyon hulls in three hearth features) was discovered at a Pinto-age (ca. 6,500 B.P.) locus at Surprise Spring (Fig. 3; Altschul 1990:105-106), hinting at the use of pinyon during Pinto times. The presence of millingstones at many Pinto Period sites is suggestive that plant processing was performed (as would be expected), but it should be remembered that other resources may have been processed on such equipment (Yohe et al. 1991).

In spite of the rather limited data, considerable diversity appears to be present in Pinto Period economic assemblages, indicating "the expansive nature of Pinto period subsistence tactics" (Hall 1994:78). The artifact assemblages

recovered from the various Pinto Period sites, including projectile points and milling equipment, support this conclusion.

### The Middle Holocene Record

**The Gypsum Period (ca. 4,000 B.P. to 1,500 B.P.).** The inception of the Gypsum Period (sometimes called the Newberry Period [Bettinger and Taylor 1974]) is marked by the appearance of several projectile point forms (Fig. 2), notably Elko series and Gypsum points (interpreted as dart points) and Humboldt Concave Base forms (viewed as either points or knives). Gypsum points, originally defined at Gypsum Cave (Fig. 4), were first thought to be Pleistocene in age (Harrington 1933), but subsequently have been redated (Heizer and Berger 1970). Lyneis (1982:176) argued that Gypsum was separate from Elko, and Fowler et al. (1973:81) suggested that Gypsum was a localized development in the northeastern Mojave. Lyneis (1982:177) suggested that a major occupation of "valley floors" occurred during the Gypsum Period. Both Gypsum and Elko points are known for the entire Mojave Desert and are generally considered temporally coeval. While the relative paucity of Gypsum Period sites has been cited as evidence of a sparse occupation, the considerable Gypsum Period material from the Fort Irwin (Basgall et al. 1988; McGuire and Hall 1988; Basgall and Hall 1992:6) and Death Valley regions (Hunt 1960; Wallace 1958, 1977, 1988a) suggests that the paucity of identified Gypsum Period sites in the remainder of the desert may be due to sampling error and the rarity of marker artifacts (Hall and Basgall 1994:82, 85).

The age of the Gypsum Period has been established by a number of radiocarbon dated sites. It begins at about 4,000 B.P., at the onset of a cooler and wetter interval. An increase in water would presumably result in "more favorable" conditions (e.g., greater biomass) in the desert and may have influenced changes in the cultural adaptations, including increasing popu-

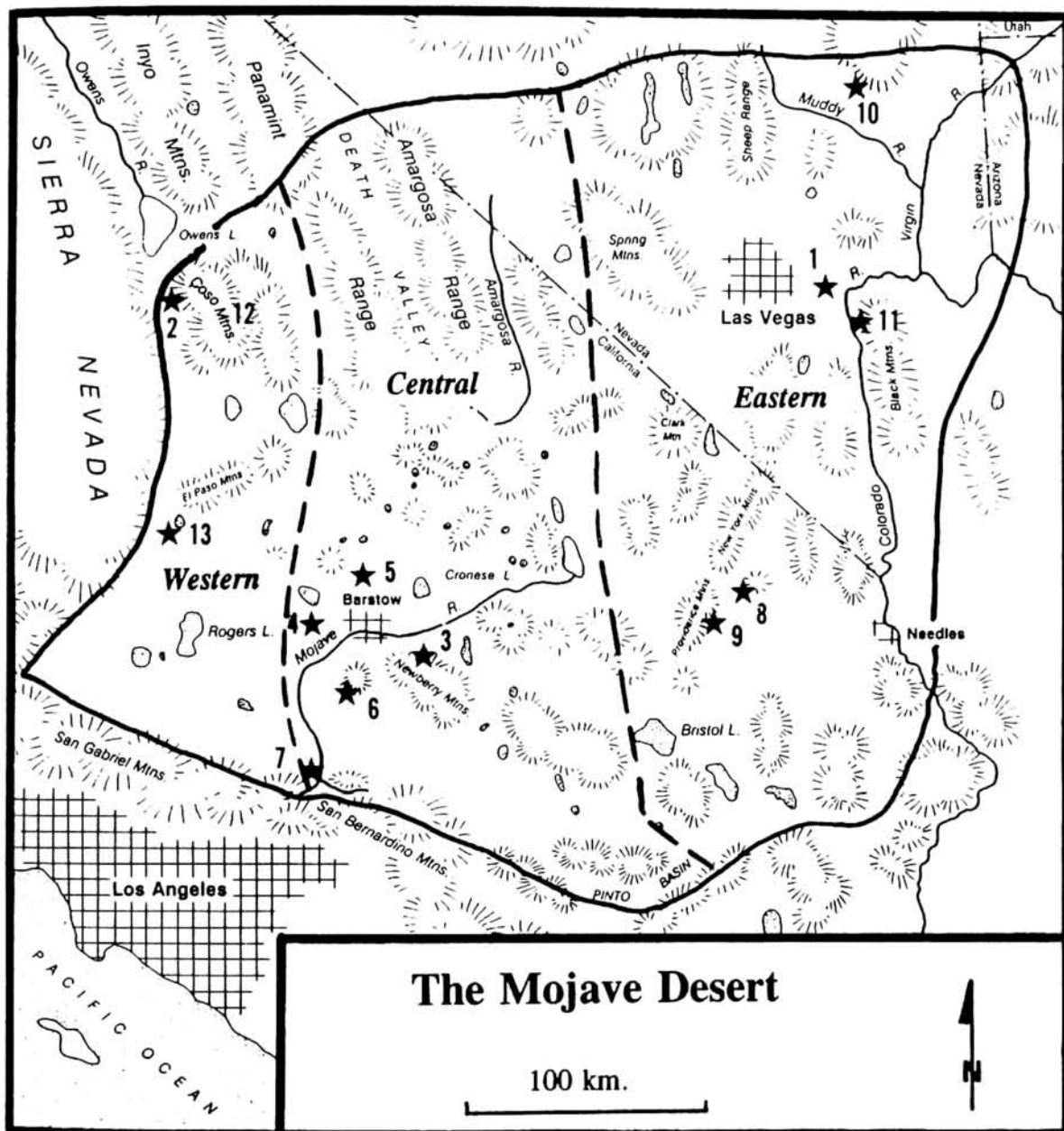


Fig. 4. Location of Middle Holocene (Gypsum Period) sites and localities mentioned in the text: (1) Gypsum Cave; (2) Rose Spring (CA-INY-372); (3) Newberry Cave (CA-SBR-199); (4) the Hinkley site (CA-SBR-189); (5) Owl Canyon (CA-SBR-3801); (6) Ord Shelter (CA-SBR-2846); (7) the Siphon site (CA-SBR-6580); (8) Rustler Rockshelter (CA-SBR-288); (9) Mitchell Caverns (CA-SBR-117); (10) Stuart Rockshelter; (11) Willow Beach; (12) the Coso Range; (13) the Koehn Lake site (CA-KER-875).

lation, trade, and social complexity.

In the western Mojave, the Rose Spring site (Lanning 1963; Yohe 1992; Fig. 4) contains a stratified record dating from Gypsum times. Ra-

diocarbon dates from the Gypsum component at Rose Spring fall between 2,200 and 4,000 B.P. (Yohe 1992: Tables 24 and 25), but few data relating to Gypsum Period lifeways are currently

available from the site. Elsewhere in the western Mojave, materials of Gypsum age and association have been found at several sites (e.g., CA-KER-526, Byrd et al. 1994). Much of the rock art of the Coso Range may date to Gypsum times (Grant et al. 1968), and may represent ritual activities, although some (e.g., Wilke and Rector 1985) have questioned the interpretation of ritual function.

In the central Mojave, the most notable Gypsum site is Newberry Cave (Smith et al. 1957; Davis and Smith 1981; Fig. 4). This site apparently contains a cache of specialized hunting and ritual equipment, including Elko and Gypsum projectile points, fragments of darts, split-twig figurines, paint, and rock art, all radiocarbon dated to between ca. 3,000 and 3,800 B.P. (Davis and Smith 1981:Table 2). Other dated Gypsum Period sites (see Fig. 4) include Hinkley (Leonard 1980) and Owl Canyon (Eckhardt et al. 1982; Sutton 1986a) near Barstow, and the Ord Shelter trapline cache east of Victorville (Echlin et al. 1981).

At Fort Irwin (Fig. 4), at least 10 Gypsum Period sites have been investigated (see summary by Hall and Basgall 1994). The work at those sites has documented significant changes between Gypsum and later periods. Gypsum assemblages at Fort Irwin contain greater numbers of bifaces; the decrease beginning in Rose Spring times probably reflects the change from dart to arrow points (Basgall et al. 1988:309). Gypsum faunal assemblages contain greater amounts of artiodactyl remains than do later components (which contain larger numbers of smaller animals), leading Basgall et al. (1988:312) to suggest a shift in subsistence orientation (from large to small game) as well as a decrease in residential mobility (not having to pursue large game). Interestingly, "Coso style" rock art is present in the Tiefert Basin at Fort Irwin (apparently during Gypsum times), suggesting that the hunting of large game may have been important (McGuire and Hall 1988:319).

Recent excavations at the Siphon site (CA-SBR-6580; Sutton et al. 1993), at the headwaters of the Mojave River (Fig. 4), revealed a 3,500-year-old deposit that contained Pinto series and Elko-looking points, suggesting an association with the Gypsum Period in the Mojave Desert. However, the artifact assemblage included many items related to the Millingstone Horizon of coastal southern California. The desert influences at the Siphon site seem clear, but it appears to be more closely related to the southern California Millingstone Horizon than to the desert (as did the nearby Crowder Canyon sites [Basgall and True 1985]; also see McDonald et al. [1987:66]).

In the eastern Mojave Desert (see Fig. 4), Gypsum Period materials were recovered from the lower level of Rustler Rockshelter (Davis 1962; Sutton 1992) and at Mitchell Caverns (Pinto 1989). At Stuart Rockshelter in southeastern Nevada, the lowest level was radiocarbon dated to ca. 4,000 B.P. and contained "Pinto" (likely Humboldt series) points with Elko series points being stratigraphically superior (Shutler et al. 1960). Other Gypsum Period materials are known from Willow Beach (Schroeder 1961) and Gypsum Cave (Harrington 1933; Heizer and Berger 1970).

One of the more interesting aspects of the Gypsum Period is evidence of hunting rituals in the form of split-twig figurines and other materials recovered from Newberry Cave (Davis and Smith 1981) and in the extensive rock art in the Coso Range (Grant et al. 1968) that have been dated to this period (see discussion in Warren 1984:417-419). The specific inferences for human behavior are not understood.

**Gypsum Period Adaptations.** The social organization and subsistence base of Gypsum populations are poorly known, although the hunting of mountain sheep may have been important (e.g., Grant et al. 1968; Davis and Smith 1981) and rodents were known to be trapped (Echlin et al. 1981). Hall and Basgall (1994:85) noted the



presence of artiodactyl, lagomorph, rodent, and tortoise remains at Gypsum Period sites in the central Mojave Desert. It is clear that there were connections (e.g., split-twig figurines) between the central and eastern Mojave Desert and the Southwest during Gypsum times.

Based on the estimated dates of the establishment of large villages, Sutton (1988a) suggested that a major population increase began in the western Mojave Desert ca. 3,000 B.P. However, more recent excavations in the area suggest that this date probably should be revised upward to the latter part of the Gypsum Period, to perhaps as late as 2,000 B.P. The basal radiocarbon dates from the major "village" along the shoreline of Koehn Lake (Fig. 4) suggest its establishment about 1,700 B.P., and may reflect a major stand of Koehn Lake (Sutton 1986b, 1990; Sutton and Hansen 1986). Gilreath and Hildebrandt (1991:7:60) reported a marked increase in the number of sites in the Coso area beginning about 2,300 B.P., and it is possible that this is related to events elsewhere in the western Mojave Desert.

### The Late Holocene Record

**The Rose Spring Period (ca. 1,500 B.P. to 1,000 B.P.).** Beginning about 1,500 B.P., small projectile points (Eastgate and Rose Spring series; Fig. 2) appear in the record, likely marking the introduction of bow-and-arrow technology, and generally replacing the dart points (e.g., Elko and Gypsum) used in conjunction with the atlatl. The term Rose Spring is used herein following the diagnostic projectile point series (Heizer and Baumhoff 1961:123; Lanning 1963), and is roughly equivalent to the Amargosa Period (Wallace 1962) and the Saratoga Springs Period (Warren 1984:420).

Sites dating from the Rose Spring Period (see Fig. 5) are fairly common in the Mojave Desert, though relatively few have been investigated. The sites tend to have well-developed middens and abundant material culture, includ-

ing hunting and milling equipment, marine shell artifacts, and considerable obsidian from a variety of sources (the Coso Volcanic Field was the most widely used source in the western and central Mojave Desert [e.g., Gilreath and Hildebrandt 1991], but many local sources were used in the eastern Mojave Desert).

In the western Mojave Desert, major excavations have been undertaken (see Fig. 5) at Rose Spring (Yohe 1992), Coso Junction Ranch (Whitley et al. 1988), various sites in the Coso Range (Hillebrandt 1972; Gilreath and Hildebrandt 1991:Table 3), the El Paso Mountains (McGuire et al. 1982), Cantil (Sutton 1991), Koehn Lake (Sutton 1986b, 1990; Sutton and Hansen 1986), and at Cottonwood Creek (CAKER-303; Sutton 1988a). A major increase in population seems to have occurred during or just before Rose Spring times, at least in the western Mojave where large villages were established (Sutton 1988a, 1990; also see Whitley et al. 1988:8). Rose Spring Period architecture is known from at least two sites; a wickiup-like structure from Cantil (Sutton 1991) and a "pit-house" from the Koehn Lake site (Sutton 1990). Many of the large, open Rose Spring Period sites in the western Mojave lack significant Late Prehistoric components, suggesting a shift in settlement (and subsistence) patterns between the Rose Spring and Late Prehistoric periods.

Despite a relatively rich record for the Rose Spring Period in the central Mojave Desert, few data are available, particularly from south of the Mojave River. Most work involving Rose Spring Period sites has been undertaken at Fort Irwin north of Barstow (Basgall et al. 1988; McGuire and Hall 1988; Basgall and Hall 1992) and in Death Valley (Wallace 1988a). One of the most important sites is Saratoga Springs (Wallace and Taylor 1959; see Fig. 5), essentially the regional type site for the Rose Spring Period.

In the Providence Mountains area of the eastern Mojave Desert (Fig. 5), Donnan (1964) proposed a cultural sequence that included a pre-

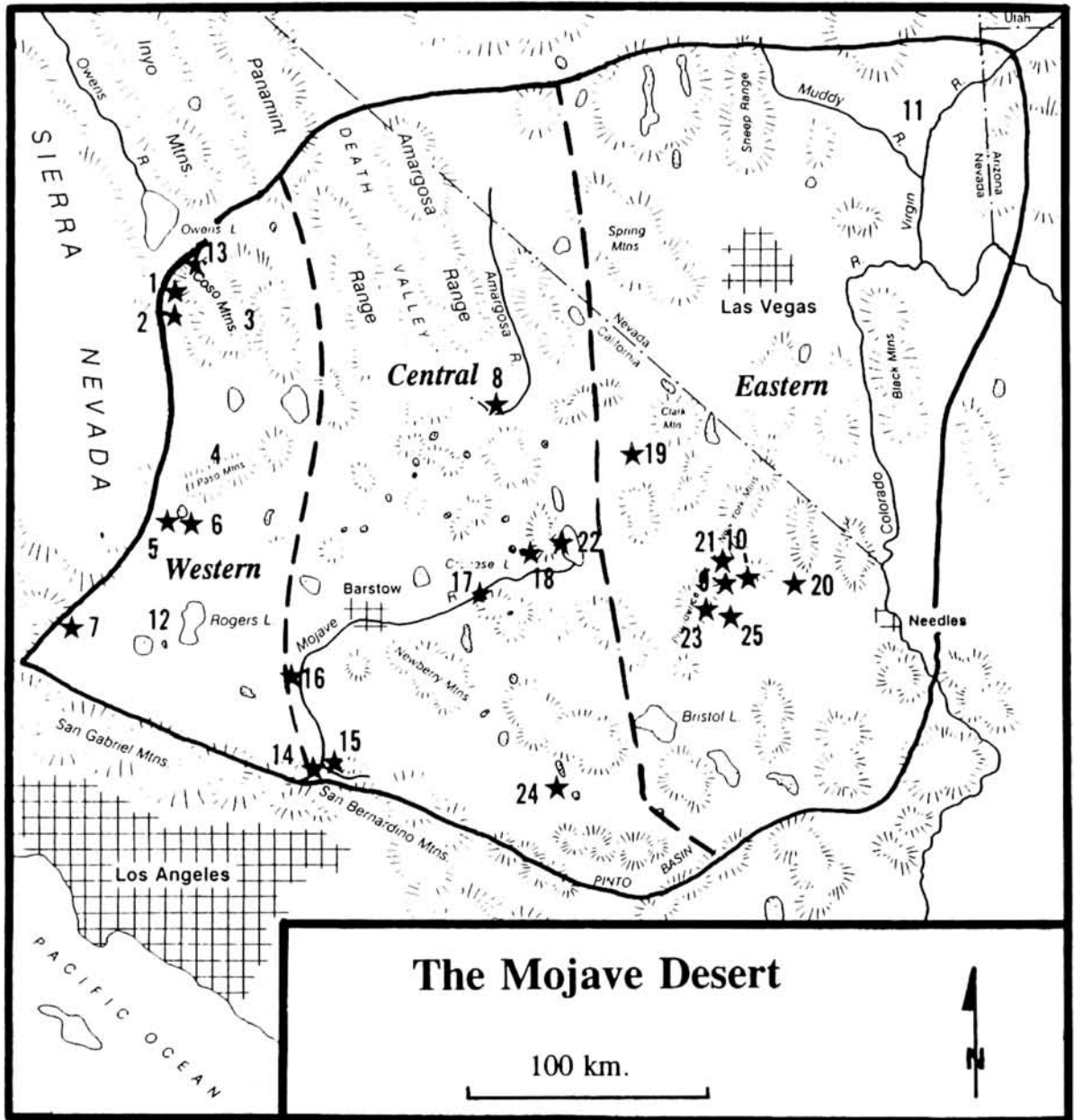


Fig. 5. Location of Late Holocene (Rose Spring and Late Prehistoric periods) sites and localities mentioned in the text: (1) Rose Spring (CA-INY-372); (2) Coso Junction Ranch (CA-INY-2284); (3) the Coso Range; (4) the El Paso Mountains; (5) Cantil (CA-KER-2211); (6) Koehn Lake (CA-KER-875); (7) Cottonwood Creek (CA-KER-303); (8) Saratoga Springs (CA-SBR-5547); (9) Southcott Cave (CA-SBR-334); (10) Rustler Rockshelter (CA-SBR-288); (11) Muddy and Virgin river area; (12) Rosamond/Rogers lake system; (13) Coso Hot Springs; (14) CA-SBR-1913; (15) Deep Creek (CA-SBR-176); (16) Oro Grande (CA-SBR-72); (17) Afton Canyon (CA-SBR-85); (18) Cronese Lakes; (19) Halloran Springs; (20) Vontrigger Spring (CA-SBR-413); (21) Counsel Rocks (CA-SBR-291); (22) Soda Springs Rockshelter (CA-SBR-363B); (23) Mitchell Caverns (CA-SBR-117); (24) Surprise Spring (CA-SBR-424); (25) Cooks Well (CA-SBR-322).

ceramic phase roughly equivalent to the Rose Spring Period. This phase was based on the 1962 excavations at Southcott Cave (Sutton et al. 1987) and Rustler Rockshelter (Davis 1962). Although analysis is not yet complete, additional excavations at Rustler Rockshelter (Sutton 1992, 1995) have confirmed the presence of Rose Spring Period materials at that site (but not at Southcott Cave [Sutton et al. 1987]). Warren (1984:395) noted that the cultural sequence of the Providence Mountains area diverged "from that of the northeastern Mojave Desert at the end of Amargosa I" (the early Rose Spring Period), and believed that the "Providence Complex, possibly preceded by a 'nonceramic Yuman' assemblage, appears to represent the Hakataya influence in the southeast Mojave Desert" (Warren 1984:395). Unfortunately, little else is known regarding Rose Spring Period settlement and subsistence in the eastern Mojave Desert.

**Rose Spring Period Adaptations.** Early interpretations of Rose Spring Period ecology were based on the original work at the Rose Spring site, from which Lanning (1963:246-248, Table 2) reported the recovery of numerous projectile points but only 18 milling implement fragments (manos, metates, and pestles), thus suggesting a hunting focus for the Rose Spring Period. However, recent investigations at that site (Yohe 1992) revealed the presence of a considerable number of portable milling implements, plus numerous bedrock milling features. Furthermore, this pattern is repeated at other Rose Spring Period sites in the western Mojave Desert (Cantil [Sutton 1991]; Koehn Lake [Sutton 1986b, 1990; Sutton and Hansen 1986]; and Cottonwood Creek [CA-KER-303; Sutton 1988a]), indicating that milling (presumably including plants) was an integral aspect of Rose Spring adaptation.

In sum, Rose Spring Period ecology appears not to have been specialized toward hunting (see the various references noted above and Gumerman 1985). Important resources included medium to small game (lagomorphs and rodents) and

a variety of plant foods, with a lesser emphasis on larger (e.g., deer-size) game than previously thought (this pattern is also reflected in the central Mojave [Basgall et al. 1988]). The exploitation of a variety of ecozones also is indicated.

**Agricultural Cultures of the Eastern Mojave Desert.** Beginning prior to the Rose Spring Period, and lasting through Rose Spring times, agricultural (and thus post-Archaic) peoples appear to have been present in portions of the eastern Mojave Desert. By about 1,300 B.P., Anasazi populations were well established in the Muddy and Virgin river areas (see Fig. 5) and controlled or influenced a considerable portion of the northeastern Mojave Desert (Shutler 1961; Leonard and Drover 1980; Warren et al. 1980; Lyneis et al. 1989; Lyneis 1992, 1995). Anasazi influence persisted into the early Late Prehistoric Period.

**The Late Prehistoric Period (ca. 1,000 B.P. to Historic Contact).** The Late Prehistoric Period is marked by Desert series (Desert Sided-notched and Cottonwood Triangular types; Fig. 2) projectile points, by various poorly defined brown ware ceramics (Bettinger 1986; Phippen 1986; Lyneis 1988), and, over the eastern three-quarters of the desert, by Lower Colorado Buff Ware. The period presumably reflects the late prehistory of the ethnographic groups inhabiting the region and has been variously called "Yuman" (Rogers 1945:168), "Hakataya" (Schroeder 1957, 1979), "Prehistoric Shoshonean and Yuman" (Wallace 1962:177), "Protohistoric" (Warren 1984:424), and "Shoshonean" (Warren and Crabtree 1986:191). In spite of the likelihood that these linguistic/ethnic assignments are mostly correct (e.g., Sutton 1989), the use of such ethnically weighted terms is dropped herein in favor of a purely descriptive term—Late Prehistoric. While the subsequent Protohistoric Period is highly significant and interesting (Arkush 1990), it is not very visible in the Mojave Desert; thus, it is not considered separately from the Late Prehistoric Period.



Most anthropologists view the Late Prehistoric as the archaeological extension of the ethnographic present (as witnessed by the use of ethnic period names). This approach appears to be valid for much of the Mojave, as regional interaction spheres (Sutton 1989) in the Late Prehistoric seem roughly the same as those in the ethnographic present, suggesting continuity for roughly the last 1,000 years. The exception to this is the southeastern Mojave Desert, where the Chemehuevi (a group speaking a Numic language) entered the area within the last several hundred years. It has been argued (Kroeber 1959; Lerch 1985; Sutton 1986c, 1987a) that the Chemehuevi replaced the earlier ceramics people (called Hakataya or Patayan by most archaeologists), and that these Hakataya were specifically the "Desert Mohave," a group speaking a Yuman language and related to the agricultural Mohave people along the Colorado River. There are two lines of evidence in support of the replacement idea; ethnography (including oral tradition) and ceramics in the archaeological record (see references above).

Schroeder (1979:100) defined the Hakataya as an agricultural "pottery-making people" who were "rock-oriented," that is, emphasized the use of stone in their various constructions (structures, rock rings, walls, roasting pits, alignments, etc.). In west-central Arizona, where the various Hakataya branches are relatively well-known (see Schroeder 1979:Fig. 1), considerable archaeological evidence as to their presence has been documented. While Schroeder (1979:Fig. 1) depicted Hakataya as extending across the bulk of the Mojave Desert, the evidence for a Hakataya presence in those areas is primarily limited to the presence of certain ceramics (e.g., Schroeder 1979:103), an artifact type that could be traded and that becomes increasingly rare as one moves west.

The Late Prehistoric Period is complicated by the fact that groups practicing agriculture were present in the eastern Mojave Desert dur-

ing that time. In the Muddy and Virgin rivers area of the northeastern Mojave (see Fig. 5), Anasazi peoples were present, perhaps having moved in from the Southwest and themselves later replaced by the Southern Paiute (hunters and gatherers who adopted small-scale agriculture). Along the Colorado River (and in western Arizona), the agricultural, ceramic-manufacturing groups (the Hakataya) appear to have been in place for some time and could be viewed as indigenous rather than intrusive. In some sense, then, "Formative" peoples (the Hakataya?) may have developed within the eastern Mojave Desert, as well as entering it already "developed," some subsequently being replaced by hunter-gatherers.

While there appears to be a greater number of sites dating to the last millennium than from earlier times, this may be somewhat illusory. The vast majority of sites is "dated" by their surface manifestations, and so many contain "late" components. However, earlier buried components may also be present but undetected, resulting in a disproportionate representation of late sites.

*The Western Mojave Desert.* An environmental factor that seems to have had major influence in the western Mojave Desert during Rose Spring times was increased effective moisture. A stand of Koehn Lake (Fig. 5) at the 1,930-ft. elevation appears to have occurred beginning sometime just after 2,000 B.P., as evidenced by a shoreline bench feature, the presence of "beach" sand in the geomorphic samples, abundant juniper seeds in the midden at the Koehn Lake site (in an area where juniper is now absent), and an adjoining large Rose Spring Period midden radiocarbon dated between 1,700 and 1,000 B.P. (Sutton and Hansen 1986). It is not known if this (apparent) mesic episode affected other lake systems in the western Mojave Desert (Rosamond/Rogers and China/Searles) or in Owens Valley. However, the Koehn Lake site appears to have been abandoned about 1,000

B.P., roughly the time of the first of the major "medieval droughts" (Stine 1994), when it is believed that Koehn Lake dried up (Sutton 1986b, 1990; Sutton and Hansen 1986; Sutton and Everson 1992). The western Mojave Desert appears to have been the homeland, or at least the southern part of it, for the expansion of populations speaking Numic languages north and east across the Great Basin (Fowler 1972, 1983; also see Sutton 1987a, 1994a; Madsen and Rhode 1994). It is possible that the drought hypothesized for the western Mojave Desert at about 1,000 B.P. was an influence in the movement of these people.

Important excavations of Late Prehistoric sites in the western Mojave Desert include the upper, and highly disturbed, component at Cantil (Sutton 1991), the upper component at Cottonwood Creek (CA-KER-303; Sutton 1988a), sites around the Rosamond/Rogers lake system on Edwards Air Force Base (e.g., Byrd et al. 1994), and at several other sites in the area (summarized by Sutton 1988a). Significantly, the Late Prehistoric occupation at both the Rose Spring (Yohe 1992) and Coso Junction Ranch (Whitley et al. 1988) sites in the northwestern Mojave is relatively minor, suggesting a settlement pattern shift from Rose Spring times. However, significant Late Prehistoric occupation is known in the Coso Volcanic Field area (Gilreath and Hildebrandt 1991), including the ethnographic Panamint village at Coso Hot Springs.

**The Central Mojave Desert.** In the central Mojave Desert, the Mojave River appears to have been the primary focus of occupation during the Late Prehistoric Period (e.g., Smith 1963). In the Summit Valley near the headwaters of the Mojave River, several late villages that were recently investigated (e.g., CA-SBR-1913 [Sutton and Schneider 1996]; the Deep Creek site [CA-SBR-176, Altschul et al. 1989]) indicated the presence of semipermanent base camps in that area late in time. The Oro Grande site (Rector et al. 1983), located along the Moja-

ve River near Victorville, proved to be a major, repeatedly used camp where lagomorph exploitation was important. Further downriver, the Afton Canyon site (Schneider 1989) contained a similar artifact assemblage but included ceramics, which were absent at Oro Grande. The exploitation of lithic resources and artiodactyls was important at Afton Canyon. A study of trails in the Afton Canyon area (James 1987, 1996) revealed a very complex system, indicating considerable activity.

Of particular interest is the presence of apparent Anasazi materials in the central Mojave Desert, discovered in the Cronese Lakes area (Rogers 1929; Drover 1979), along the Mojave River (Rogers 1929; Warren 1984; Schneider 1989), and at the Halloran Springs turquoise mines (Rogers 1929; Leonard and Drover 1980). These developments may be related to either the influence of Virgin Anasazi trade or to part of a problematic Anasazi "occupation" of the area, or a combination of both.

At Fort Irwin, in the central Mojave Desert north of the Mojave River, a number of late period sites have been investigated (Basgall et al. 1988; McGuire and Hall 1988; Hall and Basgall 1990). Data indicate an increasing dependence on small game (a pattern continuing from the Gypsum Period, see above), relating either to a decreasing abundance of larger animals and/or a shift in subsistence-settlement organization away from the exploitation of large game. Basgall et al. (1988:316) supported the idea of a shift in subsistence-settlement organization.

In Death Valley (the north-central Mojave Desert), the Late Prehistoric record is rich (Hunt 1960; Wallace 1977, 1988b). Wallace (1977: 129) suggested that the increase in the number of Late Prehistoric sites from the preceding period may indicate the arrival of the ancestors of the Panamint Shoshoni (part of the expansion of Numic peoples) in the area ca. 1,000 B.P.

**The Eastern Mojave Desert.** The Late Prehistoric Period in the eastern Mojave Desert is,

perhaps, the most difficult to address. At the beginning of the Late Prehistoric, much of the eastern Mojave was either occupied or influenced by agricultural populations centered along the Colorado River, populations that also practiced extensive hunting and gathering. It is not at all clear who occupied the eastern Mojave; there could have been practicing agricultural peoples living in the interior desert (there is no physical evidence of agriculture known), hunter-gatherers using ceramics traded from the river, or river agriculturalists who were hunting and gathering wild foods in the region. No specific research program to address these questions has been carried out.

After about A.D. 1700, the hunting and gathering Chemehuevi occupied part of this region, leaving a "vener" on the archaeological record and making the task of sorting out the various prehistoric ethnic units even more difficult. Late Prehistoric sites, mostly containing Lower Colorado Buff Ware ceramics (Hakataya?), are very common in the Providence Mountains and the Mid Hills area, indicating a significant population, at least during the early portion of the Late Prehistoric Period prior to the entrance of the Chemehuevi.

Excavations have been undertaken at a number of Late Prehistoric Period sites in the eastern Mojave Desert. Rustler Rockshelter (Davis 1962; Sutton 1992, 1995) contains a record dating from dart-point times. A record of ceramic traditions is present at the site, but lithic procurement and tool production were major activities there. Other excavated sites include Vonttrigger Springs (Sutton and Novickas MS), Counsel Rocks (Cameron and Rafter 1983), Soda Springs Rockshelter (Cameron 1984; Schroth and Joesink-Mandeville 1987), Southcott Cave (Sutton et al. 1987), Mitchell Caverns (Pinto 1989), Surprise Spring (Altschul 1990), and Cooks Well (Moskowitz 1994).

**Discussion.** There is a number of important issues regarding the Late Prehistoric Period

(e.g., Schneider 1988), particularly the fate of the apparently large populations in the western and southeastern Mojave Desert. It may be that the western Mojave Desert was depopulated by disease and/or forcefully by the Spaniards (Sutton 1988a), while in the eastern Mojave the Chemehuevi may have pushed out the Desert Mohave.

Additionally, there is a greatly reduced presence of obsidian in the southern half of the Mojave Desert during the Late Prehistoric Period, leading to the speculation that some sort of a trading (sociopolitical?) "boundary" was present (Sutton 1988b, 1989). This boundary roughly follows the ethnographically recorded linguistic boundary between Takic and Numic language groups (except the Chemehuevi) and may suggest that a major sociopolitical shift had occurred by about 1,000 B.P.

## GENERAL RESEARCH ISSUES

### Early Human Occupation

The physiographic situation of the Mojave Desert makes it a good place to look for early (pre-Clovis) human occupation. The presence of an extensive system of Pleistocene rivers and lakes provided an environmental setting where humans, if in the New World at an early date, could be expected to have lived. In addition, the "stable" (and inferentially old) and relatively pristine landforms suggest that such early sites could be located and investigated. The archaeological record provides some hope for proponents of early human occupation. Sites associated with lakeshores are known and morphologically old-looking lithic materials are widespread. The analytical problems include demonstrating firm associations of sites with lakeshores, dating the lakestands, and determining whether "old-looking" equals "old." To date, none of these associations has been shown to be true and no unequivocal evidence of pre-Clovis humans is known. However, there is nothing to

say that such evidence will not be found. The recent dating of some rock art is provocative (but not widely accepted) and may serve to re-energize some researchers.

### **The Paleoclimatic Record**

Considerable information regarding the distribution of biotic communities over time in the Mojave Desert has been, and is continuing to be, obtained and synthesized. These data are acquired from packrat nests, tree ring records, archaeological sites (botanical and faunal data), spring investigations, lake corings, and from a variety of other contexts. Portrayals of a very dynamic climatic history, particularly in the Holocene, is emerging.

However, virtually all of the interpretations regarding paleoclimate in the Mojave Desert (and elsewhere) are based on proxy data. While the presence of a particular species at a particular place and time may be well-demonstrated, the climatic meaning of that presence is quite another matter. Arguments rage over the amount of rainfall in an area, whether the temperature was higher or lower, how such conditions affected spring flow and animal populations, etc. As one might expect, the more recent and complete the data, the more agreement there is regarding its interpretation. As more paleoclimatic data are amassed, this situation can do nothing but improve.

The more difficult problem is to relate paleoclimatic information to anthropological issues. At what point in time do lake-adapted (Pleistocene) cultures "become" spring-adapted (Archaic) cultures? How do "droughts" affect desert-adapted hunter-gatherers? At what threshold does a drop in animal populations trigger human subsistence shifts? What were the social organizations present and/or necessary to successfully adapt to changing environmental conditions? These, and many other questions, remain unanswered (and sometimes unasked).

### **The Archaic as an Analytical Unit**

Is the Archaic a useful concept for ordering and understanding Mojave Desert prehistory, or is it just an arbitrary category used for convenience? If used as a "stage" of generalized hunter-gatherers, as operationally defined in this paper, then it is related to the antecedent Paleoindian adaptation, and in order to understand one, we must understand both.

Perhaps one of the most important problems in using the Archaic as an analytical unit in Mojave Desert archaeology is the tendency to "lump" cultures across temporal and geographic space. This sometimes occurs in the Great Basin, where the "Desert Archaic" period is often used. However, the use of a Desert Archaic concept "masks substantial change in the Mojave Desert 8000-1500 B.P." (Lyneis 1982:172), oversimplifies a very complex prehistory, and gives the impression of substantial cultural continuity throughout most of the Holocene. The record of the Archaic in the Mojave Desert is one of substantial variability and should not be concealed through the uncritical use of the "Archaic" concept.

In their discussion of the Mojave Desert, Chertkoff and Chertkoff (1984) end the Archaic at 4,000 B.P., apparently concluding that their succeeding period, the Pacific, exhibits a sufficient increase in social complexity. While this argument has merit in much of the California culture area, with its relatively dense populations and specialized economies, this does not seem to be a valid application in the Mojave Desert. Perhaps due to the environmental constraints of a relatively low productivity ecosystem, cultures throughout the Mojave Desert never became as large or as culturally complex as some of the California groups.

### **Paleoindian-Archaic Transition**

Adjunct to the above issue is an understanding of the transition from the Paleoindian



culture(s) of the Pleistocene to those of the Holocene. Clearly, environmental change affected the cultural transition, but how and to what degree? To answer that question, one must understand the environmental and cultural systems of both periods. The commonly held model of Paleoindian adaptation is predicated on the assumption that big game (namely Pleistocene megafauna) was emphasized. However, as noted above, it is more likely that the Paleoindian adaptation was much more generalized (e.g., Simms 1988). It may be that the Paleoindian adaptation of the Late Pleistocene was very similar to that of the Early Archaic, except that Paleoindians utilized "big" game, whereas the Archaic peoples did not. With the extinction of megafauna, along with the associated procurement and processing technologies, the adaptation "suddenly" became Archaic at some magic moment, even though the remaining large mammal species were still utilized. If this scenario approximates reality, it is clear that we must radically rethink both our definitions and research designs.

If, for example, the Lake Mojave Complex (and Period) is essentially a Paleoindian adaptation minus Pleistocene megafauna, it may be that Lake Mojave peoples retained a focus on big game even in an atmosphere of diminishing return. This is the same argument used to model the transition between the Lake Mojave and Pinto periods (Warren 1986, 1991); perhaps there were several transitions over time to adjust to the loss of that resource class. This model is testable, particularly given the potential of protein residue techniques (Kooyman et al. 1992; Newman et al. 1993).

### Rock Art Research

Rock art is widely distributed across the Mojave Desert, primarily pictographs, petroglyphs, and geoglyphs. Several important rock art research efforts have been undertaken, most notably in the Coso Range (Grant et al. 1968; Whitley 1982; Wilke and Rector 1985), at Black

Canyon (summarized in Turner 1994), in southern Nevada (Green 1987), and on geoglyphs (von Werlhof 1987). A variety of interpretations has been presented. Among the most interesting and innovative was the work of Whitley (1994) on the Coso petroglyphs, where he argued that the increase in bighorn sheep rock art after ca. 800 B.P. was not the result of hunters attempting to intensify hunting success but was an attempt by gatherers to increase rainfall.

### Archaic-Formative-Archaic Transitions

Archaic hunter-gatherers had occupied the northeastern Mojave Desert since the Pleistocene but were "replaced" by Formative agriculturalists within the last several thousand years. A Basketmaker/Anasazi archaeological sequence is evident in the Virgin/Muddy river region (Harrington 1927; Shutler 1961; Lyneis 1992, 1994, 1995). However, it is not clear whether these populations entered the area from the Southwest, perhaps displacing hunter-gatherer populations, or "evolved" in place. If it is an indigenous development, the Virgin Anasazi borrowed the full suite of Southwestern traits, from ceramics to architecture.

At about A.D. 1150, or shortly thereafter, the Virgin Anasazi abandoned the area and were replaced by the Southern Paiute, a Numic group, although it has been suggested that the Virgin Anasazi "developed" into the Numic (Gunnerson 1962). Ambler and Sutton (1989:41-42; also see Sutton 1986c) suggested that the Southern Paiute forced the Anasazi out of the area, although this argument is largely circumstantial. The other major possibility is that Anasazi populations withdrew into the Southwest due to environmental degradation (Larson and Michaelsen 1990), with the void being filled by the Southern Paiute.

In any case, both the transitions from Archaic to Formative and from Formative back to Archaic did occur, even if the details are very poorly understood. Perhaps both transitions are

related to similar processes occurring in the eastern Great Basin with the Fremont (e.g., Madsen 1982). Exploration of the details and modeling the anthropological causes and effects of these transitions could have widespread application.

### **Settlement/Subsistence Models (Human and Cultural Ecology)**

There currently is no coherent baseline of human or cultural ecology for the Mojave Desert, not even for the ethnographic period (but see Fowler 1995). The Great Basin model (Steward 1938; Thomas 1971) is not applicable, except in a very broad sense, due to the significant difference in the biotic environment and resource base between the Great Basin and Mojave deserts. In addition, the environmental regimes of the Mojave Desert during the Holocene and Late Pleistocene are poorly known (particularly to archaeologists), and there is a great need to understand more fully the apparently diverse and dynamic paleoclimatic record (Spaulding 1990). Such an understanding is key to the reconstruction of settlement/subsistence systems and to the modeling of cultural change over time. There is, however, a number of ideas regarding changing settlement/subsistence patterns from period to period. These transitions, discussed above, are only very broadly known, and no complete settlement/subsistence systems have been described (issues of sedentism or territoriality remain unexplored). Consequently, researchers are forced to look at small segments of systems and model the remaining, usually major, portion. Such an approach is ultimately unsatisfactory, but it is a start.

**Changing Settlement/Subsistence in the Western Mojave Desert.** Recently, a model of changing settlement/subsistence systems in the Fremont Valley over the last several thousand years has been proposed (e.g., Sutton 1988c, 1990, 1991) based on data from excavations at the Cantil and Koehn Lake sites and from earlier work in the southern Sierra Nevada. The first

system, perhaps dating to Gypsum times, was hypothesized (based on site location) as being related to riparian habitats, with exploitation of the surrounding areas. It is presumed that Koehn Lake was dry during this time. The second system, primarily dating to Rose Spring times, changed from the previous pattern, when Koehn Lake apparently became filled (ca. just after 2,000 B.P.?). This second pattern involved the occupation of lakeshore sites and probably focused on the exploitation of lacustrine resources and lagomorphs. The third system, dating after ca. 1,000 B.P., exhibits a shift in the settlement/subsistence pattern away from the lake and back to a dependence on streams and/or springs, and an apparent (but as yet unknown) shift in resource exploitation. The Rose Spring component at the Cantil site (Sutton 1991) contains attributes of the second and third patterns: it is dated at the end of the second pattern (or at the beginning of the third) and is associated with a riparian habitat. Thus, the Cantil site might be viewed as a transitional adaptation between the second and third patterns.

Assuming that the later climate was hotter and drier than during the preceding Rose Spring times, segments of the population may have moved out of the area as a response to more xeric conditions. There is some reason to suspect that the pattern of major Kawaiisu occupation of the southern Sierra Nevada documented during the ethnographic period is late (Sutton 1991), as suggested by the current understanding of the archaeology of the area (e.g., Pruett 1987). Sutton (1991) suggested the possibility that, due to the beginning of a warmer and drier period beginning about 1,000 B.P., the Kawaiisu core occupation area shifted from the western Mojave Desert to the southern Sierra Nevada. However, the Kawaiisu still retained claim to the western Mojave Desert, as recorded by Kroeber (1925) and Zigmund (1986).

Further, if the southern Sierra Nevada/western Mojave Desert supported a substantial popu-

lation until about 1,000 B.P. when the environment deteriorated, as suggested above, those people may have intruded upon their neighbors to the north and east. This may have been the beginning of the Numic expansion thought to have originated in this area at about this time (Sutton 1987a, 1994a; Madsen and Rhode 1994).

The expansion of population documented in the Antelope Valley to the south (Sutton 1988a, 1988c) seems to have begun too early to have been influenced by the apparent desiccation of Koehn Lake at ca. 1,000 B.P. However, the initial establishment of the Koehn Lake site may date from the same time (ca. 2,000 B.P.) as the population extended to the south, and could be related. If there was a series of lakestands in the Fremont Valley throughout the Holocene (as it appears from multiple visible fossil shorelines), the implications regarding our understanding of prehistoric cultural ecology and population movements could be quite significant.

### Linguistic Prehistory

Although the ethnographic distribution of languages in the Mojave Desert is not very complex, as it is in the California culture area, this relative simplicity belies a very complicated and dynamic situation in prehistory. The western Mojave Desert/southern Sierra Nevada region appears to be the homeland of Northern Uto-Aztecan (NUA), a large language group that includes the Takic, Numic, Hopic, and Tubatulabal branches (Lamb 1958) and commonly, but erroneously, referred to as "Shoshonean." According to the current majority view (summarized by Sutton 1994a; but see Aikens and Witherspoon 1986; Aikens 1994), NUA arrived in the western Mojave/southern Sierra Nevada region about 5,000 years ago and diverged into the four branches listed above about 3,000 years ago. While the Tubatulabal branch (consisting of one language, Tubatulabal) remained in place and Hopic (consisting of one language, Hopi) apparently moved into the Southwest at least

several thousand years ago (e.g., Sutton 1987b, 1994b), both Takic and Numic (several languages each) diverged and expanded.

The distribution of the various Takic languages (including Kitanemuk and Serrano in the Mojave Desert) suggests an expansion sometime during the last several thousand years (Moratto 1984:560). Although the direction of this expansion is debatable, it seems reasonable—based on the center of gravity argument for all of NUA—that the Takic homeland was in the western Mojave and that the expansion was southward into southern California. No detailed examination of the "Takic problem" has been undertaken.

On the other hand, the divergence and expansion of the various Numic groups has received much more attention (summarized in Sutton 1994a). The generally accepted view is that Numic diverged into three "mother" languages (all in the Mojave Desert/Owens Valley area), each of which then gave rise to a "daughter" language that expanded rapidly across the Great Basin beginning about 1,000 B.P. (but perhaps earlier). The causal factors involved in the movement of the Numic (or Takic) are unknown, but may be related to environmental factors (e.g., a xeric period). The mechanisms by which such a population movement may have occurred are also unclear, although there have been several models put forth (Bettinger and Baumhoff 1982; Sutton 1986c).

Thus, within the last several thousand years, the Mojave Desert was witness to three major population (though possibly only language) movements out of the region: the movement of Hopic to the Southwest; the expansion of Takic into most of southern California; and the expansion of Numic across the Great Basin and beyond. The key to understanding these population movements, and ultimately their effect on the prehistory of western North America, lies in the Mojave Desert and Owens Valley. It is an exciting research prospect.



## CONCLUSION

The archaeological record of the Mojave Desert is very rich, highly varied, and relatively uninvestigated. That record includes both the earliest known and claimed archaeology in the western hemisphere and a record of indigenous peoples from the late 1800s. The Archaic of the Mojave Desert is quite long and complex, encompassing virtually the entire Holocene. The transition(s) to the Formative in the eastern Mojave is late enough in time that a fairly detailed record of that process still exists. The opportunities to elucidate problems of considerable anthropological importance are many in the Mojave Desert. They are waiting for us.

## NOTES

1. Although published later, the summary of Mojave Desert prehistory by Warren and Crabtree (1986) was written well before (ca. 1972) that of Warren (1984), the latter being more up to date than the former.

2. The term Archaic has been defined in a variety of ways, most commonly referring to a generalized hunter-gatherer "stage" postdating the Pleistocene (Willey and Phillips 1958). Some prefer to define the Archaic as an adaptive strategy, "an economic pattern in which a wide range of locally available plants and animals are exploited across regional microenvironments by populations familiar with their distribution and seasonality" (Willig and Aikens 1988:5), while others suggest abandoning the term altogether (Simms 1988:41). For the purposes of this paper, the Archaic is considered to be a stage (Willey and Phillips 1958) that represents the "generalized economic adaptation" (Willig and Aikens 1988:5) of post-Pleistocene hunting and gathering peoples at the band or tribe level of sociopolitical complexity. So defined, the Archaic of the Mojave Desert begins ca. 10,000 B.P., although some groups may have had relatively specialized adaptations depending on location (Meighan 1959:302). The Archaic persisted throughout most of the Holocene, and many cultures in the Mojave Desert were still "Archaic" at the time of European contact.

3. When first defined, the temporal period and Pleistocene body of water herein called Lake Mojave was spelled "Lake Mohave" (with an "h" rather than a "j"). The "j" is used here, both due to recent convention (e.g., Warren 1984; Warren and

Crabtree 1986; Grayson 1993; although some others still use the "h") and to avoid any possible confusion with the currently full and artificial Lake Mohave located along the Colorado River behind Davis Dam.

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