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A Cultural Resource Overview for the Amargosa–Mojave Basin Planning Units

by
Claude N. Warren
Martha Knack
Elizabeth von Till Warren

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Claude N. Warren

Martha Knack

Elizabeth von Till Warren

University of Nevada, Las Vegas

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Bureau of Land Management
Desert Planning Staff
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Riverside, CA 92506

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FORWARD

As the disciplines of anthropology and history evolve, and as time passes, studies with changing emphases and theoretical orientations are being completed and accumulated. This is the pattern of research for the central portion of the Mojave Desert, the subject of this study. The continued research and management of the cultural resources in this region will benefit from this study by compiling these previous works in a synthetic and analytical fashion.

This study was contracted as part of the Bureau of Land Management's California Desert Planning Program and serves well as documentation for planning purposes. But not only do cultural resource overviews establish the initial base for land use planning, they also provide (1) guidance to further research and interpretation and (2) information to the public for their education and enjoyment. Data from the desert overviews, field investigations and other sources of information are the foundation for cultural resource management.

A number of complementary studies also have been prepared including Chester King and Dennis Casebier's Background to Historic and Prehistoric Resources of the East Mojave Desert Region 1976; E. Gary Stickel and Lois J. Weinman-Roberts' "An Overview of the Cultural Resources of the Western Mojave Desert" 1979, on file with BLM in Riverside; Gary Coombs' The Archaeology of the Northeast Mojave Desert, BLM Cultural Resources Publication 1979; and Richard Brooks, Richard Wilson and Sheilagh Brooks' "An Archaeological Inventory Report of the Owlshead/Amargosa-Mohave Basin Planning Units of the Southern California Desert Area" 1979, on file with BLM in Riverside.

This overview summarizes and elaborates on anthropological and historical studies of the central Mojave Desert from early in the 20th century to the present. These studies suggest that the region continues to be poorly known. The authors' pleas for further work in their specialities will hopefully be encouraged by their papers published here.

The authors are to be congratulated for not only bringing together the anthropological and historical literature and documents into a practical publication, but also for formulating thoughtful analyses and workable-testable hypotheses. I believe this is a very useable and comprehensible work which contributes positively to our understanding of prehistoric and historic desert peoples in the central Mojave Desert region.

Eric W. Ritter
General Editor

HALLORAN WASH PETROGLYPH (NO SCALE)

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PREFACE

This overview is an attempt to pull together existing cultural resource data and to evaluate those resources of the Amargosa-Mojave Basin planning units. It is our goal to provide an evaluation and a description of the data that may be used as a basis for educated management of the cultural resources. These are divided into archaeological, ethnographic and historic resources with a section of the report devoted to each. The archaeological section includes only the aboriginal data. The exclusion of historic material from the archaeological remains reflects the present status of the development of historical archaeology in the Mojave Desert in general, and in the Amargosa-Mojave Basin planning units in particular. Archaeological investigation of historic sites is in an embryonic stage of development. Few historic European sites have been excavated in the Mojave Desert and none in the Amargosa-Mojave Basin planning units. European sites are plentiful and varied, however, the lack of archaeological investigations of these sites necessitate an evaluation based on the historical documentation. Therefore, they have been omitted from the archaeological section.

The cultural resources have been evaluated in terms of chronological sequences projected against the environmental conditions of the Mojave Desert. This approach is carried over into the ethnographic and historic presentations as well, and represents an integrative element of the evaluations. In the ethnographic section adaptation to the desert conditions is emphasized in the discussion of subsistence, social organization and other aspects of culture discussed. The Historical section also takes into consideration the European uses of and adaptation to the Mojave Desert environment. On the basis of this analysis it becomes possible to define broad environmental areas of the desert that are utilized and or adapted to in the varying ways by past populations. The identification of the diverse environmental areas and variations in adaptation and use should form a basis for assessing significance of cultural resources.

The research and writing of this report has involved the cooperation of a large number of persons and institutions, without whose assistance this report could not have been written. In the list below, brought together by the three major authors, it is possible that certain individuals may have been inadvertently omitted, if such is the case we apologize. Every individual and institution contacted, cooperated fully and we wish to thank the following individuals and staff of the following institutions:

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THE ARCHAEOLOGY AND ARCHAEOLOGICAL RESOURCES OF THE AMARGOSA-MOJAVE BASIN PLANNING UNITS

by

Claude N. Warren

in collaboration with
Richard L. McCarty

Chapter 1: Topography, Vegetation and Environmental Change in the Amargosa-Mojave Basin Planning Units

Topography

The Bitterwater, Kingston, Owlshead/Amargosa and Mojave Basin planning units cover an area of approximately 2.7 million acres in southeastern California. These planning units are grouped together for a single overview study and for simplicity will be referred to hereafter as the Amargosa-Mojave Basin planning units. This name is chosen because it emphasizes the dominant features of its landscape--the low lying drainage basins that traverse the entire length of the area.

The Amargosa-Mojave Basin planning units are bordered on the northeast by the California-Nevada border, on the west by Death Valley National Monument, at the south end of which the Owlshead district extends westward between Death Valley National Monument, United States Naval Ordnance Test Station and Camp Irwin Military Reservation. The area extends southward on the east margin of Camp Irwin Military Reservation through the Avawatz, Soda and Cady Mountains to the Marine Corps Training Center. The southern boundary follows the border of the Marine Corps Training Center to the Lavic Hills. From the Lavic Hills the eastern border extends irregularly northwestward through the Bristol Mountains to the Devil's Playground, across the west slope of the Cow Hole Mountains in a northerly direction to Interstate Highway 15 east of Baker. From here it follows the interstate highway to the California-Nevada border (Map 1).

The major topographic feature of the Amargosa-Mojave Basin planning units is the low north-south trending basins of the Amargosa and Mojave rivers, which henceforth will be called the Mojave Trough. This trough has elevations as low as 300 feet near Salt Springs where it enters Death Valley National Monument. The elevation of the Amargosa reaches about 2350 feet at the extreme northern edge of the study area. At the southern end of the Amargosa-Mojave Basin planning units the drainage begins near Ludlow with an elevation of approximately 1780 feet. The drainage flows northward to Broadwell Lake at 1300 feet (which is separated from Soda Playa by a low divide) The Mojave River enters the study area from the southwest at an elevation of about 1600 feet, but drops steeply through Afton Canyon to the Cronise Lakes (1080 feet) and Soda Playa (1080 to 932 feet). From the south end of Soda Playa to a point about ten miles north of Salt Springs the Mojave Trough has an elevation of less than 1000 feet.

The Mojave Trough contains Broadwell Lake, Dry Lake (just south of Soda), Soda Playa, Silver Playa, Dry Lake (just north of Silver Playa, Silurian Lake and Alkali Flat (just north of Eagle Mountain on the Amargosa River). In addition to the dry lakes, major sand dunes are also located in the trough at the south end of Soda, just east of Salt Springs and just north of Alkali Flat (Map 2).

The western margin of the Mojave Trough is marked by the Funeral, Owlshead, Avawatz, Soda, Cady and Bullion mountains. The Funerals are the highest of these with peaks well over 6000 feet. The Owlshead, Avawatz, Cady and Bullion mountains all range up to about 4500 feet while the Soda Mountains are the lowest with elevations up to 3500 feet.

To the east of the Mojave Trough the peaks rise in the north as high as 6000 feet in the Resting Springs and Nopah ranges and over 7000 feet in the Kingston and Clark ranges (where they reach their highest at 7929 foot Clark Mountain). West of Clark Mountains and east of the Mojave Trough lie the Shadow and Turquoise mountains with elevations to 4500 feet. In the far southeastern edge of the study area lie the Bristol Mountains with elevations to about 3800 feet.

On the far eastern edge of the study area, north of Interstate Highway 15, are a series of playas separated by low passes forming a second trough with a northwest-southeast orientation along the California-Nevada border. These playas are Ivanpah (2606 feet), Mesquite (2560 feet), Pahrump (2510 feet), and Stewart Lake (2457 feet).

The Amargosa-Mojave Basin planning units are thus marked by a low lying trough running north and south through the center of the units. The western boundary is marked by the ranges of mountains varying in elevation from about 3500 feet in the south to 6000 feet in the north. To the east of the Mojave Trough the topography rises to the high mountains of the Clark and Kingston ranges with elevations of over 7000 feet and then drops to the lower elevations of the playas at 2450 to 2600 feet along the California-Nevada border.

Vegetation

The differences in elevation, slope, soils, etc. are reflected to some degree in the vegetation of the Amargosa-Mojave planning units (Map 3). Throughout most of the area the vegetation is Mojave Desert scrub which is characteristic of the area below the coniferous woodland communities. Mojave Desert scrub vegetation includes saltbush scrub and creosote bush scrub. at lower elevations and blackbush scrub and shadscale scrub at slightly higher locations, sometimes interspersed with Joshua Trees. In general the Mojave Desert exhibits a relatively low density of perennial plants. Often creosote bush (*Larrea tridentata*) or creosote bush and a single associate (usually *Ambrosia dumosa*) dominates the Mojave Desert communities (Vasek and Barbour 1977:836-37).

The saltbush scrub vegetation is interpreted by Vasek and Barbour (1977:850) as equivalent to the alkali sink community of Munz and Keck (1949). Vasek and Barbour (1977:850) describe two phases for the saltbush community: xerophytic and halophytic. The xerophytic phase is located on dry soil and includes many of the species that are characteristic of the shadscale scrub and probably has a close relationship with it. Important species of the xerophytic saltbush scrub are Atriplex polycarpa, A. confertifolia, and A. hymenelytra and they have limited salt tolerance. This vegetation, therefore, usually occurs in basins and valleys throughout the Mojave Desert region (Vasek and Barbour 1977:850).

The halophytic saltbush scrub is found on soils with available ground water and usually with high concentrations of salt or alkali. This vegetation occurs on playas, in sinks, and near seeps with available surface or ground water high in mineral content. Important species include Allenrolfea occidentalis, Nitrophila occidentalis, Salicornia subterminalis, Suaeda spp., and Sarcobatus vermiculatis (Vasek and Barbour 1977:851).

The playas in the Mojave are often salt encrusted and usually devoid of plants. However, intermittent mounds of soil raised a few inches to a foot or so above the playa level occur toward the edge of the playa, and in these mounds are found patches of halophytes. As one moves away from the playa center, the patches of halophytic species increase in size and density; these are then joined by xerophytic salt scrub species which then gradually replace the halophytic salt scrub species. At a still greater distance from the playa center the creosote bush scrub gradually replaces the xerophytic saltbush scrub (Vasek and Barbour 1977:851).

Shadscale scrub is a community of low shrubs that occur in the Great Basin. To the north it is commonly found in alkaline soils of broad desert valleys. While to the south shadscale scrub occurs on steep mountain slopes, usually with heavy rocky soils. It is found in western and southern Nevada and parts of eastern California. Shadscale scrub is dominated by Atriplex confertifolia and Artemesia spinescens. However, as a community it is very limited in the Amargosa-Mojave Basin planning units and seems to be replaced in most of southern Nevada and presumably adjacent Mojave Desert regions by the blackbush scrub.

The blackbush scrub is considered to be a zonal desert scrub community in southern Nevada by Bradley and Deacon (1965). It is dominated by blackbush (Coleogyne ramosissima) and interspersed with other desert shrubs such as Yucca baccata, Thamnosma montana, Grayia spinosa, Eurotia lanata, Artemesia spinescens, Agave utahensis, or species of Ephedra, Dalea, Atriplex, Tetradymia, Eriogonum, and Lycium. The blackbush community is widespread ranging in elevation from about 4000 to 6000 feet, on upper bajadas, or old alluvium overlain with rocks. This elevation is definitely colder than that occupied by creosote bush.

Although the blackbush scrub is well documented as a zonal community in southern Nevada it varies considerably across the Mojave Desert so that it is not always easily recognized when present. In the western Mojave, a California juniper woodland, a Joshua tree woodland, a vegetation of low dark shrubs, or some combination of the three occurs above the creosote bush scrub. "The vegetation of low dark shrubs bears a physiognomical resemblance to the blackbush community and therefore is considered a phase of blackbush scrub, even though Coleogyne may be absent" (Vasek and Barbour 1977:856).

Joshua tree woodland is a desert scrub vegetation with an overstory of Joshua tree (Yucca brevifolia) and an understory of various shrubs and herbs. The range of the Joshua tree conforms closely to the extent of the Mojave Desert (Jaeger 1957). The Joshua tree occurs at elevations between the creosote bush scrub and pinon-juniper woodlands and in the same elevational zone as blackbush scrub and shadscale scrub. However, Joshua tree woodland usually occurs on sandy, loamy, or fine gravelly soils on fairly gentle slopes while blackbush scrub and shadscale scrub are often found on heavy or rocky soils. Some of the same species occur in all three communities, however, Yucca brevifolia may be co-dominant with Larrea tridentata in the gradation toward the creosote bush scrub, while at higher elevation in gradation toward pinon-juniper woodlands the Joshua tree may be codominant with Juniperus osteosperma, and Pinus monophylla (Vasek and Barbour 1977: 857-8).

Pinon-juniper woodlands are here defined as vegetation types having one or more of the following species as a conspicuous emergent above a shrubby understory: Pinus monophylla, Juniperus osteosperma, J. californica, P. quadrafolia, P. edulis. The pinon woodlands occur above the Joshua tree-blackbush zone, but there is a partial separation with juniper on lower slopes, pinon on upper (steeper) slopes, and an overlapping of the two to some degree near midslope. Pinon woodlands without junipers occur in the Kingston and Clark mountains (Vasek and Thorne 1977:808-10).

Little is known of the vegetation in the mountains east of Death Valley. However, the pinon woodland appears extensive, dense and widespread in the Kingston Mountains and the pattern of pinon on steeper slopes and Utah juniper on alluvium or gentle slopes continues through the Kingston, Clark, New York, and Providence mountains.

Variation in composition of the pinon-juniper woodlands community is present as noted between Clark Mountains and New York Mountains. Clark Mountain pinon-juniper includes an abundance of Artemisia, Coleogyne and Thamnosma and an absence of Quercus turbinella while in the New York Mountains the converse occurrence was noted (Vasek and Thorne 1977:812).

In addition to the pinon-juniper woodland, Rocky Mountain white fir, Abies concolor spp. concolor, has been found in the eastern Mojave Desert on the Kingston, Clark and New York mountains as well as on the Charleston Mountains of southern Nevada. This white fir forms groves, often mixed with pinon and other trees in steep mesic, north facing ravines and on slopes at elevations of 6300 to 6700 feet on either granitic or limestone substrata and usually below the crest of the ranges.

The desert riparian community (Bradley and Deacon 1965:28-29) is an arborescent community occurring along desert washes. In the Mojave this community is not greatly different from that of the surrounding shrub communities of creosote and blackbush. The soils are usually sandy to quite rocky at higher elevations and there is increased subsurface water resulting from runoff which accumulates along washes draining the surrounding areas. Desert shrubs which commonly occur along these washes and are largely absent or sparse in the surrounding communities include Hymenoclea salsola (cheese weed), Gutierrezia spp. (snake weeds), Salazaria mexicana (bladder sage), and Haplopappus spp. (golden weeds). At lower elevations where subsurface water is available in large washes, shrub and small trees grow, including Prosopis pubescens (mesquite), Acacia greggii (cat claw), and Chilopsis linearis (desert willow).

Desert springs and marshes are also found scattered throughout the Amargosa-Mojave Basin planning units. Most of these springs are thermal with water temperature varying only a few degrees during the year. Small marshes commonly surrounding these springs support Carex sp., Scirpus sp. (sedges), Juncus sp. (rushes), Eleocharis sp. (spike rushes) and Typha angustifolia (cat tail). Also commonly associated with these springs are a number of trees including Salix (willows), Prosopis juliflora and Prosopis pubescens (mesquite), and Populus fremonti (cottonwood) (Bradley and Deacon 1965:44-45).

The major plant communities occurring in the Amargosa-Mojave Basin planning units include nearly all the major plant communities of the Mojave Desert. The study area includes some of the highest peaks and some of the lowest valleys in the Mojave. It also includes a number of major washes, playas and sand dunes. However, the largest portion of the area consists of pediments covered by creosote bush scrub usually located at elevations between the lower washes and playas and the high Joshua tree-blackbush communities. The creosote bush community was the least productive community for aboriginal populations. This separation of the more productive zones must have been an important influence on the aboriginal pattern of land use. Furthermore, the separation of two productive zones by the broad creosote bush community must be a pattern which, with some modification, has been characteristic of this portion of the Mojave during the Holocene. As such it is important to understanding prehistoric land use during most, if not all, of human prehistory in the region.

On the other hand it seems apparent that cultural changes in the Mojave Desert are related in many instances to changes in environment and fluctuation in climate of the region.

Environmental Change in the Mojave Desert

The influence of environment as an explanatory device can be seen in two diverse archaeological approaches. Baumhoff and Heizer (1965) use climatic change as a possible explanation of large scale population developments and culture change throughout the arid West. These developments are predicated on shifts in the availability of plant and animal resources, as these resources adjust themselves to changing environments. The other approach (Davis 1978; Warren and DeCosta 1964; Ore and Warren 1971) is framed in the model of human ecology, answering questions about human adaptive responses to the changes in specific environments (e.g. adaptation to changes in a lake shore environment).

Because of the necessary reliance on environmental factors, archaeologists in the Mojave Desert work closely with the related fields of geology and biology and are obliged to integrate specific aspects of these diverse and fast growing bodies of data into their own interpretations.

A number of problems arise in attempting to use the available information on palaeoclimates. For example, the geologists study the Mojave Desert as a part of the Great Basin and its hydrologic and lacustrial character is tied to the work on the large lakes of the northern Great Basin. The paleobotanists, however, see the Mojave as a part of the Sonoran and Mojave life zones and tie their information to the southwestern deserts and as far east as Texas. Another complication is the conflict both between and within the fields responsible for reconstructing paleoenvironments (cf. Martin and Mehringer 1965; Van Devender 1977; T. J. King 1975).

These problems (and others not mentioned) point to the caution necessary in the use of geologic and biologic data in the study of past climates. These studies contribute observational data from which are built more or less accurate maps of Quaternary environmental changes. Past climates of the Quaternary are poorly understood. There are conjectural schemes which attempt to explain the phenomena observed (e.g. Antevs 1948), but these are grossly incomplete (cf. Bernard 1964). Until the climatic elements (e.g. temperature, precipitation, wind belts, radiation) and the physical climatic factors (e.g. shifts in radiation, shifts in wind belts) can be defined and quantified, we have to be satisfied with continually adjusting our understanding of past climate with each new piece of information (e.g. Van Devender and Spaulding 1979).

Today the climate of the Mojave Desert is classified as subhumid with evaporation greatly outstripping precipitation, especially at the lower elevations. Maximum temperatures in the lower valleys (900 ft.) reach 130°F during the summer months. Winter minimums at the higher elevations (7000 ft.) drop to 10°F. The average temperature for the valleys, January/July is 45°/85°F.

The Mojave also has very low rainfall due to the blockage of waterladen air masses by the mountains to the northwest, west and southwest. The northern portion of the study area receives an average of between 3.5 and 4 inches per year on the valley floors and from 8 to 10 inches in the Greenwater and Kingston ranges (Troxell and Hofmann 1954).

Temperature and rainfall combined make the Mojave a particularly harsh environment. The dominant plant is creosote (Larrea tridentata) with salt-resistant plants or no vegetation around playas and juniper-pinon occurring only above 5000 ft. The nearest occurrence of higher vegetation zones of Bristlecone Pine (Pinus aristata) are in the Panamint Range to the northwest and the Sheep and Spring ranges to the northeast in Nevada (Mehringer and Ferguson 1969).

The evidence on past climates indicates some dramatic shifts alternating between cool/moist and hot/dry periods over the last 40,000 years. The cool/moist periods are associated with the Mojave's pluvial maximum during the mid and late Wisconsin stage. This alteration was associated with a general shift to more abundant effective precipitation and a projected drop in average temperature of 8° to 15° F. The result was a network of small and large lakes up to 200 m in depth connected by a flowing drainage. These were surrounded by grasslands, chaparral with scrub oak (Quercus turbinella) and possibly some other oak varieties and juniper/pinyon. Other periods indicated in the climatic history show conditions hotter and dryer than present (cf. Antevs 1948; Martin and Mehringer 1965:433).

There are a number of "tools" that have been used to extract the sometimes rather detailed identification of climates during the Quaternary. And, in spite of conflicts, confusion, and controversy, the comparability of results has shown that there are some sound statements being made.

In discussing the "tools" used to make these statements, we divide them into the categories of geologic and biologic types.

Techniques which Morrison outlined to extract information about geology of the arid west include analysis of lacustrine sediments and shoreline boundaries, and comparisons of alluvial, colluvial and eolian sediments, the tufa formations and the sand dunes with related environmental factors (Sharp 1966).

This information can be used to infer filling, maintenance, and desiccation of the lake system within the study area. Associated with the lacustrial input are studies on the glacial activity found in the Sierra Nevada (Birman 1964; Sharp and Birman 1963). These aid in the correlation of various lake stand chronologies throughout the Great Basin.

In recent decades students of paleobiology have increased and refined our understanding of the paleoclimate and its regional variations. The three interrelated approaches of this discipline are coprolite analysis, Neotoma (pack rat) midden analysis, and pollen analysis. Analysis of extinct Quaternary fauna at China Lake has recently been added to the list of contributions (Fortsch 1978). Shell analyses of both fresh and salt water varieties have posed some interesting questions concerning the destination of the Mojave drainages during the pluvial periods (T.J. King 1975).

First attempts at gathering information regarding paleoenvironments focused on geologic aspects. The two classic studies of climatic reconstruction for arid North America are Russell's (1885) pioneering work with pluvial lake fluctuations in the northern Great Basin and Antev's (1948; 1952) work, which essentially refined Russell's interpretations and developed the Holocene (Neothermal) portion of data presented for lakes Lahontan and Bonneville and associated glacial tills in the Sierra.

Antev's scheme for his "Neothermal" environments categorized the Holocene into three parts: the Anathermal (9000-7000 BP) having warm and moist conditions, the Altithermal (7000-4500 BP) characterized as hot and dry, and the Medithermal (4500 to present) again having warm and moist conditions. Much of Antev's hypothesis was based on the supposed position and magnitude of the Aleutian Low Pressure area and the Pacific High Pressure area, wetter conditions prevailing under the strong influence of the Aleutian Low and hotter and dryer conditions under the Pacific High.

A major focus of pluvial lake studies within the northern Mojave has been the work done at Searles Lake (Smith 1968; Martin 1965; Stuiver 1964). Searles Lake is located some 75 miles to the west of the study area. It is part of the hydrologic dystem running from Owens Lake to Lake Manly in Death Valley. Smith (1968:295) reported on core borings into the Searles Lake sediments which showed alternate beds of muds, indicating large and permanent lakes, and saline silts, indicating saline or dry periods in the lake's history. Carbon 14 dates have been used to bolster the interpretations of the climatic history and correlations are evident between Searles Lake and other Great Basin Pluvial lakes (Smith 1968: 307). Lake level fluctuations extend through the Quaternary, showing at least three dry lake periods (28,000 BP; 10,000 - 6,000 BP, and present). There are two periods when Searles

Lake filled its 680 ft. basin and overflowed into Panamint Lake and Lake Manly. The first of these high stages lasted 2000 years from 23,000 to 21,000 BP. The other instance was much shorter, 10,000-9,000 BP, when it rose dramatically, reached its overflow, and then dried completely during the next 3000 years.

The Mojave River drainage has two other large lake systems, Lake Manix just outside of the study area to the west and Lake Mojave which covered the area of present day Soda and Silver dry lakes.

Fluctuations in the lake levels at Lake Manix appear to result from a combination of tectonic activity and pluvial conditions for there is evidence for a blockage of the lake's outlet between the Cave and Cady mountains. The limited amount of information on the lake comes largely from tufa formations at the high lake stands. This information was compiled by Blackwelder and Ellsworth (1936) and has recently been correlated with other data from Lake Mojave (T.J. King 1975). King indicates three lake stands, two during the mid Wisconsin 30,000 to 28,000 BP and 23,000 to 16,000, and a third stand of much smaller size in the canyon area is postulated from 14,500 to 9,000 BP. The only dated material comes from the second lake stand (Ferguson and Libby 1964). The other two stands have been inferred from the conditions at Searles Lake and Lake Mojave.

Lake Mojave chronology covers the terminal Pleistocene between 16,000 and 8,000 years ago. Ore and Warren (1971) have interpreted the lacustrial history of the lake based on location of tufa and shell and a series of radiocarbon dates (9 from tufa, 15 from shell). The chronology of lake stands follows the general pattern found at Searles Lake. Both show a lake stand from 14,000 to 12,000 BP and then a short period of desiccation lasting from 12,000 to 11,000 BP. During this time Searles lowers and Lake Mojave dries. A resurgence in both is noted immediately following this period. Lake Mojave records indicate a period of overflow lasting from 11,000 to 9,000 BP with Searles Lake overflow somewhat shorter, from 11,000 to 10,000 BP. Lake Mojave also shows another pluvial period that is not recorded at Searles Lake and is an anomaly to other hydrologic studies in the western United States dealing with this time period. It is a short period that apparently occurs between 8,500 and 8,000 BP.

Archaeological evidence from Lake Mojave is associated with the Pluvials of 8,000 and 10,000 years and possibly older components (Ore and Warren 1971:2561; Warren and DeCosta 1964). Other lacustrial deposits are identified in the study area (Cronise Lake, Broadwell Lake, Silurian Lake and Alkali Flat on the Amargosa, Mojave drainage system; and Ivanpah, Mesquite, Pahrump, and Stewart lakes on the California-Nevada border), but there have been no reports on the Pluvial chronologies of these lakes. It is assumed, however, that they follow the general outline presented by Searles Lake and Lake Mojave studies.

Studies in the marsh and sand dune areas of Ash Meadows (Mehringer and Warren 1976) present a chronology of dune and marsh formation that presumably reflect climatic or environmental changes. This chronology includes the following units:

1. A period of peat formation coeval with dune migration from 5,300 to 4,500 BP.

2. Hiatus from 4,500 to 4,000 BP.

3. Period of peat formation culminating at the time the marsh was completely overriden by sand, 4,000 to 3,000 BP.

4. Dunes deflated and reduced to surface with low relief upon which fine material was deposited and a weathering profile developed, 3,000 to 2,000 BP.

5. Burial pits were dug through this surface about 2,000 BP (Muto, Mehringer and Warren 1976) and then covered by dunes containing Anasazi pottery dating from about 1,000 BP.

6. Weathering episode about 400 years ago; Paiute pottery occurs here.

7. Peat deposition resumes about 400 BP.

8. Marsh development after brief hiatus in peat deposition.

The biological contribution to the study of paleoclimate has not been as great as that of geologists until the last two decades. Biological contribution centers around paleobotanical approaches. Analysis of botanical remains in ground sloth dung from Rampart, Muav and Gypsum Caves of northwestern Arizona and southern Nevada (Laudermilk and Munz 1934, 1938; Long and Martin 1974) revealed an 80% occurrence of Joshua Tree (Yucca brevifolia) in the sloth's diet. Joshua trees now grow at higher elevation and are not found in the general vicinity of Gypsum Cave today. Radiocarbon dating has placed the sloth dung at 12,000 to 8,500 BP (Wells and Berger 1967). The depression of the Joshua Tree Woodland as suggested here is supported by Martin and Mehringer (1965). Their study indicates juniper/pinon woodland at much lower elevations about 12,000 BP, but by 10,000 BP conditions had deteriorated and were similar to the arid conditions of today.

Another study of paleoclimate was made by Martin (1965) which resulted in a vegetational map of the glacial maximum at 23,000 - 17,000 BP. Using analysis of soil pollen from cores taken at Searles Lake, Martin reconstructed the configuration of the vegetation during its lowest depression of the Quaternary. He indicated a 4000 foot drop in elevation below that of the present for the Woodland communities.

Mehringer's (1967) pollen analysis from the Tule Springs area supports Martin's map. Mehringer believes that juniper woodlands were low enough to rim the Pluvial Lake Las Vegas at about 22,600 ± 500 BP.

The analyses of pack rat (Neotoma spp.) middens have resulted in the development of even more paleobotanical data for the last 40,000 years. Wells and Jorgensen (1964) recognized the importance of pack rat midden because of the unique gathering pattern of the pack rat. This pattern involves a rather random sampling within a very restricted range of about 50 yards. Their middens are built stratigraphically by long term and sequential habitation. Excreta in the midden solidifies and preserves twigs, seeds, bark, and other small pieces of material that the pack rats have accumulated from the immediate environment of its midden.

The sheer amount of data available through this method has made it a productive approach. For example, Wells and Berger (1967) reported on seventeen middens within the Mojave, while Van Devender (1977) has analyzed twenty-nine middens from a wider area of the southwest. These analyses in conjunction with radiocarbon dates on the middens provide a powerful tool for reconstructing paleoenvironment of a particular place at a given point in time.

With a more thorough sampling of pack rat middens in the Mojave Desert, a better understanding of paleoenvironments is being developed. Some assumptions are being questioned as a result of this analysis and some interpretations are being challenged. More recently Van Devender and Spaulding (1979) have presented a review of 15 years of analysis of pack rat middens. They infer from a wealth of data that the division of the Southwest into regions of predominantly winter precipitation in the west and predominantly summer precipitation in the east does not hold for the Late Wisocnsin (22,000 to 11,000 BP). They suggest instead that there was a more general pattern of predominantly winter precipitation with mild winters throughout the Southwest and that:

> The xeric juniper woodlands at middle elevations and the bristlecone-timber pine forests at higher elevations in the Northern Mohave Desert suggest that southern Nevada was relatively drier than areas south of the 36°N. This apparent anomaly may be attributed to the Sierra Nevada rainshadow (Van Devender and Spaulding 1979:708).

Pinon and other species, big sagebrush (Artemisia tridentata) and shadscale disappeared from the middle elevations by about 11,000 BP. But the xeric woodlands and inferred predominance of winter precipitation continued until 8,000 BP.

The blocking effect of the Cordilleran and Laurentide ice sheets, which prevented the cold northern winds and produced relatively mild winters, was removed with the opening of the ice free corridor about 11,500 years BP.

The present climatic and vegetational regions were established about 8,000 years ago with the Mojave Desert remaining an area of predominant winter rains while much of the Southwest underwent a more pronounced change to predominant summer rains. Unfortunately, Van Devender and Spaulding (1979) provide little else in the interpretation of Middle and Late Holocene (8,000 years ago until the present).

Mehringer (1977) has reviewed the factors reflecting or contributed to changes in local and/or regional environment in the Great Basin. In this study he lists fluctuations of lake levels, lowering of tree lines, dune activity and stabilization, peat formation in desert salt marshes, arroyo cutting and filling and significant tectonic and volcanic activities among such factors. Mehringer's (1977) review is the most complete of environmental change in the Great Basin (and the Mojave Desert) that is currently available. Although these data are still rather limited, Mehringer is able to make some positive statements.

In his summary of prehistoric changes in environment of the Great Basin Mehringer states (1977:148-149):

> "During the last pluvial many basins, now dry and salt encrusted, were fed to overflowing by cool waters and joined by great rivers. As woodlands descended to the treeless deserts, glaciers carved beds in the snow capped mountains. Herds of camels, horses and mammoths grazed the steppes and fertile marshes. And then, within 2000 years (12000 - 10000 BP), lakes shrank, rivers ceased to flow and springs began to dry. Plants and animals began the long retreat northward and to higher elevations and man witnessed the demise of the Pleistocene megafauna. By comparison, all subsequent environmental changes have been minor.
>
> "A trend toward aridity prevailed for the next few thousand years...Short term reversals of this trend probably occurred shortly before 10,000 and 8,000 B.P. By 7500 radiocarbon years ago conditions were much like the present. Some researchers have suggested the persistence of extreme arid climates, hotter and drier than the present for the next 3000 years. Perhaps this

view is oversimplified as there is some evidence for a brief increase in effective moisture sometime between 6500 - 5500 radiocarbon years ago... Considerably more data are required to establish the detailed chronology and magnitude of Great Basin climatic change from 7500 - 4000 BP. As far as the rest of postpluvial time, the influence of climatic change on man is best considered in terms of evidence for its effects on local resources.

"Many lines of evidence are suggestive of a significant change to more effective moisture starting about 4000 - 3000 B.P. and ending before 2000 B.P. At this time minor changes to deeper lakes are recorded from Great Salt Lake, Pyramid Lake, Searles Lake and Death Valley. In the north, pollen records reveal an increase in arboreal types and in the White Mountains there is a lowering of the bristlecone pine tree line. These events are accompanied by change in aolian activity and from erosion to deposition and soil development.

"It becomes more difficult to make broad regional generalizations as the data becomes more abundant. Fortunately, tree ring studies probably will establish regional climatic patterns for the last 2000 years in a more precise manner than is otherwise possible (La Marche 1974). During the past 2000 years... there was geological and biological instability of sufficient magnitude to affect the abundance of local resources. The evidence includes plant macrofossils from caves of northwest Utah suggestive of a significant moist interval 1500 - 600 B.P. Fluctuations in lake levels, lowering of tree line, renewed dune activity and stabilization, peat formation in desert salt marshes, arroyo cutting and filling and significant tectonic and volcanic activity all continued through the past 1000 years.

We feel that Mehringer's summary is the best developed statement of climatic and environmental change that can be made at this time. It is this chronology of climatic and environmental changes that we will apply in our study of prehistoric culture in the Mojave Trough and adjacent mountain ranges.

Chapter II: Cultural Chronology of the Mojave Desert

Introduction

The prehistory of the Mojave Desert has not yet reached the stage of development that may be referred to as culture history. Many of the problems of the Mojave Desert are still problems of chronology and typology and until most of these are resolved there can be little understanding of culture change, adaptation and other processes of culture history. The primary goal of this discussion of the cultural chronology of the Mojave Desert is to attempt a cultural sequence and to isolate the problems of chronology and typology.

The unifying concept for the development of the Mojave Desert chronology is "Period." "Period" is defined as a "unit of time" or "unit of contemporaneity," and as such is to be distinguished from cultural units or "units of similarity" (Rowe 1962). The use of the period concept in Mojave Desert chronology is important because of: 1) the diverse cultural factors influencing the Mojave at various points in the past, and 2) the changing quality of the harsh environment. These factors have had a profound effect on the early populations of the desert and it is necessary to clearly distinguish between units of similarity and units of contemporaneity if we are to understand the processes of cultural change. We must be able to distinguish contemporaneity in the Mojave during periods of diverse cultural expression. For example, when the Anasazi developments are taking place in the eastern Mojave (Muddy River Valley of Nevada), the populations of the western Mojave are following a different way of life. From AD 500 to ca AD 1150 is a period (unit of contemporaneity) in which there are at least two distinctly different cultural expressions (units of similarity).

At the present time there are not sufficient data to define the units of similarity (cultural phases, stages, complexes) to the degree required to discuss processes of culture history. Therefore, we argue that cultural periods should be the beginning point for the chronology in order that archaeologists do not automatically equate cultural similarity to contemporaneity and more importantly that they not equate cultural dissimilarity to non-contemporaneity. If the processes of culture history are to be understood in an area as large and diverse as the Mojave Desert, it is necessary to be able to recognize distinctively different cultural traits (more than two units of similarity) that were in existence during the same period (unit of contemporaneity).

Periods are not set by arbitrarily picking boundary dates. Periods were originally determined by the occurrence of time sensitive artifact types or attributes (Rowe 1962). In more recent years tighter temporal control has been maintained through the use of radiocarbon and other dating techniques.

Time sensitive artifacts still form the primary means of establishing the temporal units in the Mojave Desert. The period markers traditionally have been projectile point and pottery types arranged in a relative sequence by seriation, cross dating and stratigraphy. In addition absolute radiocarbon dates for most period markers have been acquired over the last 30 years. The pottery types and projectile points again have served as period markers in the proposed chronology presented below.

The time sensitive artifacts (period markers) are cultural items, and generally create chronologies dependent upon cultural changes that are reflected in those artifacts. Although they reflect certain cultural changes, time markers represent only a very small part of the total artifact assemblage. Consequently, many changes in settlement patterns, social organization, addition or deletion of economic activities or technological attributes may occur without significant changes in the projectile point and pottery types. On the other hand changes in time markers may not always reflect cultural changes, as when temper in pottery is changed because the temper source is exhausted or lost. The change in temper may be a good period marker, but reflect no other cultural change. The projectile point or pottery type undeniably has cultural content, but conceptually, the period marker omits the cultural aspect and represents only a period of time; not cultural content. The function of the period marker is in the construction of a chronology by which the whole, preserved cultural assemblage of sites may be dated.

A period is a unit of time identified by the occurrence of an artifact type or types (period markers). Because it is identified by a small range of artifact types a period may be a time when a given area was occupied by one cultural unit or several distinct cultural units. Cultural units need not conform temporally to the periods. A cultural unit may be included in one period, fall partially in two periods or even extend over two or more periods. Cultural units and time periods are independent and distinct concepts.

A point that perhaps needs some elucidation is the relationship between period markers and causal factors in culture change. It is possible that the invention or diffusion of a technological devise, used as a period marker, may have resulted in wide ranging cultural change. However, conceptually the period marker is only a symbol of a time period used in establishing a chronology. It is tautological to construe a time marker as a causal factor on the basis of its identification with the beginning of a period. If a period marker proves to be a causal factor in cultural change that function will have to be demonstrated independently. Cultural changes that can be identified in the Mojave Desert will be better explained by environmental, technological and social factors that have little direct relationship to the period markers.

In summary, the period is a unit of time that is identified by the occurrence of a time sensitive artifact type termed period marker. The period marker identifies only the unit of time and not the cultural content. The cultural unit, as defined here, includes the taxonomic divisions and units traditionally used by the archaeologist. Complex, phase, stage, tradition, culture, etc. are all based on some degree of similarity of the cultural content of the archaeological components included. The concept used usually varies with the problem with which the archaeologist is coping or the bias of the archaeologist. However, the critical factor is that the basis for definition is similarity in cultural content.

The period as an integrative concept for the California deserts archaeology has been used by Bettinger and Taylor (1974) and Warren and Crabtree (1972). These papers were written about the same time (1971-72) but independently of each other. Both chronologies added a fifth period to the existing chronology (e.g. Wallace 1962) and are surprisingly close in the absolute dates assigned to the three latest periods. There is virtually no agreement in the names of the periods however (Fig. 1). Warren and Crabtree limited their discussion to the Mojave Desert while Bettinger and Taylor included both the Mojave and Colorado deserts. There are some significant differences between these two chronologies and the interpretation of the material remains in each period. Warren and Crabtree place the beginning dates for the Gypsum, Pinto and Lake Mojave periods significantly earlier than the equivalent periods of the Bettinger and Taylor chronology. Furthermore, Warren and Crabtree's interpretations of the Pinto and Gypsum periods are significantly different from Bettinger and Taylor's interpretation of the equivalent periods. The period marker for Bettinger and Taylor's Little Lake Period is the "Little Lake" point series that they assume to be "contemporary regional stylistic variant of a widespread stemmed-indented base point system" (1974:14). The absolute dates of the Little Lake Period are based on radiocarbon dated points of the Little Lake series in the western Great Basin and at Rose Springs (Bettinger and Taylor 1974:14). Warren and Crabtree utilized the more crudely made Pinto Points as period markers and argued for a somewhat earlier date. The problem of dating the Pinto points is discussed at length below and the interpretations presented below are more nearly in line with Warren and Crabtree's interpretations than with those of Bettinger and Taylor. Therefore, the Warren and Crabtree naming and dating of the periods will be followed in this report. There will, however, be some modifications of the temporal boundary between the latest two periods to better conform with pottery dates; and there will be an addition of the hypothetical Pleistocene Period so that certain purportedly early man sites can be discussed in a temporal framework. Finally, all dates are given in radiocarbon years and are not corrected to the Bristlecone Pine calibration unless so indicated.

The following definition of periods is essentially limited to a listing of time sensitive artifacts and a discussion of dates (Fig. 2). An analysis of the data and interpretations will follow in later chapters.

The Pleistocene Period

The Pleistocene Period is dated as earlier than 10,000 B.C. and is a tentative period that may in the final analysis lack cultural remains. The name Pleistocene was selected because of the uncertain nature of the archaeological remains attributed to this period. "Pleistocene" does not refer to a cultural assemblage and may be discarded if no assemblage is discovered to date from this period. Secondly, Pleistocene refers to a long period in which there could be many cultural units and therefore can be replaced "piecemeal" by new period names if cultural units are demonstrated.

The evidence for human occupation for the Pleistocene Period falls into two categories: 1) bonafide artifacts that can be demonstrated to be man made, but lack the context necessary to demonstrate their age. The Manix Lake Lithic Industry belongs to this category, and includes "handaxe like" bifaces that suggest paleolithic age to some archaeologists (Fig. 3; H-K). These bifaces are found together with cores, flakes and scrapers, but are limited to surface distributions, so their age cannot be demonstrated at this time; 2) demonstrated Pleistocene age, but consists of "artifacts" that have not been demonstrated to be man made. The Calico assemblage is representative of this category.

If these "assemblages" prove to be cultural and to date prior to about 10,000 B.C. then the Pleistocene Period may be characterized by lack of projectile points. If the Calico material proves to be non-cultural and the Manix Lake Lithic Industry later than the proposed date, then it may derive from quarry and workshop sites which lack projectile points because they represent such a limited range of specialized activities. The Pleistocene Period in the Mojave Desert chronology is tentative and will hopefully be changed as necessary in the future.

Lake Mojave Period

The Lake Mojave Period is placed by Warren and Crabtree (1972) at 8,000 B.C. to 5,000 B.C. Bettinger and Taylor (1974) place it somewhat later ending about 4,000 B.C. and beginning sometime before 6,000 B.C. (Bristlecone calibrated). This period is characterized by a series of artifact types including fluted points, leaf shaped points and knives, crescents, Haskett points, Lake Mojave points, Cougar Mountain points (sloping shoulders and long parallel sided stem), a variety of concave scrapers (spoke shaves ?) of unusual forms and flake gravers with one or more sharp projections (Fig. 3; A-G). These artifacts have been assigned to the Western Pluvial Lakes Tradition by Bedwell (1970, 1973) and Hester (1973), the Western Lithic Co-Tradition and Lake Mohave Pattern by E. L. Davis (1969, 1978), the Lake Mohave Tradition by Tuohy (1968, 1974) and separated into Fluted Point, San Dieguito and Haskomat Complexes by Warren and Ranere (1968).

Recently characteristic Lake Mojave artifacts have been dated earlier than 8,000 B.C. in the northern Great Basin (Bedwell 1970, 1973) and possibly older than 8000 B.C. at Lake Mojave (Warren and Ore 1978). Consequently, in order to maintain a correlation between the period boundaries and the time sensitive artifacts, the initial date for the Lake Mojave Period is extended back to 10,000 B.C. There seems to be a general agreement among archaeologists as to the artifact inventory for this period. The interpretation placed on these inventories, however, lack such agreement as will be discussed in the following chapter.

The Pinto Period

Warren and Crabtree (1972) defined the Pinto Period as falling between 5,000 B.C. and 2,000 B.C. and note that it is the most poorly defined (in terms of cultural content) in their Mojave chronology. Ideally this period is marked by the Pinto point series, however, no undisputed Pinto points from Mojave Desert sites have been dated by radiocarbon (Fig. 4; A-J).

Furthermore, the definition of Pinto points is so poor that it is generally uncertain whether archaeologists are referring to the same forms when using the rubric "Pinto." There are several different interpretations of cultural development, as well as different definitions of Pinto points. Problems of point type identification have led to problems of interpretation. Some problems are, for example: Are Thomas's (1970) Pinto Points comparable to the intuitive types defined by Rogers (1939) or Harrington (1957)? It is, for the most part, Pinto Points of Thomas' type that have been dated in the western Great Basin. Are these dates applicable to the Pinto points of the Mojave Desert? Is there a recognizable Pinto Basin Complex? Very little is known about this period and its definition almost certainly will change as data dating to this period is recovered in and/or around the Mojave Desert.

Gypsum Period

The Gypsum Period begins at about 2,000 B.C. and continues to about A.D. 500 according to Warren and Crabtree (1972). This period is characterized by Humboldt and Elko series points and by Gypsum Cave points (Fig. 4; K-R). Fortunately there are a fair number of occurrences of these points in association with radiocarbon dated material. These are shown in Table 1. The projectile points have been recovered in association with different kinds of assemblages suggesting different cultural influences or independent developments in different regions of

Table 1: Radiocarbon Dated Occurrences of Humboldt, Elko, and Gypsum Points in the Mojave Desert Area, Southwestern Great Basin.

Site	Date	Projectile Point Type
Rose Springs	950 ± 80 B.C. 290 ± 145 B.C.	Elko Series
Newberry Cave	1020 ± 250 B.C.	Elko Eared Elko Corner Notched Gypsum Cave
Stuart Rock Shelter	1920 ± 250 B.C. 2100 ± 300 B.C.	Pinto Shoulderless (Humboldt Concave base point)
Gypsum Cave	450 ± 60 B.C. (UCLA 1069) 950 ± 80 B.C. (UCLA 1223)	Gypsum Cave Points
Atlatl Rock Shelter	600 ± 120 B.C. (UCR 810)	Gypsum Cave Points Elko Corner Notched Elko Eared
Ash Meadows Barnett Site	660 B.C. to A.D. 210 (based on nine dates)	Elko Eared Humboldt Concave Base Gypsum Cave
O'Malley Stratum II	4560 B.C. to 1970 B.C. (RL 91, RL 45, RL 106)	Gypsum Cave Elko Series Humboldt Concave Base
O'Malley Stratum III	1790 B.C. (RL 93)	Gypsum Cave Elko Series Humboldt
O'Malley Stratum IV	A.D. 930 (RL 44)	Gypsum Cave Elko Series Humboldt
O'Malley Stratum V	A.D. 1060	Gypsum Cave Elko Series Humboldt
Conway Shelter	100 B.C. (RL 39) 140 B.C. (RL 40) 30 B.C. (RL 41)	Elko Series

the Mojave Desert. In the western Mojave there appears to be a close tie with the western Great Basin to the north seen primarily in Humboldt and Elko Eared points. In the eastern Mojave the southwestern influence can be recognized most readily in split twig figurines and pit houses followed by the later introduction of agriculture and Basketmaker III pottery.

Saratoga Springs Period

The Saratoga Springs Period begins about A.D. 500 and terminates about A.D. 1200. This is essentially the period of Basketmaker III and Pueblo development in the eastern Mojave and their influence in adjacent central Mojave. Although the Anasazi influence does not extend, in any degree, to the western Mojave, the period is marked by the widespread occurrence of projectile points of the Rose Springs and Eastgate series (Fig. 5; K-S). In the eastern Mojave Desert this period is marked by the occurrence of Gray Ware pottery (some with distinctive olivine temper found as far west as Ash Meadows and Cronise Lakes). The Rose Springs and Eastgate projectile points occur at least as early as A.D. 620 and there is evidence that they may occur earlier than 300 B.C. in the Great Basin (Hester 1973:34). They persist until historic times and cannot be used for the terminal date of the Saratoga Springs Period. The terminal date of the Saratoga Springs Period is determined by the appearance of the Desert side-notched points and "Paiute brown wares" pottery.

Shoshonean Period

The characteristics that mark the Shoshonean Period according to Warren and Crabtree (1972) are Desert Side Notched and Cottonwood Triangular points (Fig. 5; A-J) and Owens Valley Brown Ware pottery or similar "Paiute brown wares." This period is also marked by variation across the Mojave. J. Davis (1962) and Donnan (1964) view the Providence Mountains as an extension of the Lowland Patayan sphere of influence after A.D. 800 when Lower Colorado Buff Wares and Tizon Brown Wares are characteristic. Somewhat later the area was apparently occupied by Paiutes. The eastern and southeastern Mojave Desert appears to have come under Colorado River influences while the western and northern Mojave were more directly influenced by the Great Basin sphere. The cultural patterns of this period appear to have led directly to the historic aboriginal cultures of the Mojave Desert.

Chapter III: Cultural Chronology and Environmental Change in the Amargosa-Mojave Basin Planning Units.

Introduction

Correlations of the cultural periods and climatic changes (Fig. 2) suggest causal relationships. However, it must be emphasized again that the periods are temporal units and the cultural items that characterize them may be, and in some instances are, representative of more than one cultural expression. The correlations that can be recognized between changes in climate and changes in period may on one hand represent broad, far-reaching environmental stresses that are reflected in the cultural behavior, or, on the other hand, they may represent the introduction and rapid spread of a single technological innovation (e.g. the bow and arrow) that appears as a horizon marker, but whose correlation to climatic change is fortuitous. Environmental change is only one of numerous factors that may be considered causal to cultural change. The total range of causal factors and resultant culture change is so great and so complex that questions of causal relationships are impossible to address with limited archaeological or ethnological data. It is more productive, therefore, to address the question of causal relationships of culture change within a more limited framework. The framework and approach described here is a statement of the bias of this report. The framework encompasses a theoretical stance, but it is primarily a method for a materialist approach to the study of culture change.

Nearly two decades ago Vogt (1960:126) wrote that there is a differing importance of technological, environmental, social structural and value systemic variables in various types and phases of culture change: "The impact of technological environmental elements upon what happens in a simple hunting society such as among the Great Basin Shoshones (Steward 1938), is direct and overwhelming, and there is virtually no possibility of either social structural or value systemic factors to affect the course of events."

Since about 99% of human societies have functioned by hunting, fishing and gathering and marginal agriculture, it would appear that the technological and environmental elements have great impact on culture changes in the majority of societies. The technological and environmental elements articulate with economic elements to form an economic-technological-environmental subsystem that includes subsistence, settlement, production, distribution, and other related subsystems. The techno-economic subsystem is thus articulated with the physical environment on the one hand and with the socio-political, psychological-religious and other cultural subsystems on the other.

The techno-economic subsystem is man's primary means of adapting to physical environment. If the techno-economic system is highly sophisticated so as to 1) screen society from environmental influence and 2) control environmental factors to some degree, then changes in the physical environment have a reduced affect upon the cultural system in general. On the other hand, where the techno-economic subsystem is not sophisticated, when it is marginal, it must change in response to change in the physical environment if it is to continue to function. Since other cultural subsystems articulate with and are dependent on the techno-economic subsystem, changes or dysfunction in the techno-economic subsystem result in more general changes throughout the cultural system. Therefore, the most basic step in understanding culture change is the analysis of the techno-economic subsystem and its articulations with the environment.

It is perhaps a fortunate coincidence that the data most readily available to and most readily developed by the prehistorian are the byproducts of the techno-economic subsystem in its articulation with the environment. This is the area most crucial to developing adequate models of prehistoric cultural systems and cultural change and it is the area best represented by the archaeological data. One of the archaeologist's first steps must be the development of a model or models of the techno-economic subsystem and its articulation to the physical environment. Once this has been developed, construction of models for socio-political and other subsystems are made with a greater degree of reliability.

The following discussion does reflect the bias of this approach. There is an emphasis on the environmental, technological and economic factors and attempts at the development of models of techno-economic as well as other subsystems and their articulation with the changing environment. It is desirable to take the study further but limits of time and data prohibit full development of the models. This study, however, throws into relief the kinds of data needed to further develop the models and test hypotheses deduced from them. Although our discussions may be limited in the "reconstructions of prehistoric culture history" it should be productive in the development of designs for relevant research.

Problems of the Lake Manix Lithic Industry and the Pleistocene Period

The Manix Lake Lithic Industry is represented in the Amargosa-Mohave Basin planning units by the Baker site, SBr-541 (Glennan 1974). This industry was first defined by Simpson (1958, 1960, 1961), although similar material was reported by the Clements (1951, 1953) for Panamint Basin and Death Valley and included by Rogers (1939, 6-22) in his Malpais Industry. Manix Lake Industry is characterized by "choppers" and bifaces, some apparent scrapers and cores and flakes. There are no projectile points reported for these sites. Another paper written by Glennan (1976) dealt with the Manix Lake Industry sites in the Manix Basin and was commented on by Simpson (1976). These two authors represent the opposing views on the interpretation of Manix Lake material (Fig. 3; H-K).

In the early papers Simpson (1958, 1960) notes that all Manix Lake Industry sites occur on, or above the highest beach line of Lake Manix. On lower beach lines were found sites of "Playa" and later industries. On the basis of the geological position of Manix Lake Industry relative to the other assemblages, Simpson reasoned that Manix Lake Industry was the oldest. Simpson (1958, 1960) also felt that this conclusion was supported by the absence of projectile points in the Manix Lake Industry and its typological similarity to the Paleolithic of the Old World.

Glennan (1974) appears uncertain in his interpretation of the Baker site. In the title of his paper he called it an "Early Lithic" site, which in Willey and Phillips' (1958:73, 79) terminology is an "unspecialized and largely unformulated core and flake" industry that presumably represents the earliest stage of development in North America. However, in the text of the article Glennan (1974:34) states:

> "However, it is unlikely that the Baker site can be used as support for the hypothetical Pre-Projectile Point Stage, at least not in the form proposed by Krieger (1962, 1964). If such a stage of New World cultural development does exist, one must look elsewhere."

Glennan (1974:32-33) attempts to make some positive interpretations of the Baker Site material, concluding that it probably represents a combination workshop/habitation site. He further states that while the Baker Site may not contain all the types of tools made at that time, it does give a fairly accurate picture of the level of lithic technology. Unfortunately, Glennan does not discuss the nature of the lithic technology of the Baker Site before stating:

> "... while the people appear to have had a technology equal to the task of producing projectile points, such items were not being made."

It is unfortunate that Glennan presents no support for the supposition that the occupants of the Baker Site were technologically equal to the task of producing projectile points. Glennan's further claim that the sample of artifacts from the Baker Site may be too small to include projectile points can be questioned because the Manix Lake Lithic Industry is not limited to the Baker Site and the sample includes a large number of specimens from many sites and projectile points are lacking. It is clear that sample <u>size</u> is not the problem.

The problem is, what does this sample represent in terms of prehistoric human behavior? Archaeologists working with this material do not agree on the answer.

Glennan (1974:33) felt the "cultural connections and temporal placement" of the Baker Site was "very much open." He noted that it was unlikely that the Baker Site served as a workshop for the "Playa Period" sites around Lake Mojave, because of the differences in methods of manufacturing certain tool types. Rhyolite, characteristic of the Baker Site, is "thinly represented" on Lake Mohave sites and the "projectile points and knives at Lake Mohave sites are generally made on large, thick flakes or cores." This same argument held true for later cultural assemblages in the Mojave Desert. Consequently Glennan (1974:33-4) argues himself into a corner where he concludes:

> "... it may be that these crude stone tools pre-date the earliest evidence of man in the Mojave Desert. Since the Lake Mohave materials are thought to date some time between 7,000 and 9,000 years B.P., perhaps somewhat earlier, the Baker site could well predate the Playa culture and still not be more than 11,000 years old... It would appear that the Baker site represents a very early occupation of the Mojave Desert."

Recently acquired radiocarbon dates in the western and northern Great Basin suggest that the dates of the "Playa culture" cited by Glennan are too young. There is a widespread early cultural horizon with strong resemblances that extends from the Columbia Plateau to southern California and includes the Glennan's "Playa Culture" material from Lake Mojave (Warren 1967, Bedwell 1970, 1973, Hester 1973). Radiocarbon dates on this horizon have been as early as 13,200 B.P. (Bedwell 1973:35) in the northern Great Basin. At Lake Mojave a radiocarbon date of 10,270 $\pm$ 160 (Y2406) has been obtained that would date a Lake Mojave occupation (Ore and Warren 1971:2559 and Warren and Ore 1978). In San Diego County a date of 9,030 $\pm$ 350 B.P. (A-722A) has been obtained from the San Dieguito occupation at the Harris Site (Warren 1967:179). The initial occupation was earlier than this date (Warren 1973). Consequently, limiting the Manix Lake Industry necessarily to a younger than 11,000 years strains the credibility of the chronology.

Another factor not considered by Glennan was the deposits upon which the Baker Site and other Manix Lake Industry sites are located. The Manix Lake sites reported by Simpson are located on the highest beach line of Manix Lake. Lake tufa from this beach line was dated at 19,500 $\pm$ 500 (LJ-269; Hubbs, Bien and Suess 1962:227) and 19,300 $\pm$ 400 years ago (UCLA-121; Ferguson and Libby 1962:109). The Baker Site is located on a remnant of an ancient surface that must be older than the Lake Mojave beaches (Ore, oral communication 1966). There appears to be no known geomorphic data that would negate a date of ca 15,000 to ca 20,000 years ago for the Manix Lake Industry. Glennan's

(1974:33) contention that the dating of this industry is still "very much open" is a fair evaluation of the problem today. However, there certainly is no reason at this time to necessarily limit the age to the post Pleistocene.

The Manix Lake Industry like the alleged assemblages of Calico (Leakey, Simpson and Clements 1968) and the core tool traditions of China Lake (Davis 1978) have not had their age and or their artifactual nature demonstrated with the rigor necessary to convince the scientific community. Therefore they must be only tentatively recognized as cultural remains dating from the Pleistocene Period. The Pleistocene Period dating earlier than 10,000 B.C. becomes a catch-all period for a number of quite different assemblages of alleged antiquity and/or alleged artifacts.

The Lake Mojave Period

One of the major foci of study for this period has been Pleistocene Lake Mojave, comprising what is today Soda and Silver playas. Over the past four decades a sizable body of literature has accumulated regarding the archaeology of Lake Mojave (Campbell et al. 1937, Rogers 1939, Roberts 1940, Brainerd 1953, Meighan 1954, Warren and True 1961, Warren and DeCosta 1964, Heizer 1965, Woodward and Woodward 1966, Carter 1967, Davis 1967, Warren 1970, Heizer 1970, Ore and Warren 1971, Venner 1978, Warren and Ore 1978). The artifacts recovered from the high beach lines at Lake Mojave have been referred to under a number of different terms, but here "Lake Mojave Complex" will be limited to include only those artifacts. The "Lake Mojave Complex" is one of many assemblages that form a widespread cultural horizon over the western Great Basin and most of California. This cultural horizon or some parts of it have also been given various and sundry names and interpretations. Rogers used the terms Playa (1939) and San Dieguito (1966) while others used Lake Mohave Complex (Wallace 1962), Lake Mohave Pattern as part of a larger Western Lithic Co-Tradition (Davis 1969, 1978), Western Pluvial Lakes Tradition (Bedwell 1970, 1973; Hester 1973), Lake Mohave-Pinto Tradition (Tuohy 1974), Haskomat and San Dieguito (Warren and Ranere 1968) and Nevares Springs Culture (Wallace 1977a) and Mohave Period (Bettinger and Taylor 1974).

The dating of the Lake Mojave Complex was a point of debate until very recently when Ore and Warren (1971) and Warren and Ore (1978) completed a study of the history of lake fluctuation and relationship of archaeological sites to lake deposits. This study, which reported buried cultural material in dated lake deposits, has apparently temporarily stalled the debate.

The Lake Mojave Complex has been interpreted as a regional expression of an early hunting tradition for the past forty years. The emphasis has changed but the general picture presented has remained unusually consistent. In the original report Amsden (1937:90) said:

> "The Lake Mohave collection characterizes its makers unmistakably as hunters; they must have lived a life much like that of the buffalo-hunting Indian tribes of the Great Plains."

Rogers felt the Playa Industry represented the remains of hunting people. He stated (1939:27)

> The manufacture of numerous scraper types, knives and possibly projectile points, would indicate a hunting pattern. The absence of the metate and mortar is almost conclusive proof that they were not seed gatherers.

Regarding the comparable Period I of Death Valley, Wallace (1958:11) stated:

> As the assemblage includes no grinding tools or other objects suitable for processing wild plant foods, it can be assumed that these early people subsisted largely, if not wholly, by hunting.

Warren and True argued for an early hunting tradition in southern California. They state (1961:275):

> "The artifact inventory argues for a basically hunting economy. /although/... the evidence for specialized hunting activities of early man in Southern California is not nearly so clear-cut or precise as that of the Plains."

In 1967 Warren argued for a <u>generalized</u> hunting tradition and in light of more recent interpretations, his argument is interesting to quote at length (1967:183-184).

> "The Great Basin of 9000 to 12000 years ago may be viewed as having a climate which alternated between moist and arid periods with corresponding fluctuations in lake levels and position of ecological zones. A culture adapted to the more northern moist climate, following a hunting, fishing, gathering pattern in which big mammals were of considerable importance, and supplemented by small game, fish and fowl, moving into the area during this period, would be best adapted to those ecological zones where bodies of fresh water were most stable and game most abundant. The north-south trending mountain ranges would provide a series of such zones. This is especially true of the Sierra Nevada and Peninsular ranges, from which a number of

streams and rivers flowed into the lakes along the western edge of the Great Basin and the Mohave and Colorado Deserts. Here the environment was presumably similar to that of the Northwest. The lakes and streams provided ample water for game animals and water fowl, and the wooded areas presumably met the more open grass and scrub lands to form an ecotone or series of ecotones in which a larger variety of plants and animals was to be found than in adjacent ecological zones. It is in this area that the San Dieguito remains appear to be most abundant. It is on these bases that an early generalized hunting tradition has been postulated. We recognize this postulated hunting tradition as a theoretical construct, one from which we hope testable hypotheses will logically follow regarding the form of the early cultures in the west and their relationships to the prehistoric environment.

Bedwell (1970, 1973) and Hester (1973) have developed a similar construct--Western Pluvial Lakes Tradition. Hester states (1973:65):

> The Western Pluvial Lakes Tradition can be defined to include lacustrine-oriented sites of the early time space between ca 9000 - 6000 B.C. Lithic traits consist of Lake Mohave, Hasket (and "Haskett-like"), Cougar Mountain, and related lanceolate points, lanceolate points with concave bases (cf. Black Rock Concave Base), probably also fluted points, long-stemmed points similar to Lind Coulee, crescents (Great Basin transverse specimens), and possibly-core-blade and burin technologies.

The sites of the Western Pluvial Lake Tradition cover a wide area and include the C. W. Harris site, Lake Mojave, the Witt site, Borax Lake, the Coleman site, Black Rock Desert sites, and Big Springs, Oregon, among others.

Hester continues:

> To summarize, there is evidence of a widespread lacustrine-oriented cultural manifestation in the Great Basin between ca 9000 B.C. and ca 6000 B.C. I prefer to group the various sites and localities exhibiting lacustrine orientation (as manifested by their location and their traits in their respective lithic assemblages) into the Western Pluvial Lakes Tradition initially defined by Bedwell (1970) (1973:68).
>
> The settlement pattern data reveal that sites of Western Pluvial Lakes Tradition were situated along the shores of ancient lake systems, and this implies a predilection toward the utilization of lacustrine resources at an early time level (1973:124).

and

> The Western Pluvial Lakes Tradition of 9000-6000 B.C. represented by a specialized tool kit and a lacustrine adaptation; there are also concomitant non-lacustrine occupations in the Basin, but these remain vaguely understood (1973:127).

The Western Pluvial Lakes Tradition was first criticized by Tuohy (1974:98-99) who questions the use of the concept of tradition and suggests that horizon might better fit the wide spread early assemblages. More recently Heid, Warren and Rocchio (1979) have more thoroughly criticized the concept of Western Pluvial Lakes Tradition. They question the idea of a specialized lacustrine adaptation pointing out that 1) the "specialized tool kit' consists primarily of hunting tools and is not oriented toward lacustrine resources; 2) the correlation of site location with pluvial lake shores reflects a bias in the sample of selecting pluvial lake environments in the search for early man; 3) there are very few faunal or floral remains from the sites of the Western Pluvial Lakes Tradition and where such remains are present they suggest a more general hunting, fishing, and gathering pattern.

E. L. Davis (1978) has recently published the results of her Lake China investigations and in her discussion of early lake side adaptation, based on ecological data ranging from megafauna remains to fish and pollen, suggests that the early sites around Lake China represented one segment of the activities of a seasonal round. She states:

> During lakeside seasons of their annual round, these people had a Primary Marsh Orientation. Marshes are rich ecosystems (Storer 1953). During favorable climatic intervals, foraging bands of people used these resources for foods and raw materials, whereas the musky swamps served as bog-traps for large herbivores. (1978:21)

and

> The Paleo Indians here /Lake China/ were not primarily mammoth eaters. They were general foragers who occasionally killed a large herbivore... (1978:177)

It seems clear that the lacustrine orientation is only one aspect of a much broader extractive system of early man in the West and that the concept of the "Western Pluvial Lakes Tradition" overemphasizes the lacustrine orientation at the expense of what now appears to have been more important hunting and collecting activities. Furthermore, there is probably more cultural variation during this early period than is expressed by the concept of Western Pluvial Lakes Tradition.

As early as 1968 Warren and Ranere outlined what they felt to be significant variations in the early assemblages now classified as Western Pluvial Lakes Tradition. Warren and Ranere's paper is of special interest here because it deals specifically with the Lake Mojave collection. At Lake Mojave they recognize three distinct cultural expressions in the Lake Mojave Complex. These are:

A. Fluted Points:

These points usually occur as isolated specimens or in questionable association on surface sites. They cannot, at this time, be shown to be part of an assemblage and they cannot be adequately dated.

B. San Dieguito:

This complex is best known today from the C. W. Harris site on the San Diego Coast. However, it is clearly represented in sites throughout much of the California desert and adjacent areas of Arizona and Nevada where it has been reported under a variety of different names (Rogers 1939, 1966; Warren 1967; Warren and Ranere 1968). The San Dieguito Complex is characterized by leaf shaped points and knives, crescents, and domed scrapers of several types. This assemblage exhibits a relatively crude stone flaking technology and is dated at the C. W. Harris site as beginning sometime before 7080 B.C. and terminating about 6000 B.C.

The San Dieguito Complex appears to have a distribution concentrated in southern California into Baja California. However, the Coleman site as far north as Reno, Nevada, exhibits both technological and typological similarities to the San Dieguito Complex.

C. Haskomat:

The Haskomat Complex is a conglomerate of what could be several distinct assemblages and is not generally recognized as a cultural unit. However, the artifacts used to characterize it (Warren and Ranere 1968) are distinct from San Dieguito artifacts and exhibit both technological and typological attributes not found in the San Dieguito assemblage. The sites are highly varied and include surface locations on ancient shorelines of Pleistocene lakes in the northwestern Great Basin and rockshelters and open sites in Oregon and Idaho.

> Distinctive artifacts include Haskett points, the Cougar Mountain type with sloping shoulders and a long parallel sided stem, a wide variety of scrapers including concave scrapers (spoke shaves) of unusual forms and flake gravers with one or more small sharp projections. There are also leaf shaped points and knives and a variety of scrapers.

Some forms of artifacts appear to be shared by the Haskomat and San Dieguito complexes. However, the stone flaking technologies appear to differ. The Haskomat projectile points, for example, were most often executed by well-controlled direct percussion with collateral flaking at right angle to the margin followed by delicate pressure flaking at the margins. This results in straight lateral margins and thin lenticular cross sections. San Dieguito points, on the other hand, were made by a relatively crude percussion technology resulting in deep negative bulbs of percussion with step fractures producing irregular edges and surfaces. Edges are also often flat and crushed as if supported on an anvil.

The Haskomat and San Dieguito complexes are both represented at the Lake Mojave sites. However, as Warren and Ranere (1968) note, San Dieguito appears to be more characteristic of the Mojave Desert, while Haskomat appears to have, primarily, a northern distribution through the northwest Great Basin.

E. L. Davis (1969:22) defined the Western Lithic Co-Tradition.

> "There is a strong resemblance between the toolkits of ancient peoples who camped near shores of Lake Panamint, Humboldt Sink, Lind Coulee (Daugherty 1956), Lake Mohave, the San Dieguito River and on the fans of Death Valley. Hunter-collectors with comparable adaptations and technologies were thinly scattered through the deserts of California, Nevada, into the Plateau and down into Baja California. It is suggested that all the industries have enough in common to compose a co-tradition (Rouse 1954) which was established by 7000 B.C. with some of its traits continuing until recently.

Davis lists the following traits as diagnostic of the Western Lithic Co-Tradition: Weak-shouldered, long stemmed point/knives, side struck flakes, "extensive production of macroflakes (massive, and more than 12 cm. long)", amorphous cores, large end scrapers, spoke shaves, crescentic implements, high domed planes, step flaking, pressure retouch of scrapers with some denticulation, point/knives made on flakes, knife/points made on ovate blanks, emphasis on ovate bifaces of all sizes, proportions and degrees of finish (i.e. biface series), choppers and chopping-tools, scarcity of blades, absence of seed milling equipment, frequent proximity to sources of water now dry or reduced.

Later E. L. Davis (1978:45-51) postulates a fluting co-tradition from which the Clovis developed before moving into the plains. The fluting co-tradition consists of a preclassic, classic and postclassic. The classic Clovis toolkit in the West includes crescents, crescentics, flake cutters, needletip knife/points with concave bases (possibly), fluted knife/points with either parallel-sided or ovate bodies, unfluted, lanceolate knives or preforms with square bases, "slug" scrapers that are keeled and bipointed, and scrapers, side scrapers, spoke shaves, saws, shredders, "steak knife" slicing flakes, choppers, pounding/grinding rocks, broad beaks, curved broad beaks, triangular broad beaks, spur beaks, single spur beaks, double spur beaks, multiple spur beaks, unmodified flakes, used for many tasks, and core ovate bifaces (preforms).

E. L. Davis' fluting and Western Lithic Co-Traditions correspond generally with the Complex described by Warren and Ranere (1968). Although Davis (1978) sees a lineal development in the Mojave, for both her co-traditions, beginning some 45,000 years ago, whereas Warren and Ranere's (1968) discussion refers only to the Lake Mojave Period.

Tuohy (1974) disagrees with these interpretations and argues for single "Lake Mohave-Pinto Tradition" during the early part of which the fluted points are an element. He thus interprets the fluted points as much a part of the assemblages as the other early artifacts: "Perhaps the reason Western Clovis points are found cheek by jowl with stone tool kits of Lake Mohave persuasion is because they belong there, just as surely as if one were to open a modern tool box and find a variety of small hand tools in the same container."

To summarize: The Lake Mojave period is charcterized by a variety of projectile points that are variable in both size and form. They are, however, of a size used on throwing darts and spears. The forms include variations of leaf shaped forms, Clovis fluted and long stemmed points with narrow sloping shoulders (Lake Mohave, Cougar Mountain and Lind Coulee points) and occasionally short bladed stemmed points with pronounced shoulders (e.g. Silver Lake). Also characteristic of this period are the crescents which occur in simple lunate to highly eccentric forms. Often associated with these period markers are simple flake engraving tools (spiked gravers) with one or more very small, finely retouched points, specialized scrapers of distinct types, some drills, leaf shaped knives, and a few heavy core tools that functioned as choppers and/or hammerstones. There appears to be no milling tools in these assemblages in the Mojave Desert.

Most of these sites are found near shorelines of Pleistocene lakes which has led Bedwell (1970, 1973) and Hester (1973) to postulate the Western Pluvial Lakes Tradition. There are few data, however, to support this interpretation. There are no tools that can be shown to be specialized for use in lacustrine environments. The tools, to the contrary, appear to be more typical of hunting activities (Tuohy 1974:106; Heid, Warren and Rocchio 1979). The primary evidence for a lacustrine adaptation appears to be the distribution of sites about the Pleistocene lake shores and this can be questioned because of sampling bias in the search for early man. Recently, Venner (1978:13) has argued for fish weirs along Party Hill Bay (also called Benchmark Bay by Ore and Warren 1971). His argument is based on fish weirs reported by Wilke (1978) from Lake Cahuilla. There are, in the opinion of this writer, significant differences in these alignments, and the analogies cannot be adequately evaluated until details of alignments from both locations are available. Finally, there are few sites with faunal remains and none that show a clear primary orientation toward lacustrine resources.

Warren (1967) proposed that these early populations were adapted to the ecotone between woodlands and grasslands found along the eastern slope of the Sierra Nevada (and presumably neighboring mountain ranges of sufficient elevation). Warren contends that these early cultures adapted to the environmental zones that were richest for generalized hunters who also collected wild plants and did some fishing. The lakes are only one aspect of this adaptation and in some instances were out of the more productive zones.

Further, as D. Weide (1976) has pointed out, the Pluvial lakes of the Great Basin were not necessarily high production areas. The development of any appreciable amount of shoreline vegetation was sharply retarded by rapidly fluctuating lake margins and gentle slopes while "along steep marginal slopes, no depositional areas were available for the development of soil, again resulting in a remarkable sterile water-rock interface" (Weide 1976:177). On this basis "the importance of large segments of their perimeters to early hunting and gathering cultures must be questioned" (Weide 1976:177).

Not all lakes in the western Great Basin necessarily fit Weide's description either. There are some lakes where large quantities of sand have accumulated and support a denser vegetation than the surrounding area even today. Such locations must have been highly productive during periods of greater availability of water. Cronise Basin and the southern end of Soda Playa are two such localities. Weide's point is well taken--a Pleistocene lake in the Great Basin is not necessarily a highly productive ecological zone.

Other water sources were available to populations during the Pluvial: namely rivers, springs and marshes. Rivers fed the Pluvial lakes, and marshes were often found adjacent to springs and in low gradient portions of the river courses. These areas of water supported heavy vegetation and were probably more productive than most lakeshore areas. There were highly productive areas other than Pluvial lake shores. There is no need to postulate any kind of specialized lacustrine adaptation as long as these other productive areas were in existence.

Currently, the interpretations of the human use of resources in the Mojave Desert during the Lake Mojave Period falls into two categories: the generalized hunters and gatherers proposed by Wallace (1958), Warren (1967), Davis (1969, 1978), and others (Amsden 1937, Rogers 1939, Hunt 1960); and the lacustrine oriented peoples of the Western Pluvial lakes Tradition of Bedwell (1970, 1973) and Hester (1973). Warren developed the hypothesis that a generalized hunting, fish and gathering culture adapted to the ecotones of the north-south trending mountains of the western Great Basin "where bodies of fresh water were most stable and game most abundant" (1967:185-4).

Bedwell (1970, 1973) and Hester (1973) see this early occupation as adapted primarily to lake resources. "The settlement pattern data reveal that sites of the Western Pluvial Lakes Tradition were situated along the shores of ancient lake systems, and this implies a predilection toward the utilization of lacustrine resources at an early time level" (Hester 1973:124).

These two positions best serve as theoretical statements that can generate testable hypotheses regarding the early occupation of the western Great Basin and the Amargosa-Mojave Basin planning units in particular. Current knowledge of the distribution of Lake Mojave Period sites in the Mojave Desert is based primarily on surveys that selected Pluvial lakes in a search for ancient man (Campbell and Campbell 1937:9). The question then is not whether human populations utilized the lakes during the Lake Mojave Period, but rather were they primarily lacustrine oriented. We have recorded the lake-side sites; it is now time to at least look for those sites at springs, ancient marshes, upland resource areas. Only recently have these areas come under scrutiny of the survey archaeologist (e.g. Coombs 1978, Brooks 1978) and then as part of a more general problem of site inventory and evaluation. An adequate test must involve an intensive investigation of localities selected because of their high potential for early occupation as well as a large random sample away from the Pleistocene lake shores. The investigation of this kind should result in the development of long chronologies that document the absence or presence of the assemblages that characterize the Lake Mojave Period.

The Pinto Period

As the Lake Mojave Period drew to a close the environment was undergoing major changes; arid conditions set in and became increasingly severe, the lakes dried up and the ecological zones supporting the flowing streams became more and more restricted in distribution. As the lakes dried up and rivers stopped flowing, the plants and animals retreated to higher elevations.

Consequently the peoples of the Mojave Desert had to either adapt to the aridity of the lowlands, retreat with plants and other animals to higher elevation, or withdraw from the desert. Any one of the alternatives or a combination of all three could have resulted in the problems of interpretation archaeologists have with the succeeding Pinto Period. To set the initial date of the Pinto Period during a time of increasing aridity is to invite immediate criticism. Pinto Basin material traditionally has been dated to the "Little Pluvial" or the "Pluvial" because of the association of artifacts with extinct bodies of water. In anticipation of such criticism we again maintain that the Pinto Period is a unit of time and in fact artifacts of the Pinto Basin Complex may be absent from at least part of the Mojave Desert during the early Pinto Period.

Warren and Crabtree (1972) dated the Pinto Period at 5000 to 2000 B.C. in the Mojave Desert. Unfortunately there are no radiocarbon dates for components in the Mojave Desert containing clearly defined Pinto points. There are two dated components for which Pinto Basin affiliations have been claimed: The Corn Creek Dunes site (Williams and Orlins 1963) with assays from seven hearths, is dated to a period of about 2080 to 3250 B.C., but it lacks any diagnostic projectile points. Shutler, Shutler and Griffith (1960) reported three shoulderless Pinto points from early levels at Stuart Rockshelter that were dated by radiocarbon at 1920 ± 250 B.C. and 2100 ± B.C. However, the shoulderless Pinto points may prove to be Humboldt concave based points. The age of the Pinto points remains one of the primary problems in dating this period.

Because of its association with topographic features attributed to extinct bodies of water, the Pinto Basin Complex was dated by early archaeologists as early post Pleistocene or Little Pluvial. Scharf (1935:20) and Amsden (1935:51) originally dated the Pinto Basin Complex at or near the close of the Pleistocene. This conclusion was based primarily on the association of Pinto Basin sites with topographic features attributed to an ancient river. Rogers (1939:72) dated his "Pinto-Gypsum Industry" between 800 B.C. and A.D. 200 on the basis of cross dating with Basketmaker assemblages from the Southwest. From the earliest reports on the Pinto Basin Complex there has been a "long chronology" (early post Pleistocene date) and a "short chronology" (Little Pluvial date). Although couched in different phraseology, this distinction of long and short chronologies still persists.

Rogers (1939), Harrington (1957), Wallace (1958, 1962, 1977), Hunt (1960), Lanning (1963), Kowta (1969), Hester (1973), and Bettinger and Taylor (1974) all argue for a short Pinto chronology. On the other hand Antevs (1952), Susia (1965), Simpson (1965), and Warren and Crabtree (1972) join Amsden (1935), Scharf (1935) and the Campbells (1935) arguing for a long chronology.

Antevs (1952) placed the Pinto Basin Complex in the early Holocene on the basis of association of Pinto Basin artifacts with Pleistocene beaches at Owens Lake.

Harrington (1957:70-71) argues convincingly that the Stahl site is a component of the Pinto Basin Complex. However, his reasoning behind assigning a date of 3,000 to 4,000 years sometimes strains credibility. He argues that the site was occupied during a more moist time

> ... because it /the site/ is now three-quarters of a mile from the nearest water (Little Lake), and villages were usually established much closer than that to their supply. Probably, we thought, the stream bed extending past the site, now dry, contained water when the place was inhabited.

Harrington (1957:71) thought his "most convincing evidence" for the occupation during a moist time was that the ground beneath the midden contained

> many tree-holes and root holes, showing that a grove of trees had stood on the site of the village either while it was occupied or very shortly before. This we know because many of the holes contained village refuse which could not have occurred had the tree existed and died a long time before.

How the village refuse replaced the trees and roots is a process Harrington did not discuss, and it seems an improbable if not impossible interpretation of those sub-midden features. Harrington continues (1957:71)

> Another argument for a wetter climate is the presence of projectile points of Silver Lake and Lake Mohave type scattered among those of Pinto origin--90 of them among 497 Pinto points--indicating association or trade and a contemporary period.

This association indicates a wetter period because Silver Lake and Lake Mojave types are associated with dry lake beds in southeastern California and Nevada.

This wetter period, we are told, is some 3,000 to 4,000 years ago during the "Little Pluvial" and not "Great Pluvial" because identifiable bone at Little Lake was all from surviving species. No extinct animals were represented. Finally, Harrington cites Shutler and Griffith's radiocarbon dates for the Stuart Rock Shelter (Harrington 1957:72).

Lanning (1963:294) argues

in every case where a Pinto point assemblage with its accompanying leaf shaped point forms has been excavated in the western Great Basin, the evidence of radiocarbon dates, Central California shell beads, or associated fauna indicates a relatively recent date. Wherever the evidence is specific, it shows dates around 1000 or 2000 B.C.--that is early Medithermal Period. The excavated and dated assemblages include not only Little Lake and Early Rose Spring, but also the closely related Karlo and Lovelock complex and the Stuart Rockshelter. Against this mass of evidence for a recent age, the Anathermal dates attributed to the Pinto industry at the Pinto Basin and Owens Lake sites cannot stand. As Harrington has shown, the cultural assemblages at Little Lake are nearly identical to that at the Pinto Basin, and it is out of the question to assume that this culture persisted unchanged for 6,000 to 7,000 years (Harrington 1957:20).

Both Lanning (1963) and Harrington (1957) imply by their interpretation that the Stahl site is a single cultural unit. However, the midden is up to 54 inches deep with four artifact bearing strata. Given the usual slow deposition on sites in the arid environment of the California Desert it seems unreasonable to assume that the Stahl site represents a single unit in time.

When a long period of occupation is assumed, then the fact that Lake Mojave and Silver Lake points make up 13.2% of the total number of projectile points can be interpreted as resulting from cultural change. If this is the case we need not postulate "association or trade" between "Pinto people" of 3,000 B.C. and "Lake Mojave people" of 5,000 B.C.; nor is it necessary to speculate that Pinto people were such avid point collectors that they gathered one out of every ten projectile points from Lake Mojave period sites. That some portion of the Stahl site dates from 3,000 B.C. is very likely, but the site has not been absolutely dated, and a much earlier date is also possible given the occurrence of Lake Mojave points, spiked gravers and "narrow notched concave scrapers," which all form part of the Lake Mohave Complex.

Wallace's Period II Mesquite Flat Culture (1958, 1977a, Wallace and Wallace 1978) for Death Valley and Period II Pinto Basin (1962) for the Southern California Deserts are dated at 3,000 B.C. to A.D. 1. Wallace's Period II Pinto Basin is a highly condensed summary of much work; consequently, his views of dating and cultural relationships are more fully expressed in his discussion of the Mesquite Flat Culture. Wallace (1958:13) comments

> The Death Valley material are comparable to those recovered at Pinto Basin in Riverside County (Campbell and Campbell 1935). The typical Mesquite Flat point is like the Pinto form though differing in details. Leaf shaped points are also shared. Both complexes

also include similar blades and rough core tools. There are divergences also: Pinto Basin sites contain milling stones and hand stones; Death Valley sites only mortars and pestles.

Wallace (1958:12) also noted that projectile points were plentiful and "frequently of excellent workmanship." There are several varieties present; the typical form has both side and basal notching, giving a characteristic "footed" or "eared" appearance; other points are either corner notched with straight or convex base, or leaf shaped. These points appear to resemble Elko Eared and Elko Corner Notched types more closely than the Pinto Points from Pinto Basin. Later, Wallace (1977a, Wallace and Wallace 1978) and Hunt (1960), subdivided the Death Valley II period into an early and late phase. The early phase being characterized by Pinto, Elko and perhaps Humboldt points in Hunt's (1960:81-110) classification, but by only Pinto in the Wallaces' (1978:4-12) presentation. Late Death Valley II is limited to primarily Elko Corner Notched in Hunt's scheme, but Elko Corner Notched and Elko Eared are characteristic of Wallace's late phase.

Rogers (1939:47-60) defines his Pinto-Gypsum Complex primarily by the presence of Pinto and Gypsum points arguing that geological evidence suggest that they were both present in the same wet period. However, he also argues that Pinto points may begin earlier than Gypsum points. Rogers gave a conservative date of between 800 B.C. and A.D. 200.

Kowta (1969:37-38) in his discussion of the Sayles Site notes the "thinning of the desert population" between 6,000 B.C. and 3,000 B.C. followed by "marked increase in the evidence of human occupation" after 3,000 B.C. The period from 3,000 to 1,500 B.C., according to Kowta, is represented in the Desert Region by the Pinto Basin Complex.

Hester's (1973) major concern was to develop a chronology for the Great Basin and in doing so gave considerable space to the dating of the projectile point types of the Great Basin. Hester (1973:28) would date the Pinto Point series, and presumably the Pinto Basin Complex between 3,000 B.C. and 700 B.C. He notes that it is possible that this type began somewhat earlier. He cites seven radiocarbon dated components that fall between 670 B.C. and 3,350 B.C. However, only one of these, the Stuart Rockshelter, is in the Mojave Desert. All others are in the Northern and Western Great Basin.

Bettinger and Taylor (1974) are also primarily concerned with developing the definition of chronological periods for the California deserts. Their Little Lake Period is characterized by Pinto points and is placed between 4,000 B.C. and 1,200 B.C. However, they again point out that the radiocarbon dates are from the northern and western Great Basin and may be misleading and inaccurate for the Mojave Desert sequence. Layton and Thomas (1979) have recently published a single radiocarbon date of 4100 B.C. ± 380 (corrected) for a series of Pinto points from Silent Snake Springs in Northwestern Nevada.

There is generally an agreement among those who follow the short chronology interpretation, that the Pinto Basin Complex in the Mojave Desert follows a period when the population was sparse and presumably totally absent from some regions. Estimates of length of this period vary, but generally the period dates between 5,000 B.C. and 4,000 B.C. or 3,000 B.C. A period of this magnitude with no occupation of the desert would require a total break in the cultural sequence. However, such does not seem to be the case as exemplified by the Lake Mojave points at Little Lake. Consequently, two other interpretations are possible: 1) that the Lake Mojave period sites actually occur later in time than proposed here and are contemporary or immediately precede the Pinto Basin and Little Lake material; or 2) the desert continued to be occupied by a small population whose archaeological record has yet to be recognized. The first alternative can be dismissed because there are adequate data to date the cultural complexes of the Lake Mojave period. The second alternative leads us to the long chronology interpretation and a reasonable compromise that apparently fits the existing data.

Susia argues for a long tradition in the Mojave Desert with the "Pinto phase" representing the end product (1964:31):

> The Pinto phase can be seen as probably the final time period in a tradition in western prehistory that can be traced back about 10,000 years to the Lake Mohave and Death Valley I surface finds. Documentation for the entirety of the period does not exist; so it remains a hypothesis..."

Simpson (1965:18, 20, 45) apparently sees the Pinto Basin phase following immediately the Lake Mojave of the late Pluvial times. The Pinto continues until about 3,000 B.C. and is followed by the Amargosa Complex. Simpson does not discuss the possible relationship between Pinto Basin and Lake Mojave Complexes.

Tuohy, on the other hand, is very specific in his discussion of the relationship of these two complexes (1974:100-101):

> I have tried to relate descrete artifact assemblages of the Western Pluvial Lakes Horizon to one another, and to similar, if not identical, manifestations elsewhere in the Great Basin. In doing this, I chose to use the term 'Lake Mohave' ... largely because Lake Mohave is the type station for such a presumed complex or culture...

> I ...would define 'Lake Mohave' both as a single phase within the Lake Mohave Tradition, and as a tradition itself within the Western Pluvial Lakes Horizon. Furthermore, I would hyphenate the Lake Mohave Tradition to include ancestral Pinto materials, presently called 'Silver Lake' in the southwestern Great Basin, thus creating a reborn 'Lake Mohave-Pinto Tradition.'

Tuohy (1974) would place the initial date of the Lake Mohave-Pinto Tradition at ca 11,000 - 9,000 B.C. and have it persist as late as perhaps 670 B.C. at the Rodriguez site in north-eastern California.

Warren and Crabtree (1972) in their review article implied support of the long chronology with Pinto Basin Complex representing a long tradition dating back to the Lake Mojave Period.

Generally the followers of the long chronology see the Pinto Basin Complex as resulting from a development out of the older assemblage(s) of the Lake Mojave Period, and to represent a long tradition covering some 5,000 or more years. This argument places the initial phases of the tradition earlier than the radiocarbon dates for Pinto points. However, it explains the occurrence of the Lake Mojave points in association with Pinto points at the Stahl site. Given this interpretation, it is not necessary to attribute the Lake Mojave points to a contemporary assemblage or to later people picking them up as curios from some earlier site. The Stahl site simply represents a long occupation and the development of a tradition.

Neither those who support the short chronology nor those who call for a long chronology have marshalled evidence enough to demonstrate the accuracy of their respective interpretation. Furthermore, there are certain basic problems that must be solved before these interpretations can be adequately evaluated. The interrelated problems of taxonomy and chronology are the most basic. The Pinto Point typology is one of the most confused and difficult to use because archaeologists devised different typologies for the same range of points. Amsden, in the original Pinto Basin Report, does not describe the variation in the Pinto points that were later to be called types. What he describes apparently includes the shouldered varieties, but not the shoulderless type recognized later. The characteristics they share are (Amsden 1935:42-44):

> narrow shoulder and usually an incurving base. Frequently there are side nocks just below the shoulder, producing most often three serrations at each edge. The points are thickish, well rounded on each face, as if made from a thick flake by trimming down to its core. (Fig. 6)

Amsden (1935:44) also notes the proportion of Pinto in which "Maximum thickness often equals 30 per cent of the total length and probably averages 20 to 25 per cent...the shoulder and base nocks usually were made by a single deft blow, producing a characteristic crude effect."

Later Amsden (1937:85) defines the Paradise Pinto as differing from "the Pinto type in its deeply notched base, forming ears, and its larger size."

Rogers (1939:54) goes further in describing five types of Pinto points.

> Type 1 has a concave base and sometimes a faintly shouldered effect...a small percentage of the points are equipped with serrated margins. It is difficult to determine the exact number, as the Pinto technique is of so poor an order. The marginal flaking of the average point is very irregular... (Fig. 7; A-E)
>
> Type 2 is broad stemmed with weakly developed shoulders. The stem is usually thick, except at the base, where a desperate effort to thin the edge is generally in evidence. (Fig 7; F-J)
>
> Type 3 has both the base as well as the sides notched. This group contains the highest percentages of serrated points... (Fig. 7; K-O)
>
> Type 4 points have straight bases and are side notched. Type 4 numbers so few that it is quite possible that the type is merely a sub-type of Type 3. (Fig. 7; R-T)
>
> Type 5 is a small, slender leaf-shaped point. The leaf-type is the rarest of all and constitutes only six percent of the total Pinto points. (Fig. 7; P-O)

Rogers also illustrates a Paradise Pinto (1939, Plate 20C) and notes (1939:68) that it is a "Pinto type 3 of exceptional size."

M. R. Harrington (1957:49-53) was the next to "define" the Pinto points. He divided them into five sub-types: shoulderless, sloping shoulder, square shoulder, barbed shoulder, and one shoulder (Figs. 8, 9). Shoulderless points can be equated with Rogers' type 1 Pinto points. Harrington's sloping, squared and barbed shoulders for the most part correspond to Rogers' type 3. However, the square and barbed shoulder sub-types each have broad shallow basal notch varieties that are similar to Rogers' type 2 and type 4.

Rogers' type 5 Pinto is apparently equivalent to Harrington's leaf-shaped points. Harrington's one shoulder Pinto point is a variety not recognized by Rogers and presumably classed elsewhere by Rogers.

Lanning (1963:250-51) in defining the Little Lake Series says:

> Of the various forms called 'Pinto points' in the literature, this series includes only those which occur associated at Little Lake.

Lanning follows Harrington's (1957) typology, defining four types. These are Pinto Shoulderless, Pinto Sloping-shoulder, Broad leaf and Willow leaf. Hester and Heizer (1973) and Hester (1973) as well as Clewlow (1967, 1968) and Heizer and Clewlow (1968) have all followed Harrington's typology with apparent modifications of combining square shoulder and barb shoulder types.

The Pinto typology is further confused because archaeologists are not able to consistently separate Pinto Shoulderless from Humboldt Concave Base A and Humboldt Basal Notched Point; and Pinto Shouldered and Barbed from Elko Eared (Thomas 1971, Butler 1970).

Another interesting parallel is presented by Rogers (1939) and Thomas (1971) showing the inability to separate Pinto points from Elko Eared points. Rogers (1939:55) suggested that Gypsum Cave points might well be classed a sub-type of the Pinto, while Thomas (1970:47) and Clewlow (1967:141) both re-classified Gypsum Cave points as Elko contracting stem points.

Given the state of the taxonomy, it appears reasonable to question 1) the distinctions between Pinto points and the Humboldt and Elko series, and 2) if there are differences, could the temporal placement also be confused by errors in identification of projectile point types? Until the problems of typology are resolved, the identification of the primary "diagnostic" artifact types (i.e. the Pinto points) of the Pinto Basin Complex cannot be consistently made. Consequently, the Pinto Basin Complex is essentially limited to the Pinto Basin assemblage. The Pinto Basin Complex also remains essentially undated because cross dating is questionable.

Another debate is to be found regarding the subsistence activities and economic pattern of the Pinto Basin Complex. Susia (1964:31) describes the Pinto Basin Complex as representing:

> A lifeway based on large and small game, collecting of vegetable foods, and perhaps exploiting of stream resources apparently permitted the Pinto groups to exist in the area without resorting to food grinding.

The lifeway described by Susia is supported by Wallace's (1958:18, Wallace and Wallace 1978:7) contention that seed processing with millingstones was relatively unimportant, but it is contrary to the interpretation of Williams and Orlins (1963) for the Corn Creek site. The difference of opinion revolves around the relative importance of millingstones in the Pinto Basin

Complex. Millingstones have been reported from the Stahl site (Harrington 1957) where they are relatively important and from the Pinto Basin sites (Campbell et al. 1935) where they occur in few numbers.

Hunting tools apparently represent a more important aspect of the economy since projectile points, knives and scrapers make up the largest part of the assemblage. It now appears that seed grinding tools were adopted by peoples of the Pinto Basin Complex but never played as important a part in the economic activities as they did elsewhere in the desert west. If the long chronology is accepted, this presents an interesting problem of adaptation to a desert environment during a period traditionally viewed as even drier than today and adaptation based on a technology oriented primarily toward hunting.

<u>Summary</u>

There are several different interpretations of the cultural developments in the Mojave Desert during the Pinto Period (5000 to 2000 B.C.) but none of them can be adequately documented. A major problem is the definition and identification of Pinto points. Pinto points are very similar (or identical) to the Humboldt Concave Based A points and Elko Eared points. There is no doubt that there has been some confusion of these types. Since Pinto points are the most diagnostic artifact types of the Pinto Basin Complex, it seems logical to assume there is some confusion of the artifact assemblage and the chronological placement of the Pinto Basin Complex. There are two interpretations of the data relating to the dating of the Pinto Basin Complex. The radiocarbon dates appear to support a short chronology with the Pinto points beginning about 3,000 B.C. and continuing until ca 700 B.C., however, most of these dates derive from sites outside the Mojave Desert and the identification of the Pinto points may be inaccurate in some cases.

The association of Pinto points with Lake Mojave points, Silver Lake points, and small beaked gravers, and certain concave scrapers in a deep midden at the Stahl Site suggests a long period with relatively little change. The general life-way as well as some artifacts of the Pinto Basin Complex, suggest a long cultural continuity dating back to the Lake Mojave Period. The long chronology interpretation also lacks adequate documentation, but explains some of the data not considered in the short chronology.

If the short chronology proves essentially correct then the Mojave Desert cultural sequence has a hiatus of approximately 2,000 years, during the height of the Altithermal. If this is correct, a whole new set of problems are before the Mojave archaeologists. We shall return to these problems after we review the succeeding Gypsum Period.

The Gypsum Period

The Gypsum Period is dated at about 2000 B.C. to A.D. 500 by Warren and Crabtree (1972) and is marked by the occurrence of projectile points of the Humboldt and Elko series and by the Gypsum Cave points. This corresponds closely to Bettinger and Taylor's (1974) placement of their Newberry Period at 1200 B.C. to A.D. 600 distinguished by Gypsum Cave and Elko points. The initial date is based on the first occurrence of the Humboldt series on the O'Malley Shelter where they first occur and are most numerous in Unit II, stratum 3 at 2680 B.C. and Unit II stratum 4 at 1990 and 1970 B.C. (Fowler, Madsen and Hattori 1973) and Stuart Rockshelter (Shutler, Shutler and Griffith 1960) where three points from the earliest levels were identified as shoulderless Pinto points. On the basis of the published photograph these points appear much closer to the Humboldt series than the shoulderless Pinto as illustrated by Rogers (1939) and Harrington (1957). These points together with the Elko series and the Gypsum Cave point persist until after the time of Christ. Pottery is introduced into the eastern Mojave about A.D. 500 (Shutler 1961) by which time the bow and arrow had essentially replaced the atlatl and this change in weapons is marked in the archaeological record by the reduction in size of the projectile points.

There are few site reports for this period in the Mojave Desert (Harrington 1937, Smith et al. 1957, Shutler, Shutler, and Griffith 1960, Shutler 1961, Schroeder 1961, Lanning 1963, Hillebrand 1972, 1974, Panlaqui 1974) and few from adjacent areas (Fowler, Madsen and Hattori 1973, and Wheeler 1973), but these are very uneven in the presentation of the data. More data are contained in the more general works of Rogers (1939), Wallace (1958, 1962, 1977a, Wallace and Wallace 1978), and Hunt (1961) but data for this period remains scanty and the definition of the cultural assemblage for this period in the Mojave Desert remains a major problem.

Interpretations of the Gypsum Period remains fall into two major categories that no doubt reflect the biases of the archaeologists as well as the trend of prehistory: Lanning (1963), Clewlow, Heizer and Berger (1970), Hester (1973), Bettinger and Taylor (1974) all tie Gypsum Period data to the western Great Basin, noting especially the similarity in projectile point types. These studies have dealt primarily with chronological problems and therefore have emphasized the projectile point sequence of the western Great Basin where it is best known.

Rogers (1939), Wheeler (1973), Schroeder (1961), Shutler et al. (1960) and Shutler (1961) interpret the Gypsum Period in terms of Southwestern relationships. The southwestern influences are seen in the occurrence of pit houses along the eastern fringe of the Mojave (Schroeder 1961, Shutler 1961) followed by the introduction of Basketmaker III pottery. Another Southwestern trait which finds its way into the Mojave during this period is the split twig figurine. These are reported at Newberry Cave where one is dated at 1020 B.C. (LJ-993) (Smith et al. 1957, Smith 1963) and in the eastern Mojave at Etna Cave (Wheeler 1973) and an unidentified shelter in the Moapa Valley (Schwartz et al. 1958). The split twig figurine is reported at earlier dates in the Grand Canyon (2145 B.C. to 1150 B.C.) and southern Utah (Schwartz et al. 1958, Euler 1966, 1967, Schroedl 1977) and presumably diffused into the Mojave Desert from that source.

The subsistence pattern during the Gypsum Period apparently emphasized hunting activities, although seed processing was more important than during earlier periods. Mortar and pestle were introduced and manos and metates continued in use from earlier periods. Seed collecting presumably became more important to the economy as the tools for processing became more varied and numerous. However hunting apparently continued to be a major focus of activity and thought. The context in which the split twig figurines are found in the Grand Canyon may have some significance for interpreting hunting activities in the Mojave Desert. Schwartz and others state (1958:273) that the split twig figurines in the Grand Canyon are always located in extremely inaccessible caves and that some of the specimens are pierced with small 'spears'. This obviously suggests that the whole complex may well be related to hunting magic ritual.

Quite independently, Smith and his colleagues (1957:167) noted that the data from Newberry Cave indicates more ceremonial use than habitation of the cave. Pictographs, weapons and figurines, paint, quartz crystals, small painted stones, sheep dung pendants and necklaces suggest ceremonial equipment used to insure success as a hunter. Making bighorn sheep figurines from split twigs or painting some animal as a symbol on the wall of the cave may be interpreted as part of a hunting ritual.

If hunting ritual involving big horn sheep is represented at Newberry Cave, and bighorn sheep are among the most numerous faunal remains there (Smith et al. 1957:168), then we may have the beginnings of the hunting ritual represented by the elaborate petroglyphs of the Coso Range (Grant, Baird and Pringle 1968, Hillebrand 1972) and by the occurrence of similar petroglyphs found throughout much of the Mojave Desert (Heizer and Clewlow 1973, Grant, Baird and Pringle 1968, Von Werlhof 1965). Although Rector (1976) prefers other interpretations of the rock art in the East Mojave Planning Unit, it is an hypothesis with interesting implications and deserves further consideration.

During the latter part of this period a divergence in cultural development of the eastern and western Mojave can be identified. In the east pithouses and apparently some agricultural traits were introduced into the Moapa and Virgin Valleys of the eastern Mojave while the western Mojave appears to have maintained a less sedentary way of life based on a hunting and gathering economy. The pithouses and agriculture in the Moapa and Virgin Valleys at this time represent the beginnings of the Anasazi influence and is equated with Basketmaker II. This development in the extreme eastern Mojave, leads to the Basketmaker III-Pueblo sequence which falls in the succeeding Saratoga Springs Period (Warren and Crabtree 1972).

This development in the eastern Mojave during the late Gypsum period creates another typological problem. There is a need to distinguish, if possible, between the Elko series projectile points and the so-called Basketmaker points. The Basketmaker points, like the Elko series, are large notched and stemmed points, but it is unclear whether they represent part of a widespread set of horizon markers extending across the Great Basin and into the Southwest, or if they represent an independent development in the Southwest. Much more detailed typological studies are required before answers can even be suggested for this set of taxonomic problems.

In discussing the climatic conditions of the Pinto Period, it is important to also consider the Gypsum Period. These periods apparently represent similar climatic regimes and typological similarities in projectile points and other artifacts. Similar adaptation to similar climatic conditions is suggested and as a concept may aid in solving problems of typology and chronology that have made it difficult to separate the artifact assemblages of these two periods.

The Pinto Period begins during the early warm, dry climatic regime beginning about 5000 B.C., carries through the short wet climatic regime between 4500 and 3500 B.C., and into the succeeding dry hot period about 2,000 B.C. The Gypsum Period begins with the initiation of another wet regime about 2000 B.C. and continues through the succeeding dry regime to about A.D. 500.

Both Pinto Period and Gypsum Period encompass wet and dry climatic regimes and similar environments must have been present during parts of these two periods. The Gypsum Period has the better evidence for a wetter climate and presumably has a somewhat longer wet regime than did the Pinto Period. Following the end of the Anathermal ca 5000 B.C. the Mojave became a howling desert and, although the amount of available water would increase at times, lack of water was to be a controlling factor of plant and animal populations.

During both the Pinto and Gypsum periods sites were occupied adjacent to springs that are today too salty for human consumption or produce too small a quantity of water to support a camp. This suggests that these sites, and perhaps most others in the Mojave Trough, were not occupied during the dry regimes and that human occupation of the central Mojave was essentially limited to those times when the climatic regime produced wetter conditions and more available water. Presumably, during the drier climatic regimes the lower harsher desert areas of the Mojave Trough would be essentially devoid of human occupation, while in the better watered areas of the higher desert, occupation would continue uninterrupted.

If this is a reasonable construction of the relationship between man and physical environment in the Mojave Desert during these periods, we should expect a certain relationship of archaeological remains to certain topographic features, particularly springs. Unfortunately, if our hypothetical relationship between man and environment is accurate then we should find occupation of both Pinto Period and Gypsum Period at the same sites adjacent to springs in the lower Mojave Desert. However, if the Gypsum Period was wetter than the Pinto Period we would expect Gypsum Period occupation at some springs that would not have been habitable during the Pinto Period.

Hypothetically, in the Mojave Trough and lower elevations of the Mojave Desert, the Pinto assemblage would date from 4500 to 3500 B.C., while the assemblages of the Gypsum Period would date from shortly after 2000 B.C. to shortly after 1000 B.C. However, the populations would have occupied the same limited site areas near springs or other water sources. The intervening dry and hot period would support little or no plant cover on the site. Consequently, the two assemblages would occur at the same spring sites and might also be found mixed in the same stratigraphic deposits.

The hypothetical relationship also suggests that the occupation in the better watered areas would be continuous throughout this period and may demonstrate the development of a long tradition beginning in the Lake Mojave Period and continuing into the Gypsum Period. Well watered areas (e.g. Owens Valley) should produce the entire cultural sequence.

The excavation and radiocarbon dating of spring sites in the Mojave Trough that contain the postulated Pinto Period and/or Gypsum Period assemblages would serve as a test of the hypothesized relationship between man and the environment presented above. Chronological placement of the assemblages corresponding to the two wet climatic regimes would support hypothesized relationships.

Several other problems relating to the cultural material of the Pinto and Gypsum periods deserve consideration, but we cannot inventory them all. The importance of apparent hunting ritual indicated by the Coso petroglyphs (Grant, Baird and Pringle 1968) and presumably by the split twig figurines in Newberry Cave (Smith et al. 1963) and elsewhere (Warren and Crabtree 1972) suggest a deep concern with mountain sheep and the hunting of mountain sheep. The apparent diffusion of these rituals and certain artifact types from Arizona and southern Utah during the Gypsum Period provides a classic problem of culture history as well as one of ecological adaptation.

The taxonomic problems of the projectile points from these periods may be viewed in terms of their culture historical significance on a broader perspective when the Pinto and Gypsum periods are considered together. The Gypsum Period is characterized by the Humboldt and Elko series points, that appear on one hand to have diffused to the Mojave from the western Great Basin, while on the other hand they appear to have evolved from the Pinto series with which they are often confused. To further complicate matters, Basketmaker II points also resemble the Elko series of the Gypsum Period. The relationship between the Southwest and the Mojave Desert during the Gypsum Period apparently is complex and obviously poorly understood. These are all problems that can be addressed by further analysis of existing data, and by further primary research.

Another, but more general, problem relating to causes of diffusion may also be addressed through the Mojave Desert archaeological data. There is obviously widespread diffusion of material items and related behavior patterns. This diffusion may be hypothesized as: 1) occurring during periods of mild climate and economically productive environment or, 2) occurring during periods of harsh climate and economic stress or, 3) occurring during periods of climatic change when climatic conditions were less stable and less predictable. The Mojave Desert provides a set of conditions for testing these two hypotheses.

The Saratoga Springs Period

The Saratoga Springs Period is essentially the period of Basketmaker III and Pueblo sequence in the eastern Mojave (A.D. 500 to 1200). In the western Mojave, sites of this period appear to represent a continuation of the Gypsum Period cultural patterns with changes occurring primarily in the size of projectile points. Projectile points characteristic of the Saratoga Springs Period include the Rose Springs and Eastgate series.

Essentially the same complex of artifacts, including millingstones and manos, incised stones and slate pendants, and the Rose Springs and Eastgate series, is found across the length of the Mojave Desert. However, in the eastern Mojave the Anasazi influence is visible in the occurrence of Gray Ware pottery (some with distinctive olivine temper characteristic of Moapa and Virgin valleys found as far west as Ash Meadows and Cronise Lake). This "influence" varies from the full blown Anasazi settlement on the Muddy River to a smattering of sherds on campsites in the central Mojave.

The Anasazi interest in turquoise certainly had some influence in the Mojave Desert as far west as the Halloran Springs region where turquoise mining was undertaken. The mining here included hundreds of small mines (Rogers 1929) that most writers assumed were manned by the Anasazi. Rogers (1929) reports an occasional turquoise chip as far south and west as Crucero and Cronise where he lists two "Puebloan" sites just west of Crucero and one on the north shore of East Cronise Lake. The identification of strong Anasazi influence at these sites has been confirmed by Drover in recent investigations (Drover, personal communication 1978). The "influence" recognized by these sites is seen primarily in the high percentage of Gray Ware pottery in surface collection.

Other sites along the Mojave Trough with Anasazi pottery present include Halloran Spring (Rogers 1929), the Saratoga Springs site (Wallace and Wallace 1978), possibly China Ranch (McKinney et al. 1971) and Ash Meadows (Hunt and Hunt 1964). These are habitation sites and all but Saratoga Springs and China Ranch sites have such high percentages or large number of Gray Ware sherds as to suggest Anasazi occupation of the sites. Rogers (1929:12-13) states:

> "...There is no doubt that the Mohave Sink region had a scattered but permanent Puebloan population. Besides the East Cronise Lake site, several other widely separated sites in the south end of the sink produced dominant percentages of Puebloan type pottery; so though the region may never have had any large settlement, it certainly had many small sites and single houses scattered over a considerable area."

The degree to which the Anasazi occupied the Mojave Trough region is debatable and remains a major question for Mojave Desert archaeologists. In order to answer questions regarding the nature of the Anasazi occupation, it is helpful to address first the question of the nature of the turquoise mining. Reports on the aboriginal mines (Eisen 1898, Rogers 1929, Leonard, personal communication 1978) indicate that these were sizable operations. However, there are no figures available upon which to base estimates of man days represented by the mining activities.

Also the very limited information relating to the time period in which these mines were exploited seems, at this time, to be in part contradictory. The Muddy River Phase (Basketmaker III) of the Moapa Valley is dated through pottery cross dating at A.D. 500 to 700 by Shutler (1961:67). Shutler further states:

> The people of the Muddy River Phase do not seem to have used turquoise and the local mines were not exploited (1961:68).

However, Sigleo (1974:459-60) reports turquoise beads from Snaketown's Gila Butte Phase (A.D. 500 to 700) that have been identified as deriving from the Halloran Spring turquoise mines. Furthermore, turquoise becomes an important item in the Lost City phase of the Moapa Valley where it is dated between A.D. 700 and 1100 (Shutler 1961:68). The proximity of the Moapa Valley suggests that the Halloran Spring turquoise mines were probably a major source. If this were the case, the lack of turquoise during the Muddy River Phase is difficult to explain if the mines were being worked. However, it is possible that the mining activity dates from A.D. 500 to 1100.

Rogers (1929:5) estimates 275 mines in the area, based on actual count of undisturbed areas and estimates made by an early miner for areas where modern mining activities have obliterated the aboriginal mines. The mines vary considerably in size but most seem to be from 15 to 30 feet across and appear as saucer shaped depressions (Murdoch and Webb 1948:13) and were dug as deep as twelve feet (Rogers 1929:4). The tools from these mines include carefully pecked and ground symmetrically formed, grooved axes and hammers in small numbers, large quantities of crudely flaked axes, hammers and picks sometimes grooved, and a few plain Gray Ware and black on gray "Puebloan-type" sherds (Rogers 1929:5-6). The pecked and polished axes are similar to those reported from southern Arizona and elsewhere in the Southwest. The crudely flaked axes, picks, and hammers appear identical to those reported by Harrington (1927) and Shutler (1961) for the Moapa Valley. Interestingly, the pecked and polished picks and axes have yet to be reported from the Moapa Valley which suggest another Southwest center may be responsible for at least part of the mining activities.

This scanty evidence suggests that the turquoise mines near Halloran Spring were the work of southwestern peoples, presumably the Anasazi. If the miners were Anasazi, what was the support system that supplied food, water and other necessities to the miners? If the miners were Anasazi they had to cross at least 150 miles of desert (from Lost City in Moapa Valley). Presumably, a support system based on local resources would be necessary if they were to stay at the mines long enough to recover any quantity of turquoise. The small "Puebloan" sites in the Crucero area and in East Cronise basin may have been the base for the support system. They are located in the most ideal areas for agriculture and are in areas where large mesquite groves stood during historic times. The occurrence of a wetter than present climatic regime during the Saratoga Springs Period suggests that agriculture could have been practiced at favorable places in the Mojave Desert. The mouth of the Mojave River where sand and water are both present would have been a most promising area for aboriginal corn agriculture during the Saratoga Springs Period. By viewing the aboriginal mining activities at Halloran Spring as part of a larger socioeconomic system it becomes possible to develop possible explanations (hypotheses) for not only the mining activities but some of the other Anasazi "influences" recognized in the area.

Finally there are some influences in the Mojave that derive from the lower Colorado. J. Davis (1962) and Donnan (1964) report a sequence for the Providence Mountains which they view as an extension of Lowland Patayan. This begins about A.D. 800 and is characterized by Colorado Buff and Tizon Brown wares. At a somewhat later date the area came under the influences from the Mojave Desert and was presumably occupied by the Paiutes. The lower Colorado influence in the Mojave is also noted in southern Nevada (Warren and Crabtree 1972) and buff ware pottery of the Mojave Sink indicates the Colorado influence there. However, the initial and terminal dates for this influence remain unknown.

The Shoshonean Period

The Shoshonean Period is defined here as beginning ca A.D. 1200 and lasts until European contact. This differs slightly from the dates ascribed by Warren and Crabtree (1972) but they conform more closely to the terminal date (A.D. 1150) for the Anasazi occupation in southern Nevada (Shutler 1961) and the initial dates for the Desert Side-notched points in southern Nevada. The diagnostic artifacts of the Period are Desert Side-notched points and various poorly defined types of brown ware pottery including Owens Valley Brown ware.

Archaeological components that can be identified as belonging to this Period include the Cottonwood Phase at Rose Springs (Lanning 1963), Cottonwood Creek site on Owens Lake (Riddell 1951), the Chapman Phase II of the Coso Range (Hillebrand 1972), the Coville Rockshelter in Panamint Valley (Meighan 1953), Death Valley IV sites (Wallace 1958, Hunt 1961) or the Panamint (Shoshone) culture (Wallace 1977a, Wallace and Wallace 1978), the sites at China Ranch (McKinney et al. 1971), the Shoshone Rockshelter (Gearheart 1974) and Rustlers Rockshelter in the Providence Mountains, except for perhaps the earliest portion of the occupation (J. Davis 1962, Donnan 1964). Materials from the Shoshonean period are noted in surveys of Panamint Valley (True, Sterud and Davis 1967) and the New York Mountains (True, Davis and Sterud 1966).

Warren and Crabtree (1972) argue that in the western Mojave there appears to be a cultural continuum from the Gypsum Period into the Shoshonean Period. This is seen at Rose Springs (Lanning 1963) and in the Coso Range (Hillebrand 1972). The projectile point assemblage at Rose Springs appears to be a continuum from the large sized Elko series to the smaller sized Rose Springs series followed by the addition of Cottonwood Triangular and Desert Side-notched points during the Shoshonean Period. In the Coso Mountains the same sequence seems to be present. In addition there appears to be a continuum in the petroglyph art of the Coso Range covering the period from pre-bow and arrow (Gypsum Period) to the period of only bow and arrow (Saratoga Springs Period) (Grant, Baird and Pringle 1968). If the petroglyphs of the Coso do indeed represent hunting ritual, they imply a strong cultural continuity.

In the eastern Mojave Desert the cultural continuity is broken by the Anasazi development on the Muddy and Virgin rivers and Anasazi influence as far west as the Mojave Trough. The Anasazi development is truncated about A.D. 1150 and its influence in the eastern Mojave Desert ends. The following Shoshonean Period is characterized by Desert Side-notched points and Brown Ware pottery and generally an artifact assemblage very similar to that found across the Mojave to the Owens Valley. This assemblage can be identified as relating directly to historic Paiutes. The continuity seen in the western Mojave (e.g. Owens Valley and Coso Range) suggest that the origin of this assemblage derives from that area. Ethnobotanical and linguistic studies by C. Fowler (1972) support this interpretation. It appears, therefore, that the Paiute were moving into the eastern Mojave Desert about A.D. 1100.

However, a complicating factor in this interpretation is the apparent north-south division of pottery types. Owens Valley Brown Ware and coarser Paiute and Shoshone wares are predominant in the northern Mojave Desert and the more refined Brown and Buff wares (derived from the Lower Colorado) predominate in the southeastern Mojave. The border between these two pottery areas has not been defined. The distribution of the pottery types in the Mojave Desert is of primary concern to studies of the late prehistoric period. However, the pottery typology for the Mojave Desert is poorly developed and little is known about regional variations during any given period.

The Shoshonean Period is also characterized in part by a "wet" climatic regime--the latter part of the same wet period experienced during the Saratoga Springs Period. About A.D. 1100 to 1200 the Anasazi influence in the eastern Mojave Desert came to an end. Causal factors for the termination of this influence have been proposed and may have been the culmination of subtle climatic changes, and a host of secondary factors such as movements of populations, coalescing villages and various other interactions that interrupted trade and support for the northwest frontier of the Anasazi. For whatever reasons, the Anasazi abandoned the Muddy River and Virgin River sites and throughout the area the Anasazi influence ceased. The Owens Valley and other coarse brown wares extended across the southern Mojave. The people using this coarse brown pottery were the ancestors of the historic Paiute. In the southern part of the Mojave Desert the Saratoga Springs Period occupants were succeeded by peoples utilizing more finely made Brown and Buff wares related to those of the Lower Colorado. Some of these people presumably were the ancestors of the historic Serrano.

The moist regime during part of this period is suggested by the middens surrounding the Cronise Lakes. Rogers (1933:119) states that in the Mojave Sink on the margins of the extinct lakes "The Mohave Indians lived for hundreds of years. From the fresh waters they took some fish and quantities of fresh-water mussels. In the surrounding desert sands, heaps of charred mussel shells incongruously conspicuous, record many an ancient feast. During these times it was possible to supplement the natural food supply by practicing agriculture about the mouth of the Mohave River."

Drover (personal communication 1978) writes:

> "...the majority of material culture at Cronise lakes is totally unlike that described by Wallace for Death Valley 'Shoshonean' materials. As regional chronologies go, the Cronise materials seem to compare best with sequences described by Davis (1962) and Donnan (1962; 1964) for the Providence Mountains. Albeit late, these occupations would appear to be prehistoric 'Yuman' (Patayan) as described by True, Davis and Sterud (1966). A late occupation of this area by Yumans is not out of keeping with ethnology (see especially Kroeber's 1959 article...)."

Drover (personal communication 1978, 1979) has obtained a number of radiocarbon dates and places this occupation at Cronise basin at 300-400 years or less.

The Shoshonean Period is one of considerably more complexity than casual examination of the data suggests. It is clear that the Anasazi influence in the Mojave Trough and adjacent mountains was succeeded during this period by the Paiute in the north and presumably the Serrano and/or Patayan influence in the south. The Paiute apparently expanded to the east across much of the Great Basin and to the south (as the Chemehuevi) replacing earlier occupants of the area. This expansion is most likely related to successful adaptation of the ancestral Paiute that made them the dominant desert dwellers. During the later part of this period dessication set in and the Mojave Desert became a progressively harsher desert. The final phase of prehistoric occupation can be seen as man's adaptation to increasingly arid conditions; an adaptation at which the Paiute excelled.

Chapter IV: Historical Sketch of the Archaeology of the Amargosa-Mojave Basin Planning Units

Wallace (1977b:249-50) and C. King (1976:34) have both noted that Mojave Desert archaeology began with casual observations of natural historians, military men, surveyors, and emigrants passing through the area. However, it was Gustav Eisen who first brought the prehistoric resources of the Amargosa-Mojave Basin planning units to the attention of the world. In March of 1898 the San Francisco Call published his report on the aboriginal turquoise mines near Halloran Spring. The harsh climate and isolation apparently prohibited the investigation in the Mojave during the early years of the century. However, Eisen's work along with Kunz's (1898, 1899) were instrumental in gaining M. J. Rogers' interest in the Mojave Sinks area (Rogers 1929).

M. J. Rogers apparently began field work in the Mojave in the mid '20's, about the same time as Elizabeth Crozer Campbell and William H. Campbell began theirs. The work of these pioneers represents a new era in California Desert archaeology. Rogers made extensive surveys until World War II when he retired to Arizona. He returned again in 1958 and continued his work until his death in 1960. Rogers worked under the auspices of the San Diego Museum of Man. It was the museum that published two papers of major significance to the Amargosa-Mojave Basin planning units: "Report of an Archaeological Reconnaissance in the Mohave Sink Region" (1929) and "Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas" (1939). Both of these papers report primary data and "Early Lithic Industries" presents a culture sequence that proved to be essentially correct except for the absolute ages assigned. Rogers' Mojave Sink paper remains the primary published source for the archaeological data of the Cronise Basin.

The Campbells' major contribution to the archaeology of the Amargosa-Mojave Basin was "The Archaeology of Pleistocene Lake Mohave: A Symposium" (1937) and Elizabeth Campbell's (1936) "Archaeological Problems in the Southern California Deserts." The Campbells developed a sophisticated environmental approach to the study of prehistoric cultures of the Mojave Desert (see Warren 1970) best exemplified in Elizabeth Campbell's 1936 paper. Although the Campbells' work was well done for the day its validity was not recognized until very recently.

The Campbells began work in the California deserts in the mid 1920's and continued until the early 1940's. During this time the Campbells made extensive collections from the dry lake beds (in their search for early man) including Silver and Soda Playa. They also made extensive collections from rockshelters and open sites elsewhere in the desert. The Campbells' collections from the dry lakes are housed at the Southwest Museum while other collections are at the Joshua Tree National Monument.

Beginning in the mid 1940's and continuing until the present Ruth Simpson and Gerald Smith carried on the tradition of extensive surveying, although they have also undertaken important excavations (Smith et al. 1957, Simpson 1961, 1965). Simpson originally worked under the auspices of the Southwest Museum, but more recently moved to the San Bernardino County Museum where she joined Gerald Smith. The major works of both Simpson and Smith lay to the west of the Amargosa-Mojave Basin planning units, however, surveys have been carried out in the study area by the San Bernardino County Museum where numerous archaeological sites were recorded and limited collections made.

Other general surveys which included parts of the Amargosa-Mojave Basin planning units were undertaken in the 1950's and 1960's. In 1950 Adan E. Treganza and Arnold R. Pilling, then from San Francisco State College and the University of California Archaeological Survey respectively, undertook an extensive, wide ranging field trip that included the California deserts. During this trip they visited the study area, recorded a number of sites, and made limited collections. Also in 1950 George Brainerd, in cooperation with graduate students at UCLA, investigated the shore line of Lake Mojave. They made surface collections and checked the level of the outlet channel by instrument in order to clarify the relationship between the archaeological site at the outlet and the outlet channel itself (Brainerd 1953). This study proved that the site was not flooded during overflow as claimed by Rogers (1939). Clement W. Meighan and Keith A. Dixon visited Lake Mojave in 1954 with the expressed purpose of examining the deposits of "the Lake Mojave site" and to "check the controversial overflow channel." Testing of the "Lake Mojave site" at the outlet proved negative, but later occupation was discovered elsewhere on the beach line. A "Recent house ring (containing potsherds) on a recessional terrace" was located one-half mile southwest of the outlet site (Meighan 1954).

From 1955 to 1964 Alice P. Hunt accompanied her husband, Charles B. Hunt, to Death Valley where he was doing geological field work. Alice Hunt devoted much of her time to an investigation of the archaeology of the region. Her best known work, "Archaeology of the Death Valley Salt Pan, California" (1960) lies outside the Amargosa-Mojave Basin planning units. However, together with her husband she also surveyed the Ash Meadows Quadrangle (Hunt and Hunt 1964). Much of this quadrangle lies within the study area so that the sites recorded and collections are the major resources for the northern half of the Amargosa-Mojave Basin. These sites are related to three of the four periods she described for Death Valley, with only the earliest period not being represented. The sites are related to sand dunes, springs, the Amargosa River and other topographic features that suggest environmental conditions at the time of occupation. The collections are housed at the Death Valley National Monument.

The Pacific Coast Archaeological Society have made limited surveys and excavations at China Ranch, near Tecopa, and near

Shoshone. This work was begun in 1961 and continued periodically through to the present. Several sites have been excavated and several papers written (e.g. Gearheart 1974, McKinney, Hafner and Gothold 1971). The Pacific Coast Archaeological Society houses the collection in conjunction with the Bowers Museum, Santa Ana, with which it is affiliated.

E.L. Davis' 1969 investigation of the Hord site under the auspices of the San Diego Museum of Man, and Warren, Ore and DeCosta's investigations at Lake Mojave in the '60's represent the continued field investigation of the early man remains at that Basin. The Hord site is a component of the Lake Mojave Complex and is located near the south end of Pleistocene Lake Mojave, though not in direct association with lake features. The notes and collections from this site are housed in the San Diego Museum of Man (Davis 1973).

Claude Warren in conjunction with H. T. Ore and John DeCosta investigated both geological and archaeological problems involved in dating the Lake Mojave assemblage. Several field trips were made between 1964 and 1969 and several problems investigated (Warren and DeCosta 1964, Ore and Warren 1971, Warren and Ore 1978).

James Benton and William T. Venner are avocation archaeologists who have worked in conjunction with the San Bernardino County Museum and the Archaeological Survey Association over the past 5 to 10 years. Benton has done rather intensive survey of portions of the Clark Mountains and Silver Lake and has undertaken limited excavations (Benton 1975). Venner has apparently concentrated his efforts on Silver Lake (Venner 1976, 1978). Records of their work may be found in the San Bernardino County Museum site records and at the Mojave River Valley Museum in Barstow.

Christopher Drover began archaeological investigations in the Cronise Basin in 1976 and has continued to the present. This research is being done under a permit granted through the University of California, Riverside and is the basis of Drover's doctoral dissertation. At present only a brief preliminary report (Drover n.d.) is available in print, although Drover has been most cooperative in providing data for this report.

More recently Drover, in cooperation with Nelson Leonard, San Bernardino County Archaeologist, have begun investigation of the aboriginal turquoise mine of Halloran Spring area. Although nothing is yet available in print as a result of this research, Leonard and Drover have provided important information for this report.

In late 1952 William J. Wallace (1977b) entered into an agreement with the National Park Service to survey and record sites within Death Valley National Monument and some adjacent area proposed for park acquisition. This contract work between

Wallace and the National Park Service continued for a decade, was probably the first contract archaeology in the area, and the forerunner to the contract archaeology and cultural resource management of the 1970's.

In 1960 Jack E. Smith and Gordon L. Grosscup undertook a pipeline survey under the auspices of the UCLA Archaeological Survey. The pipeline crossed Soda Playa and one of the sites recorded by the Campbells. A brief report, site records, and a few artifacts are housed at UCLA.

In 1964 a UCLA crew again went to the Mojave Sink on contract to investigate the Baker Site which was about to be impacted by construction of the interstate highway. The field work was under the direction of Norm Nakamura who produced a descriptive report in mimeograph for the California Department of Parks and Recreation. Later Glennan (1972, 1974) analyzed this material as part of his dissertation and published the portion dealing with the Baker Site. The notes, catalogue and artifacts are housed at UCLA.

In more recent years the number of archaeological surveys in the Mojave Desert has increased tremendously in response to the requirements of the environmental laws. Many of these have been located in or partly in the Amargosa-Mojave Basin planning units. These include the assessment of archaeological impact of the Shadow Valley Mobilehome Park (Decker 1973), survey of three locations adjacent to Valley Wells Station for proposed roadside rest facility for the California Department of Transportation (Hammond 1976), survey of the Barstow-Las Vegas Motorcycle Race Course (Hanks and Ritter 1974), the Class II Cultural Resource Field Sampling Inventory Along Proposed IPP Transmission Line Corridors, Utah-Nevada-California (Fowler et al. 1978) and the Class II inventories undertaken by Archaeological Research Incorporated in the Bitterwater, Kingston and northern half of the Owlshead/Amargosa planning units (Coombs 1978), and by the Nevada Archaeological Research Center in the Mojave Basin and southern half of Owlshead/Amargosa planning units (Brooks et al. 1978). A number of other surveys, primarily by BLM in Riverside, are completed each year.

All of these recent surveys have been oriented toward evaluating resources that are endangered. Therefore the field orientation is toward recording everything rather than being directed toward a particular problem. The result is extensive data, but in no case is the research on any one area intensive. Few artifact collections result from these surveys, but the cumulative effect of these surveys is increased data relating to site distribution and settlement pattern in relation to topographic, vegetational, geologic and other factors that influence where people have lived in the past. These surveys, together with the more intensive, problem oriented research provides an interesting and valuable data base.

In the history of archaeology of the Amargosa-Mojave Basin planning units we see reflected what are probably the major trends in archaeology throughout the desert. During the late 19th and early 20th century archaeology was primarily nothing more than casual observations by travelers passing through the region. Gustav Eisen's (1898) field work at the turquoise mines stands as the first scientific archaeological investigations in the area. However, further serious field work was not undertaken until the 1920's when Elizabeth and William Campbell and M. J. Rogers began their desert field work. These investigators continued their work until the 1940's when Ruth Simpson and Gerald Smith began surveys and excavations in the region which they have continued until the present time. Treganza and Pilling and the Hunts also undertook limited surveys during this period. In the 1950's Brainerd and Meighan and Dixon undertook short field trips to investigate specific problems at Lake Mojave. This pattern of specific limited problem solving was followed into the 60's and 70's by Warren, Ore and DeCosta who also made several trips to Lake Mojave and by Drover who carried out research in the Cronise Basin.

In the 1950's salvage archaeology was introduced to the Mojave Desert with its emphasis on "clearance" or rights-of-way for highways, pipeline, power lines, etc. and surveys for the National Park Service in Death Valley. Over the next three decades salvage archaeology has developed into cultural resource management with a broader perspective and a greater emphasis on historic sites, site preservation and more sophisticated methods and techniques of survey and excavation. This development is reflected in the changes that can be seen between the 1960 pipeline survey of Grosscup and Smith and Coombs' class II cultural resource inventory of 1978.

Chapter V: Significance of Museum Collections

The archaeological collections from the Amargosa-Mojave Basin planning units vary considerably in size and significance. The early collections of the Campbells and of M. J. Rogers are very large in size with extensive notes and are of major importance. The Pacific Coast Archaeological Society collection from the China Ranch is small, but it is very significant because of its location and because it has a well documented collection of ceramics. Rather than reviewing each collection separately, we will discuss major areas (Map 4) where collections have been made that are extensive and/or of major value in understanding Mojave Desert archaeology.

Cronise Lakes

The major collections of Cronise Lakes were made by M. J. Rogers and Elizabeth and William Campbell and are housed at the Museum of Man in San Diego and Joshua Tree National Monument respectively. Rogers identified and collected from fourteen sites on the margins of East and West Cronise Lakes. These collections are of major importance because they are from late sites (Saratoga Springs or Shoshonean periods) and are associated with dry lake beds. The implication that there were lakes in existence in the Cronise basin during this later period is supported by the occurrence of considerable quantity of fresh water mussel shells in the middens of both East and West Cronise. The mussel shell middens clearly indicate that the lakes were in existence at the time of occupation of these sites and that the lakes lasted long enough for the shellfish to develop and grow plentiful enough to supply a considerable number of meals. Some of these sites also exhibit a large percentage of Anasazi pottery. However, the vast majority of the pottery in Rogers' collection appears to have derived from the Lower Colorado River.

The Campbells' collection is more modest and unfortunately they did not recognize the number of sites recorded by Rogers. They recorded only one site for West Cronise and two for East Cronise. It is impossible to correlate their sites with Rogers' sites.

Recent work undertaken by Christopher Drover has added to this data base including radiocarbon dates that place the major occupation of the Cronise sites at A.D. 1500 to A.D. 1600. When his research is published it will provide us with not only important data, but important interpretations of man's adaptation to the lacustrine resources during the later periods of occupation.

Lake Mojave

The Lake Mojave Basin consists of Soda and Silver Playa, and when the lake was full to capacity formed a body of water about 17 miles long and up to 6 miles wide. The height of the lake was controlled by an outlet at the north end. Consequently there are well developed beaches at the elevation of this outlet channel between 946 and 937 feet. Located on these beaches were numerous archaeological sites recorded and collected by the Campbells and M. J. Rogers. These collections are today housed in the Southwest Museum and the San Diego Museum of Man. Both are large collections numbering hundreds of items and containing notes and maps. These sites are for the most part associated with the Pluvial Lake and date from the Lake Mojave Period.

The Lake Mojave collections have been the source of controversy from the first publication of their discovery (Campbell et al. 1937, Rogers 1939). These collections are essential to any re-investigation of the Lake Mojave occupation. A more detailed typological study and distributional study of the collections would probably contribute substantially to the understanding of the relationship between man and Pleistocene Lake Mojave.

Rogers reported about twelve sites on the margins of the Pleistocene Lake, while the Campbells reported twenty-six different sites on the ancient beach lines. Critics (Rogers 1939, Roberts 1940, Heizer 1965, 1970) have questioned the association of artifacts with the ancient lakes, suggesting that the Campbells did not include the detail in their report that demonstrates the association of artifacts with ancient beaches.

The notes from both Rogers and the Campbells contain description of site locations and maps that make it possible to locate the sites with confidence. Furthermore, additional notes by the Campbells on Silver Lake, Soda Lake and Crucero Dry Lake (in the Crucero area) indicate that they did indeed separate the sites associated with the Pleistocene Lake features from those sites associated with topographic features of later or unknown date. The Campbells' notes and collections from Soda Lake, Silver Lake and Crucero Dry Lake are housed, in part, at the Joshua Tree National Monument and, in part, at the Southwest Museum. These notes and collections are extremely important to early man research and solving the problems of dating the Lake Mojave sites and in identifying the Lake Mojave Complex.

Crucero Area

The Crucero area is the region between Soda Lake and the mouth of Afton Canyon in the Mojave River Wash or Valley. This area is apparently complex with a variety of topographic features dominated by sand deposited by the Mojave River and blown eastward by prevailing winds. The sand accumulates in large moving and semi-stabilized dunes. The occurrence of sand along the river drainage resulted in sizable stands of mesquite (most of which have been cut and burned during historic times) and probably the most favorable conditions for horticulture in the central and western Mojave. Rogers (1929) suggested the possibility of horticulture in this area and in his notes we find

> McManus reports digging house sites out of sand dunes here with many corn cobs and buff potsherds. No trace of houses or cobs now (Rogers n.d. M-15A).

There are many sites of late occupation in the sand dunes that extend across the south end of Soda Playa. These were recorded an collected by both Rogers (n.d.) and the Campbells (n.d.) with collections at the Museum of Man and Joshua Tree National Monument respectively. These collections contain more variation in assemblage than do those from either Cronise Lake or Lake Mojave. These probably represent a longer period of time beginning perhaps as early as the Gypsum period and continuing up until the Shoshonean period.

Mesquite Hills Dry Lake

The name "Mesquite Hills Dry Lake" was applied to the small dry lake just south of the Crucero area by Elizabeth Campbell. This dry lake lies south of the Mesquite Hills which separates it from the Crucero area and Lake Mojave. Elizabeth and William Campbell surface collected a series of sites found along the margins of the Playa in sand dunes and on apparent beach lines. This material appears to date from the Gypsum and later periods although it is very limited in quantity. Farther south and not associated with this Mesquite Hills Dry Lake is found the Hord site (Davis 1973), an early component dating from the Lake Mojave Period. These collections are important because they reflect a use of resources marginal to the valley bottoms where the heaviest site concentrations are found.

The Hord site collection is housed at the San Diego Museum of Man and the Mesquite Hills Dry Lake collection and notes are at Joshua Tree National Monument.

Salt Springs

Salt Springs is located near the confluence of the Amargosa River and Salt Creek near the south end of Death Valley. The Salt Springs locality includes the area around the site for a distance of about one mile radius. Within this area M. J. Rogers (n.d.) recorded eighteen sites which he describes as "detached camps" or temporary camps. Most of these sites are noted by Rogers as "Pinto-Gypsum"; however, later occupation is also present, but far more limited in intensity. This is a major site for Rogers' definition of Pinto-Gypsum and one of the best collections of Pinto shoulderless points (Rogers' Type 1) was made here. One site alone produced 125 Pinto points (of Type 1 and Type 3) plus 59 other classifiable points. These points could serve as the initial sample for redefining the Pinto points in a manner that would differentiate them from the Humboldt and Elko series.

Rogers' notes include the comment that Salt Springs water "is not drinkable at least by Whites." It should be noted that Salt Springs was used during the early days of the Mormon Road, however, it appears to have been but little used in historic times because of the bad water. The following was written by David Cheesman about his 1850 visit to Salt Creek (Foy 1930: 296):

> "...The water here was so alkaline that the stock would not drink it. They would make the effort, but give it up."

However, earlier occupation apparently was much more intense suggesting that water was better, probably due to greater flow. A thorough investigation of spring deposits and sites for paleoclimatic data plus a thorough study of the collections would probably provide some new insight into the climatic and cultural relationships in the Mojave Trough.

The Salt Springs collections are extensive and include those made by 1) M. J. Rogers and Clark Brott, housed in the San Diego Museum of Man, 2) by various individuals, housed at the San Bernardino County Museum, 3) by Adan Treganza and Arnold R. Pilling, housed at the University of California, Berkeley, Lowie Museum, and 4) by the Campbells, housed at Joshua Tree National Monument.

China Ranch

The China Ranch collection resulted from a survey in the vicinity of China Ranch and the excavation of Robinson Cave (McKinney, Hafner and Gothold 1971) and Shoshoni Cave #2 (Gearheart 1974) by the Pacific Coast Archaeological Society. Robinson Cave apparently dates from Shoshonean and Saratoga Springs periods while the Shoshone Cave #2 is from Shoshonean and historic periods. At the Robinson Cave projectile points suggest both periods. The pottery, if the identification is accurate, would date from the Saratoga Springs period. However, the pottery, in part at least, appears to be incorrectly identified. Those sherds identified as Shinarump corrugated shown in Figures 10C and 10F of the published report (McKinney, Hafner and Gothold 1971) appear to be kind of "false corrugation" characteristic of the Brown Ware of the Paiute. This identification is also supported by the color and temper description for these sherds. Furthermore, unidentified sherds in Figures 11d and 11e of the same report exhibit the fingernail impression that is also characteristic of the Paiute Brown Ware.

The pottery from the China Ranch as well as from other sites in the Mojave Trough region need to be reanalyzed by trained specialists using recent techniques.

The China Ranch collection provides a pottery sample from an excavated site in the central portion of the study area where little excavation has been undertaken and where very few collections of any sort have been made. A thorough analysis of the pottery would provide good evidence of the cultural influence present during the late period.

Farther north, just outside of the study area, a pottery collection from Ash Meadows includes Paiute brown wares and Anasazi Gray Ware, but lacks the Buff Ware of the Lower Colorado. In the vicinity of the Mojave sink the Buff Wares are the most common types, Anasazi Gray Ware is present and Paiute brown wares are rare. It would appear that a "boundary" between Colorado Buff Ware and Paiute brown wares exists somewhere between these two areas. China Ranch is located approximately half way between Ash Meadows to the north and the Cronise Lakes and Soda Lake to the south. China Ranch should, therefore, be crucial to defining the "boundary" between two pottery areas (that presumably represent ethnic groups). The archaeology of the China Ranch area should also provide some clue to the kinds of interaction between these two groups.

Ash Meadows Quadrangle

The Ash Meadows Quadrangle lies to the north of China Ranch and takes in the upper Amargosa drainage as well as the Ash Meadows Spring Complex, with Funeral Mountains to the west and Resting Spring Range to the east. Alice P. and Charles B. Hunt (1964) recorded numerous sites and made surface collections that are housed at the Death Valley National Monument. The collections represent three of the four occupations recognized in Death Valley. The oldest occupation, Death Valley I (Lake Mojave Period) is not recorded in the Ash Meadows Quadrangle.

The three later occupations of early and late Death Valley II (Pinto Period and Gypsum Period), Death Valley III (Saratoga Springs Period) and Death Valley IV (Shoshonean Period) are all represented. These sites and collections are important because they are the only collections from the north end of the study area and because they apparently show a correlation of sites of different periods with different available water sources. Early Death Valley II (Pinto Period) sites are few in number and associated with springs or areas of high ground water. Late Death Valley II (Gypsum Period) sites are concentrated along the Amargosa River, especially in the vicinity of the mesquite groves near Franklin Well. Some are also found near springs at Ash Meadows and near other ancient water sources such as along playa edges in adjacent Stewart Valley.

Death Valley III (Saratoga Springs Period) has few sites represented and all are found near springs, mostly in the Ash Meadows vicinity outside the study area. Death Valley III sites are in all but two cases associated with Death Valley IV artifacts and occupation. Death Valley IV (Shoshonean) sites occur in sand dunes near water sources. In addition to those sites with both Death Valley III and IV represented, there are three other dune sites of Death Valley IV (Shoshonean) Period. One is near the Franklin Well on the Amargosa River, while the other two are at Ash Meadows near Crystal Pool and in Stewart Valley.

Turquoise Mines

The Turquoise Mines of San Bernardino County are another interesting and important series of sites. These sites were apparently operated for (and probably by) the Anasazi peoples to the east and the turquoise was traded over a wider area of the Southwest. Turquoise is not uncommon in the Anasazi sites on the Muddy River in southern Nevada but is apparently quite rare or absent to the west of the mines in southern California. The trade of turquoise appears to have been essentially exclusively with peoples to the east.

There are California coastal shell beads in late sites around Cronise Lakes but the absence of turquoise in California coastal middens indicates that the beads were not traded to the Mojave in exchange for turquoise. The miners apparently had closer trade relations with peoples to the east and may have been of Anasazi affiliation themselves. If the miners were Anasazi, there may have been some support system involving occupation sites with storage for necessary food or sites where limited agriculture could be practiced.

The turquoise mining sites present a number of problems that have yet to be addressed by archaeologists working in the Mojave. These questions involving the nature of trade networks across the Mojave, the support system for the miners, and the interaction between the miners and local population (assuming they were of different ethnic affiliation). There are also simple questions of aboriginal mining technology and quantitative studies of mining activities to determine time and manpower needed to carry out the mining activities.

The notes and artifacts from these mines are housed at the San Diego Museum of Man and the San Bernardino County Museum. Eisen's collection and notes were lost in the 1906 San Francisco fire (Rogers n.d.).

Mesquite Lake

The Mesquite Lake collection was made by M. J. Rogers and is housed in the San Diego Museum of Man. The collection is important because it includes artifactual materials from nine sites on the margin of Mesquite Lake. One site contains representative projectile types from both Pinto and Gypsum periods. Other sites yielded both Anasazi Gray Ware and Paiute brown wares.

These sites apparently represent a fairly long sequence of occupation at Mesquite Lake and appear to be segregated horizontally so that a more complete understanding of sequence of occupation in the Mesquite Lake vicinity could be developed from these collections. One major difference between the Mesquite Lake sites and the Mojave Trough site is the greater quantity of Anasazi Gray Ware relative to the other pottery wares. The Buff ware so common in the Mojave Trough are far less frequent at Mesquite Lake, suggesting greater influence by Anasazi of the Moapa Valley, and less influence from the Lower Colorado during the later prehistoric periods at Mesquite Lake.

Clark Mountains

The Clark Mountains, which lie between the Mojave Trough and the Mesquite and Ivanpah basins, also contain a large number of sites but these have yielded only small collections. Jim Benton of Baker, California, has undertaken independent surveys of this area, and has filed site sheets and reports with the San Bernardino County Museum. He discovered a large number of roasting pits in this area (Benton 1975). Unfortunately these contain very few artifacts and on the basis of present data are extremely difficult, if not impossible, to place chronologically. In the Spring Mountains where large numbers of roasting pits have been examined (Larson 1978) it appears that they date from both Saratoga Springs and the Shoshonean periods and perhaps even earlier. This dating also probably would apply to those of the Clark Mountains. The roasting pits apparently represent the major utilization of these higher elevations and a major activity in the seasonal round of the late prehistoric population. As such they must be considered in the culture history as an important factor in the cultural development and ecological adaptation in the area. Few have been excavated and none has been analyzed and reported. Their function has been deduced from their distribution and physical characteristics noted during field observations. Excavation, careful examination of the structure of the "pits," collection and flotation of a sample of the contents, and a microanalysis of the material recovered should provide data pertinent to determining the function of these sites.

Chapter VI: Two Views of Existing Data in the Amargosa-Mojave Basin Planning Units

In reviewing the existing data, considerations of resource management were taken into account. Management of archaeological resources was considered from two points of view: 1) a broad bird's eye perspective of the whole area and 2) the "up close" perspective of selected collections. The two points of view are presented below, but we wish to stress that these points of view and suggestions are based on existing archaeological data and these data have certainly been biased by sampling procedures that reflect certain limited problems that were crucial to the research of the archaeologists of the day. The paradigm for the archaeology of the Mojave Desert has been consistent in its chronological and typological models. Questions regarding settlement patterns, ecological adaptation, economic and social subsystems, trade networks, and causes of changes in these cultural systems have not been addressed with any degree of success in defining and analyzing these areas of behavior. The overriding questions of Mojave archaeology from its inception until the present time have been those of typological comparisons and chronological relationships. Consequently, the data developed by this work reflects this strong chronological bias. This bias is in turn reflected in the two points of view presented here.

Bird's Eye Perspective

The Amargosa-Mojave Basin planning units cover an area of considerable topographic relief with corresponding contrasts in vegetation. The dominating topographic features are the Mojave Trough, adjacent mountains, and a second trough extending from Ivanpah Lake through Mesquite Lake, Pahrump Valley, Stewart Lake and Ash Meadows. These two troughs converge to form, on the map, an inverted V with the point in the vicinity of Ash Meadows. This inverted V includes most of the planning units under study. The low lying areas along the troughs contain stream channels, playas, sand dunes, and some springs. The economically important plants include many from the saltbrush community, rice grass and mesquite often associated with sand dunes, and the reeds, rushes and other plants found in and about springs and along segments of the river courses. The creosote bush community is found above these resources and below the black bush community and/or the Joshua tree woodland. The creosote bush community which extends for miles up the pediments, generally contains a paucity of economically important plants, except near springs or where stream channels support the desert riparian community.

The blackbush, Joshua tree woodlands and pinon-juniper occurs at higher elevations where the land is more broken by rock outcroppings and deeper valleys and arroyos than those of the creosote bush covered pediments. The blackbush, Joshua tree woodlands, and pinon-juniper together make another productive zone at the higher elevations with pinon, yucca and agave being the most prominent economically important plants. Above the pinon-juniper woodland, the Rocky Mountain white fir occupies small economically unimportant areas in the Kingston and Clark Mountains (Map 3).

Based on abundance of resources, the two areas of greatest site density would appear to be the saltbush--sand dune zone in the low valley and the blackbush-Joshua tree-pinon-juniper zone at higher elevation. The existing archaeological data appears to support this conception.

The major site concentration, based on existing data, is along the generalized area of valley floors, especially where water occurs, or occurred sometime in the past, and where the mesquite is found nearby. The secondary generalized area of site concentration is at higher elevation in the blackbush, Joshua tree, pinon-juniper zone. Here the sites appear to be scattered, not necessarily near existing springs. The two areas of site concentration have different resources and different arrangements of sites and different kinds of sites. Most sites at high elevation appear smaller, more scattered and contain fewer artifacts and other cultural debris (as indicated by surface finds) than sites at lower elevation.

The valley bottom sites are more concentrated in particular areas around lake margins and springs. Some sites appear large, covering several acres. However, this size may be deceiving in that they may result from continued use of a small area by one or more small groups over a considerable period of time. The argument for occupation of some sites by a single group over a considerable period of time is supported by the occurrence of what appears to be cemeteries at some Cronise Lake sites (Rogers n.d.). The valley bottom sites often have a wide range of artifacts suggesting many different activities were carried out on the sites. It would appear that they were occupation sites of a non-specialized or multifunctional nature.

In contrast the high elevation sites are small and often specialized such as the roasting pit sites in the Clark Mountains and the turquoise mining sites in the Turquoise Mountains and the widespread flake scatters. Other sites are small occupation sites such as rock shelters or small open sites. The nature of these sites suggest temporary occupation by small groups undertaking specialized activities. These activities involved turquoise mining (probably only during the Saratoga Springs Period), collecting and roasting of agave and other plants in the roasting pits, the collection of pine nuts, and presumably hunting. With the exception of turquoise mining, all of the activities appear to have been undertaken by scattered, small groups. (The turquoise mining undoubtedly represents a different pattern of settlement and activities from the generalized pattern we are attempting to develop.) The artifact content of most high elevation sites is too limited to adequately identify the cultural periods to which they belong, although some have two or more periods represented (Rogers n.d.) which seems to indicate that it is probable that the high elevation resources were utilized throughout the prehistoric period.

The site distribution would fit a generalized Great Basin settlement pattern of small bands, breaking up and uniting in a reasonably flexible manner. During the more productive periods the bands might have numbered twenty-five to fifty, but during hard times these groups would fragment into smaller bands that might consist of single nuclear families. However, alternative patterns should be explored.

The major plant resources of this area generally appear to be concentrated at high elevations and at low elevations separated by the long creosote covered pediments. The distance between these two zones along much of the Mojave Trough (and to a lesser extent elsewhere in the planning units) is so great that it is more than a day's journey from one to the other and back. Consequently, it appears impossible that the same band could have utilized both zones simultaneously. This distance would, therefore, dictate seasonal use of these resources. The limited site data suggests that the occupation at high elevations was scattered while sites in the lower valleys were concentrated near water sources. This in turn suggests that the occupation of the higher elevations was less permanent and perhaps by smaller task groups.

This bird's eye view of the site distribution does not distinguish changes that presumably have occurred during the 10,000 years of prehistory. The data currently available does not allow such distinctions to be drawn. There are some exceptions to the pattern as described above that must be considered. The turquoise mining activities appear to be correlated with the Saratoga Springs period and may be attributed to the Anasazi. The Anasazi must have maintained a population at the mining sites for considerable periods of time. This may have required permanent sites with a sizable portion of the population producing food in quantities sufficient to feed themselves and the miners. Furthermore, the occupation sites in the Clark Mountains reported by Rogers (n.d.) often contained Anasazi pottery, but usually with other forms of pottery also being present. In short the Anasazi settlement pattern differs from the generalized settlement pattern in the presence of mining sites, but these activities must have had far reaching effects on the activities of the local Anasazi settlements. Unfortunately data with which to document the activities of past economic and social systems are lacking and our "hypothesis" regarding Anasazi settlement patterns and land use goes untested.

The "bird's eye view" of the site distribution clearly indicates the concentration of sites in saltbush--sand dune areas on valley and basin floors and at higher elevations in the blackbush, Joshua and pinon-juniper zones. The higher density of these areas appears to be substantiated by the one percent

Class II inventories carried out in these planning units (Brooks et al. 1978, Coombs 1978). The pattern of site distribution suggests several attributes of prehistoric socio-economic organization. The distance between the low elevation and high elevation sites, in most areas, dictate a seasonal movement between them. It is impossible to make the round trip between the two productive zones in less than several days and therefore would be essentially uneconomical in human energy to make the trip for only short duration use of the zone. Therefore, it can be reasoned that the prehistoric people moved seasonally in a manner similar or identical to the historic populations of the region.

The other distinctions between the low elevation (valley bottom) and high elevation (mountain) sites are also suggestive. The valley sites appear to be more tightly clustered about water sources and to include some large sites (relative to the high elevation sites). For example sites are found in especially heavy concentrations around Salt Springs and around the Cronise Lakes. On the other hand some areas exhibit sparse or no occupation as between Silver Playa and Salt Springs. It appears that in the valley bottoms the prehistoric population was drawn together about water sources and that the relatively heavy concentration of people was possible because of the locally abundant mesquite, with the addition of fresh water mussel at the Cronise Lakes.

The higher elevation sites appear to be small and more widely dispersed than the valley bottom sites (although much less information is available for these zones than for the valley bottoms and much of what we can say is little more than conjecture). This site distribution suggests small bands dispersed about the countryside in search of more widely scattered resources.

On the basis of the distribution of the sites and the resources we propose that the prehistoric settlement system for the Mojave Trough and adjacent mountains involved a seasonal movement from valley bottoms across the relatively unproductive creosote pediments to the blackbush, Joshua, pinon-juniper zone of the higher elevations. This movement was made in small groups (perhaps single families) which dispersed throughout the high elevation zones in search of pine nuts, agave, deer, mountain sheep, etc. During the occupation of the high elevation zones the dispersed band pattern persisted. However, upon return to the lower valley bottom sites the population was drawn together by the water source and nearby mesquite, rice grass, and other foods. The pattern thus becomes one of apparent central based wandering with bands gathering in the valley bottoms and dispersing in small task groups at higher elevations.

This settlement pattern and land use is here suggested for all prehistoric and historic aboriginal groups occupying the Mojave Trough except the Anasazi. We cannot describe the settlement pattern for every period because the necessary data are incomplete. The data we do have supports the interpretations in that some material from each period fits some portions of the pattern, but not all aspects of the central based wandering activities can be identified for any one period.

The following up close view of the site data is a look at the quality of the data available and an evaluation of the Mojave Trough settlement pattern described above.

The Up Close Perspective

The "up close perspective" is a more detailed examination of available data from the Amargosa-Mojave Basin planning units. These data are presented by area and only collections that are large enough to contribute materially to our knowledge of the area are included (these criteria are determined intuitively by examination of documents and notes made on the collections). The collections are presented by "areas" from north to south along the Mojave Trough and west to east from Cronise Lakes to Mesquite Lake.

A. Franklin Wells Area

The Ash Meadows Quadrangle extends across the northernmost portion of the Amargosa-Mojave Basin planning units and into adjacent Nevada at Ash Meadows proper. This region has produced archaeological data from two major areas: Franklin Wells adjacent to the Amargosa River and Ash Meadows in Nevada. Ash Meadows will be included in the discussion because of its close proximity to the study area.

Twelve sites and nine isolated artifact locations are reported by the Hunts (Hunt and Hunt 1964) in the Franklin Wells area. The condition of these sites is described as follows.

> "The tools and flakes on the late Death Valley II /Gypsum Period/ sites along the terraces on both sides of the Amargosa River are widely scattered as though they had been washed by floods. Artifacts on gravel terraces west of the river appear more uniformly scattered than those east of the river and probably were more subject to sheet flooding. It seems reasonable to assume that the scattered tools and flakes once were concentrated in limited areas at camp sites, and that the scatter is a measure of the degree of sheet flooding and washing on these surfaces since the sites were occupied..." (1964:7).

These sites contain large stemmed points similar to Elko Corner-notched and presumably date from the Gypsum Period. The sites are located along the Amargosa River in a region of sand dunes and mesquite trees and apparently are the remains of a series of small camps occupied seasonally during a period when more available moisture was present.

The Barnett site at Ash Meadows also contains Gypsum Period artifacts. This site contained Elko-Eared, Humboldt Basal Notched and Concave Based, and Gypsum Cave points. This component has been dated by radiocarbon at between 660 B.C. and A.D. 210. The Barnett site also contained large numbers of knives, along with milling stones and manos indicating both hunting and collecting activities were undertaken. Ash Meadows is an area of springs and sand dunes with mesquite groves and rice grass close by. The sites appear to have been occupied by a band(s) of hunters and gatherers utilizing these resources.

Sites of the Death Valley III period (Saratoga Springs Period) in Ash Meadows Quadrangle are usually associated with springs in Ash Meadows. These sites contain the characteristic small stemmed points as well as engraved slate schist pendants, slightly basin shaped metates, and pottery including olivine tempered Moapa Gray Ware (Hunt and Hunt 1964:10). The Hunts further suggest that the Moapa Gray Ware was imported from the Lower Virgin Valley, Shiviwits Plateau or Toroweap Valley. "Ash Meadows probably has had eastward ties for a long time, perhaps because the well-watered Spring Mountains (alt. 11,910 feet), 35 miles southeast, would be a source of nuts, greens, berries and game, and a natural meeting place for Indians over a wide radius." (Hunt and Hunt 1964:11)

Sites of Death Valley IV occupation (Shoshonean Period) in the Ash Meadows Quadrangle are usually found on sand dunes near springs. One is found on a small dune in the channel of the Amargosa River. These are marked by Paiute Brown Ware and small triangular and Desert Side Notched points. However, knives, gravers, drills, choppers, manos, metates, and hammerstones are all reported from these sites.

The Hunts (1964:13) note some differences between the assemblages of the Ash Meadows Quadrangle and Death Valley and suggest that the prehistoric population of the Ash Meadows Quadrangle had stronger ties to the east than to the west and that perhaps an ethnic boundary existed between the two areas.

The Ash Meadows-Franklin Wells collections appear to represent Gypsum, Saratoga Springs and Shoshonean periods with enough data that it is possible to postulate temporary camps for each of these three periods and suggest that the spring water, mesquite and rice grass were major factors in attracting groups of peoples to this area for part of the yearly round. The tools and site locations both suggest mobile hunting, fishing and gathering peoples who were attracted to the area by these or similar resources.

B. China Ranch

The China Ranch area includes China Ranch (McKinney et al. 1971) plus the Shoshone Cave #2 Gearheart 1974). Robinson Cave on China Ranch and Shoshone Cave #2 date from late in the cultural sequence. Robinson Cave contained both Anasazi Gray Ware and Paiute brown ware pottery while Shoshone Cave #2 contained only a few sherds which are apparently Paiute brown ware. Robinson Cave also exhibited Desert Side Notched, Rose Springs series points and one possible Gypsum Cave point while Shoshone Cave #2 exhibits small triangular and Desert Side Notched points. Shoshone Cave #2 appears, therefore, to date to the Shoshonean (and historic) period while Robinson Cave probably covers both Saratoga Springs and Shoshonean periods. They both contain metatesand manos as well as points, knives and scrapers. In addition, both contained quids of what appear to be cane fiber and bundles of cane. Robinson Cave contained mesquite seed and pod and some unidentified seeds. Bone is not reported from either cave except for few bone tools, but at Shoshone Cave #2, egg shells, small pieces of rabbitskin blanket, and sea shell (as ornaments) were reported, while at Robinson Cave pieces of fur were reported.

In localities nearby quarries, trails and stone circles have been recorded (McKinney et al. 1971) but these lack diagnostic tools and consequently cannot be dated. Some of the rock circles and alignments were reported by Rogers (n.d.: site M118 and M119) as dating from San Dieguito I (Lake Mojave Period) and Amargosa I. However, a later study by Gary Richardson (1976) suggests that they were made in conjunction with early Borax mining operations.

The China Ranch area has a number of late sites that clearly show use of spring related resources as well as mesquite and game animals. These data appear to represent migratory hunting and gathering peoples who spend some portion of the yearly round near the springs in the China Ranch area.

C. Salt Springs Area

Salt Springs area consists of approximately eighteen small dispersed campsites scattered over about four square miles along Salt Creek. Rogers (n.d. M-35) states that at Salt Springs "...prepottery hunting people... lived in detached camps or else periodically returned to different portions." The area is characterized by "residual humps" and fossil dunes that have undergone considerable erosion. The erosion has exposed the campsites apparently even at times lowering artifacts and cultural debris to a more resistant surface. At the present time the water source is Salt Springs which is very salty suggesting that in the past there must have been a greater flow of less alkaline water.

The artifacts from these sites number in the hundreds and most campsites exhibit Pinto Period and/or Gypsum Period points. Later periods are very sparsely represented with pottery or characteristic projectile points occurring on only two or three sites. The most characteristic artifacts are the Pinto series, Gypsum Cave points, Elko series and a few Humboldt types. The Pinto points are often found at the same site (on the surface) with one or more of the other types. It is in this area that Rogers believed he found evidence of contemporaneity of Pinto and Gypsum points. Later authors have cited Rogers in support of this contention. However, the evidence is hardly conclusive. Rogers describes the evidence as follows: (1939:47-48)

> "The Salt Spring Basin of California has produced one Gypsum camp level, with hearths and a partially complete assemblage of lithic implements buried in a fossil sand dune. In close juxtaposition erosional basin surfaces in the underlying lake beds produced the same assemblages, plus two different types of Pinto points on levels two to four feet below the Gypsum cultural stratum. Apparently all the implements and refuse spalls had been derived from the same formation, i.e., the fossil dune stratum, for they occurred also upon the talus of the hump leading downward from the exposed cap of hard, packed sands. Although the Pinto types were not found in sites with the Gypsum points, there can be little doubt regarding the approximate contemporaneity of all objects present."

It was suggested above (Chapter III) that there may have been two major occupations of this area dating to the Pinto and Gypsum Period and that these might be difficult to distinguish stratigraphically. The post occupation erosion of the sites has further masked any cultural stratigraphy that might have been present and the cultural sequence at this site has yet to be demonstrated.

The presence of sand dunes and more water during the Pinto and Gypsum periods suggests that mesquite groves and rice grass were more abundant (they occur today a few miles east of Salt Springs) and were major attractions in the occupation of the area. The artifact assemblages from these sites include a wide range of tools. In addition to projectile points, knives and scrapers are numerous; hammerstones and cores, and manos and metates are frequent indicating a wide range of activities. These sites are all small, but concentrated about an old water source and fossil, eroding sand dunes, suggesting that Salt Springs was a site to which a number of groups returned seasonally. The pattern of small dispersed sites in the vicinity of the water source and other resources suggest a kind of dispersed central base, and is a pattern that reoccurs elsewhere in low valley resource areas in the Mojave.

D. Lake Mojave Area

The Lake Mojave Area consists of Soda and Silver playas and excludes the sand dunes to the south of Soda Playa. The Campbells (1937) and M. J. Rogers (1939) have reported about two dozen sites on the high beach lines about Soda and Silver playas. These sites have a wide range of tools with the characteristic points of the Lake Mojave Period. These sites were associated with Pluvial Lake Mojave during a time of a much greater quantity of available water. Lake Mojave was at least 17 miles long, 7 miles wide and over 28 feet deep (in Silver Playa). This lake must have supported vegetation and attracted wildlife to its shores. The early human occupation probably took advantage of these resources and many have used the lacustrine resources (however, there is no direct evidence of use of fish or shellfish).

The sites are dispersed about the lake shore where level areas were available. The sites vary in size from a few square yards to several acres in extent. The pattern is again a series of camps dispersed about the resource center. However, some of the Lake Mojave sites appear to be larger than those at Salt Springs. The pattern again appears to be seasonal camps distributed through the resources of the valley bottoms. However in this instance the environment was so different from present day environment that it is difficult to determine the resources that man was utilizing at that time. The tool assemblage included large numbers of projectile points, knives, scrapers, drills and gravers, some heavy chopping tools, and a few hammerstones, cores and anvils. Interestingly, millingstones are extremely rare or absent from the assemblages at Lake Mojave.

The lack of millingstones represents a significant difference from later cultural assemblages in the Mojave Desert, suggesting that the economic pattern may have more heavily emphasized hunting, and that small hard seeds were not here being processed for consumption. The functional differences between the tool assemblages of Lake Mojave sites and later occupation suggests that the resources were different, or that they were being utilized differently. This being the case it may be that the people of the Lake Mojave Period followed a different seasonal round and had a different settlement pattern from later peoples. However, the distribution of sites on Lake Mojave beaches fits well the valley bottoms aspect of the general settlement pattern for this area. It is suggested that even during the relatively cool, wet Pluvial, the most productive zones were on the valley bottoms and at higher elevations. These two zones were even then presumably separated by a considerable zone of low density resources. If this were the case the pattern of settlement would very likely have been similar to those of the later periods. This remains speculation, however, until more complete distribution of sites can be achieved and a better knowledge of the resources utilized can be obtained.

E. Crucero Area

M. J. Rogers and the Campbells made extensive and intensive surveys of the sand dune area about the mouth of the Mojave River at the south end of Soda Playa. The Campbells' notes and Rogers' notes for this area contain a tremendous amount of data. However, Elizabeth Campbell also wrote general descriptions of what she called districts. These are areas where there are concentrations of archaeological resources and the descriptions of them appear to have been the initial draft of a manuscript that was never completed.

Our Crucero area includes her Crucero district and a portion of her Dry Lake District. Campbell differentiated Soda Dry Lake District from Lake Mojave in that Lake Mojave material was limited to that found on the Pluvial lake beaches. The following are quotes taken from her description of the Soda Lake District: (Campbell n.d.)

> "...On the north, Soda Lake is separated from Silver Lake by a very low divide through which a cut conveys storm water to the lower lake in times of flood. On the northeast the playa is bordered by long alluvial slopes which continue to the central part of the eastern shore until interrupted by a group of small volcanic mountains. South of these, slopes rise once more for several miles along a rough shore of self rising ground green with phragmites canes. Beyond the canes a grove of mesquite extends for more than a mile and these in turn give way to low scrub-covered dunes that form the margin of the great sand dune area bordering Soda Lake on its southeast shore...
>
> "At the south end of the playa lie the Crucero and Mesquite Hills and the Broadwell Mountains which form a divide between Soda Lake Basin and Broadwell Valley beyond. Mesquites grow in this district continuing around the southwest shore to a mile or more beyond Rasor Station on the Tonopah and Tidewater Railroad. These trees, which grow as far south as the Mesquite Hills and as far west as King Station on the Union Pacific Railroad, must cover an area approximately five miles wide by seven miles long. These mesquites fade out half way to Soda Station from Rasor. At this point the lake flat meets the mountains and continues thus to Soda Station, where a limestone hill protrudes into the lake. A few mesquites grow here and there about the base of this hill at the north and south end, and on the east side facing the playa proper, quantities of phragmites canes and tules are spread out on the flat below the hill...
>
> "...springs seep forth from the base of a limestone hill. Water trickles down the slope here in several places, but except in wet weather, descends only as far as the playa surface. The water is highly mineralized and tastes salty but tules grow about it and some patches

of salt grass and a few stunted clumps of mesquites nearby. About a mile beyond this rather uninviting watering place gravelly washes begin to border the playa and follow its shore line nearly all the way to its northern extremity... Beyond Crucero, near the Mesquite Hills, are two seepages known as Mesquite Springs and near the Crucero Hills another water hole occurs named Epsom Spring. These water holes along with the springs at Soda Station never seem to go dry regardless of the surface condition of the playa.

"...The largest camping area lies in the mesquites about the southwest shore where the Union Pacific and Tonopah and Tidewater Railroads cross. This was probably at one time the richest site in the Mohave Desert for recent Indian artifacts, a regular pot hunter's paradise. Tales are told of section crews shipping artifacts from here by the gunnysack full, at the time of the construction of the two railroads... Too many camps lie here to make it feasible to plot them all, for every hollow between the dunes is covered with camp stones, and it is often only a few steps from one fireplace to another. Most of these camps contain arrowpoints and are also littered with sherds emerging from the drifting sands. The two seepages on the north slope of the Mesquite Hills and the one at the west end of the Crucero Hills are probably the answer to so much camping hereabouts. These springs lying at the southern edge of the mesquite belt were within easy reach of any people who sought shelter among the tree covered dunes... Camps may be found all the way from Soda Lake on the east to a mile or so west of the Tonopah and Tidewater Railroad, and from the Mesquite Hills on the south to the general vicinity of Rasor on the north.

"Despite the prevalence of potsherds in this district some camps were discovered that seemed to be older. The farther we travelled from the open water holes on the south to the dry river bed on the north the less pottery we encountered. Here we found camps on low flats that seemed to have no relation to those in the mesquites and these camps contained neither potsherds nor arrowpoints. Fragments of flint scrapers and many crudely made blades three or four inches in length with a few dart points were the rule. Sand blasted hammerstones and flint cores were found about grouped stones that might have been camp hearths and an occasional mortar or mano fragment appeared. Dart points of the leaf shaped, Pinto and Gypsum types were among the things recovered from the general district and almost every kind of an arrowpoint that we have ever found anywhere else in the desert. These included tiny points, rabbit eared ones, triangular and Paiute type with indented base and straight sides, Pueblo types similar to those found in southwestern Nevada and points with serrated edges... On the pottery camps there were quantities of broken mortars... (and) many fragments of manos...

"Along the southwest part of the lake (Soda Playa) are large willows that have caught the sand until at a distance they look like clumps of mesquite among which they lie. Nearing the playa these grow smaller, until they and the mesquites disappear and their place is taken by low scrub-covered sand dunes rising out of yeasty ground with here and there patches of salt grass. Among these hummocks a few thin potsherd camps appear near the central part of the southern shore line."

Additional recent sites were reported associated with the mesquite grove on the southeast shore. Campbell (n.d.) states, "On old maps a water hole is marked in this vicinity and probably was near here, as Indian camps begin again and continue sparsely for the half mile or more throughout the area of the grove."

Crucero Dry lake district (Campbell n.d.) is contiguous with the Soda Lake sand dunes, being

"framed by the Mesquite Hills on the south and east, the Crucero hills on the northeast, and sand dunes and flats on the north and west toward the mouth of the Mohave...The playa is not over a ½ mile long, and might have been part of Soda Lake at one time... the few sand dunes just back from its shores are covered with a thick growth of mesquite which betokens shallow depth to water. Nothing else grows about the lake except dry desert scrub.

"The south shore is bordered with low gravel strewn hills that descend gently to the flat except where they are interrupted by the mesquite covered dunes. About the dunes are huge Indian camps strewn with rocks and a few flint chips. Only one metate fragment appeared on any of these numerous camps and no potsherds anywhere." (Campbell n.d.)

The sites scattered about Curcero Dry Lake were all apparently relatively early, lacking pottery, and few projectile points and much of the area may have been used as a quarry where "people repaired... to pound up rock and obtain fragments to carry to their camps." (Campbell n.d.)

Rogers (n.d.) also reports a number of sites for this area and many of his sites can be correlated with those reported by Campbell. There is rather close agreement between Campbell and Rogers as to the general nature of these sites. Both note widespread scatter of small camps associated with mesquite and usually relatively close to springs. They also both indicate that probably the entire cultural sequence is represented in the general area, at least back to the end of the Mojave Period. The bulk of the remains reported probably date from the Shoshonean Period based on the common occurrence of side notched points and Buff pottery. A site near Crucero (Rogers M-15A) was reported by Mr. McManis (a surveyor for the General Land Office) to have had, in 1909, house remains, many corn cobs and buff colored pottery. This suggests that agriculture may have been practiced during the Shoshonean period and that this area was under strong influence from the Colorado River.

The Saratoga Springs Period is represented by Anasazi pottery at a site on the east side of Soda Lake (Rogers n.d. M-14). A few Anasazi sherds occur elsewhere in the dune area but not so heavily concentrated as at these two sites. The earlier periods are represented by a few non-ceramic sites but by far the most heavy occupation of the area appears to have been during the Shoshonean Period.

The arrangement of the sites in the Crucero area is similar to that at Salt Springs, but dates primarily from a later period. In both cases small sites are concentrated in areas where water and sand dunes are found. This suggests again that water, mesquite and rice grass were major resources that attracted heavy populations to these limited areas, creating a "central base" appearance to the site distribution.

F. Mesquite Hills Dry Lake Area

Just south of the Crucero Area is the Mesquite Hills and at the base of their southern slope lies a small dry lake which Campbell (n.d.) referred to as Mesquite Hills Dry Lake. This playa, according to Campbell, was about two and one half miles long in an east-west direction and about two thirds of a mile wide. The southern shore of the playa is met by the toes of long gradual alluvial fans which descend from the mountains to the south. The extreme northeast edge of the Playa seems to be the lowest point and there is located a gully that appears to be cutting away to a canyon below. This canyon has mesquite trees growing in it and opens out toward the Crucero area.

The north shore of the Playa is bounded by the steep alluvial slopes deriving from the Mesquite Hills. While at the west end the shore ends in a few sandy spits not over three feet above the playa surface. These spits are tuffed with bunch grass and desert scrub and among this growth a few camps are to be found. Nothing remains here, however, except quantities of fist sized rocks, a few coarse pot sherds of "common red and brown wares" and an occasional flint chip (Campbell n.d.)

At the east end of the lake the shores are abrupt, ending in a rise of ground of soft clayey material. Here a few groups of stones suggest camps.

From the head of the outlet canyon westward along the north shore for at least three quarters of the length of the playa is a stone covered bench (or beach) upon which camps are located containing both pottery and "pre-pottery" artifacts. A little farther to the west on the north shore small sand dunes extend for about a mile. These dunes do not rise over about eight feet above the playa surface. Here among the sand dunes and on the nearby flats were quantities of "flint chip and camp stones." Manos, metates, small (arrow) points "of the Paiute type" and "Pueblo types" were found. To the west the canyon becomes increasingly "poorer" until near the west end of the lake both sand dunes and camps disappear altogether.

The Mesquite Hills Dry Lake Area also includes the Hord site (Davis 1973) which is characterized by Mojave Period artifacts. This site was presumably located near seasonal water about one mile south of Mesquite Hills Dry Lake and represents a seasonally occupied site. However, the artifact inventory is very similar to that of the Lake Mojave beaches and apparently dates from a period of greater available water.

The Mesquite Hills Dry Lake Area has a site distribution that follows the pattern found elsewhere in the Mojave Trough--a series of small sites associated with sand dunes and water resources. The water resources about Mesquite Hills Dry Lake are limited today to an ephemeral lake. This paucity of water is reflected in the sparse distribution of sites throughout the area.

G. Cronise Basin Area

The Cronise Lakes are an alternate sink for the Mojave River. When the waters of the Mojave reach the Mojave sinks they flow into either the Cronise Basin (with its two playas--East and West Cronise Lakes) or the Lake Mojave Basin (consisting of Soda and Silver playas). Rogers (n.d.) recorded fourteen sites around the margins of the Cronise Lakes. All of these fall within the Saratoga Springs and Shoshonean periods.

The sites form almost continuous occupation along the margin of the lakes where sand dunes are found. There is virtually no water present, except for the lakes that form during periods of heavy flow of the Mojave River. However, mesquite is plentiful in the dunes and the lakes in this basin form over a long enough period that fresh water mussels could mature and be collected by the prehistoric inhabitants. The sites here also were of a permanent nature as reflected in several cemeteries reported by Rogers (n.d.). The cemeteries clearly indicate the use of the area over a considerable period of time although probably seasonal use was characteristic.

The assemblages collected from these sites by Rogers are characterized by Colorado Buff Ware, triangular and Desert Side

Notched points and a wide variety of tools including mortars and pestles, manos and metates, shaft smoothers, scrapers, drills and other tool types. Shell beads from the California coast are also present. One site has a heavy concentration of Anasazi Gray Ware and Rogers thinks it may represent an occupation by that group. Relatively few Owens Valley Brown Ware or other Paiute pottery types are present and both cremation and interment are represented in the cemeteries. The common occurrence of Desert Side Notched points seems to indicate a contemporaneity between the Paiute brown ware farther north and some (if not all) of the Buff Ware at Cronise Lakes.

The site distribution at Cronise Lakes is identical to the other areas in the Mojave Trough where water was present. The sites are scattered through the sand dunes and mesquite and appear to be small and extensive. However, they probably represent repeated seasonal occupation by small bands who gathered together at low elevations in close proximity to water and mesquite and rice grass sources in the sand dunes.

H. Turquoise Mountain Area

The Turquoise Mountain area is rough broken terrain east of the Lake Mojave Basin. This area is primarily a creosote zone with steep slopes extending from about 3000 to 4500 feet and including within its boundaries Halloran, Bull and Francis springs and Turquoise and Squaw mountains and Solomon Knob. Resources in this area are very limited, the main attractions apparently having been the springs for people passing through and the turquoise that was mined in this area during aboriginal times.

The sites appear to be of two or three types. Open campsites generally in association with or close to springs, rock shelters, and mines. The best known camp sites are at Halloran Springs where evidence of Saratoga Springs and Shoshonean periods are found. Earlier periods may also be represented, but evidence is very scarce. In addition to campsites, petroglyph sites, "hunting blinds" and "sleeping circles" are reported from the vicinity of the springs. This site appears to have been often used on a temporary basis by small groups.

Francis Spring also exhibited some signs of occupation, but according to Rogers (n.d. M-19) the vicinity of the spring was "badly washed and no camp could be found, only a few chalcedony flakes on a mesa in the wash." A few petroglyphs are also present on lava blocks nearby and a few caves in the lava escarpment east of the spring have been occupied as indicated by an occasional sherd.

No sites are reported associated with Bull Springs.

There are three large groups of turquoise mines. Rogers states,

> The west and east groups... are known as the Toltec and Himalaya groups respectively, and are situated eight miles apart, with an unnamed intermediate group lying three miles east of the Toltec group.(1929:2)
>
> At the Toltec and Middle groups, the surrounding contours are extremely rugged and the ancient diggings are badly eroded. It is often impossible to distinguish a man-made cut from a natural ravine. Most of the ancient mining here was conducted by running open cuts up on the steep sides of the canyons.
>
> At the Himalaya group, the terrain is more in the nature of a plateau, and the mines have been better preserved. Most of the work in this area was conducted by sinking pits... They now appear like shallow craters dotting the plateau... (1929:4)
>
> Although many of these mines have been obliterated by modern work, especially at the Toltec group, it is possible to identify with certainty fifty aboriginal workings at the Himalaya group, twenty at the Middle group and for the Toltec group, I take Mr. Hyten's estimate of two hundred, this count having been made prior to modern disfiguration.(1929:5)

Stone manos, picks and axes were found in varying numbers at all sites. In addition to these mining tools, about twenty-five "Puebloan-type" sherds apparently from bowls and a canteen were found at the Himalaya group (Rogers 1929:6) as well as two Basketmaker spear points (Rogers 1929:6, n.d. M-20). Water is not found at any of the mines and the nearest spring is five miles distant. The mines do not appear to have living sites in direct association with them.

That many man days are represented by the aboriginal mining pits cannot be doubted. Mr. James Hyten reported to Rogers (1929:4) that he was hired with four miners to muck out the Tiffany mine which was the largest pit. He gave the dimensions of the aboriginal pit as being "thirty feet long, twelve feet wide and twelve feet deep. From this main pit, numerous short drifts or 'gopher holes' extended, where the Indians had pursued promising veins. There is practically no soil at this site, and the entire excavation was conducted in bedrock." Hyten and four miners reportedly worked for several months mucking out the loose debris. Therefore, it must have taken the Indians even longer to excavate the bedrock. There must be some permanent camps in the vicinity where the aboriginal miners stayed while working the mines.

Rogers (1929:7) feels that "Of all the sites in the region, excluding the mines, the Halloran Springs site produced the most Puebloan artifacts, and possibly was a temporary camp of the turquoise miners."

Rogers also reports some rock shelters that may have served as temporary residence for the aboriginal miners. Site M-20A (Rogers n.d., M-20) is described as

> "Rock shelters of turquoise miners in a basalt cliff overlooking mines on south side. Cliff has scaled badly since occupied and house sites are buried with blocks of lava. Probably about seven of these shelters with crude walls thrown up in front of them--floors are full of turquoise chips and a few sherds--talus below is full of basalt spalls and broken hammers and picks. Most of the sherds and one Pueblo arrowpoint found in talus. The miners made all of the mining tools here as is evidenced by the debris of basalt chips and incomplete mauls on the dump. The local basalt was utilized."

Rogers describes two other rock shelters (n.d. M-21 and M-23). M-21, unlike M-20, lacked evidence of turquoise mining except for a single piece of chrysocolla. There were a few chips of chalcedony, food bones, strip of tanned leather and a few plain crude Brown Ware bowl sherds. They are assigned to Chemehuevis by Rogers (n.d. M-21).

Half Moon Cave (M-23) is located in conglomerate formation, is half mooned in shape, being 40 feet wide and 6 feet deep. Rogers apparently tested this shelter and found two feet of deposit. The bottom foot contained turquoise chips indicating mining activities, the sherds were dark gray Puebloan and no white or lighter Gray Ware was present. Later Chemehuevis used the cave and two yucca and bunch grass beds were found in the later occupation. All occupation was covered by roof fall.

In addition to the occupation sites and mines, petroglyph sites are found in this area, especially in the vicinity of Halloran Springs and on the north slope of Beacon Mountain in the Turquoise Mountains. No stylistic analysis of these petroglyphs has been made.

The sites of the Turquoise Mountain area, while sparse, do provide some important information. The large sites are the turquoise mines that represent many man days of labor. The occupation sites of these laborers appear at the present time to be rock shelters and small open sites. This strongly suggests that the laborers lived in small groups and probably worked in small groups. The mining sites consist of many small pit excavations that further support this interpretation. The occupation sites so far recognized, contain mining tools and turquoise chips indicating that the workers continued activities related to mining such as preparing tools for mining and removing turquoise from its matrix. Rogers (n.d. M-20) suggests that at M-20 the lack of manos and metates may indicate "that women were not brought along."

The components that relate directly to mining activities can be identified as dating from the Saratoga Springs period while the later Shoshonean components apparently lack any indication of mining activities. These later components are also small units that must have been occupied for short periods by small bands, probably serving as overnight stopping places for peoples moving between the high elevation and low elevation resource zones. The petroglyph sites have yet to be analyzed, but they may have served as maps, hunting rituals or other religious activities by several different prehistoric groups. This group of sites exhibit a different range of activities from those found in the low elevation resource zones.

I. Clark Mountain Area

The Clark Mountain Area lies on the slopes of Clark Mountain above 4200 feet elevation. This area includes primarily blackbush-Joshua tree zone with pinon-juniper at the higher elevations. There are a number of springs about the slope, but the sites are generally not in direct association with the springs. Sites consist primarily of single or grouped roasting pits, rock shelters, rarely an open midden, flake scatters, and an occasional rock alignment.

By far the most common site feature is the roasting pit. These occur on approximately 70 percent of the sites reported in the Clark Mountain area. Roasting pits may occur as isolated features, in groups up to six in number or in combination with rock shelters or other site features. The roasting pits were almost certainly used in preparation of agave and yucca for consumption. The occurrence is generally in association with the Joshua tree-blackbush zone that contains both agave and yucca in greater abundance than other zones.

Unfortunately very few of the roasting pits have been excavated and no excavation has been published. However, they are composed primarily of burned limestone. Apparently, after each use the limestone that has been burned during the roasting of the agave is thrown out and replaced by fresh limestone. Consequently, with each use, the roasting pit increases in size, the burned limestone accumulating in a large ring about the pit. The size of the pit and surrounding rock ring can therefore be correlated roughly with the length of time it was used. It would appear that many of the large roasting pits were used seasonally over a long period of time.

Unfortunately there are virtually no artifacts associated with roasting pits in the Clark Mountains, so that it is impossible to assign them directly to a time period. However, in the Spring Mountains (the adjacent range to the east and north) roasting pits are found associated with both Anasazi and Paiute pottery as well as without pottery (Larson 1978). It is probable that the roasting pits in the Clark Mountains also date from the same time range and should fall in the Shoshonean, Saratoga Springs and possible Gypsum periods.

The other sites reported for the Clark Mountains include small rock shelters exhibiting little occupation, a few open sites with small artifact inventories collected from the surface. Excavations in the Clark Mountain Area are virtually non-existent, but all sites appear to be specialized sites, flake scatters and roasting pits or small occupation sites. None of the sites suggest long term occupation nor occupation by large groups.

The Clark Mountain sites are interpreted as being utilized during periods when local resources were seasonally available. Probably none of them were occupied for more than a few weeks as small task groups roamed about the area in search of agave, yucca, pine nuts, game, and other resources. The location of the sites and duration of use probably is related not only to the local food resources, but to the distance to nearest water. It is clear that they were temporary camps and represent only one part of the seasonal round of activities probably during the spring and/or summer months.

J. Mesquite Lake Area

The Mesquite Lake Area includes the Mesquite Dry Lake and adjacent shore line and extends to the southeast along the boundary of the study area to include State Line Pass. Mesquite Lake lies at 2540 feet above sea level and is a southern extension of Pahrump Valley, being separated from Pahrump by only a low rise. Mesquite Lake is approximately 3 1/3 miles long by 2 1/2 miles wide and is surrounded by mesquite and sand dunes. A number of wells have been drilled in the area during historic times, but no springs are recorded on the USGS maps. To the southeast State Line Pass rises to an elevation of about 3800 feet before dropping to the Ivanpah Basin.

Most of the area is low creosote zone but at the higher elevation of State Line Pass blackbush and some Joshua trees are encountered. There are no known springs in the vicinity of State Line Pass and water either had to be carried in or the area used during times when water was available in natural tanks that do occur in some areas of State Line Pass.

Sites on State Line Pass include a series of roasting pits that lack any temporally sensitive artifacts and could date from a pre-pottery period or later. The rock shelters, some of which are in association with roasting pits, exhibit only slight occupation with flakes and a few metates being found. Two rock shelters also yielded Anasazi sherds, however, no Paiute pottery was recorded (Rogers n.d. M-32). The State Line Pass sites, like the sites of the Clark Mountain area, appear to be temporary special activity sites and/or temporary campsites for people passing through the area. These sites, too, reflect a very limited portion of the range of activities of the prehistoric population of this region.

Mesquite Lake sites (Rogers n.d. M-33) are distributed along the margins of the dry lake and adjacent sand dunes. About these sites, Rogers states (n.d. M-33):

> "Most of the occupation as well as the mesquite here is on the northeast end of the lake--no evidence of a lake terrace could be found here. The modern mesquite dunes carry practically no occupation. Most of the occupation here is on old dune surfaces and not in sand craters. It is almost entirely pre-pottery... The occupation is all back of the large modern mesquite dunes and far back from the surface of the dry lake except on the east end where much washed out occupational material was found spewed about the dry lake surface near old stream channels."

Rogers recognized ten distinct sites that vary in assemblage as well as in location. These sites represent occupations during the Shoshonean, Saratoga Springs, Gypsum and Pinto periods. The sites are very similar to those at low elevation in the Mojave Trough, in that they are scattered around the playa in association with sand dunes and concentrate where mesquite is the most plentiful. The artifact assemblages for all periods contain a wide range of artifacts including projectile points, knives, scrapers, millingstones, drills, occasional ornaments of shell, hammerstones, flakes and in the later periods pottery.

The Mesquite Valley sites appear to have been occupation areas in which (or from which) a number of activities were undertaken. Hunting and seed processing are both represented as is the making of chipped stone artifacts. These sites are more extensive than the high elevation sites and probably represent heavy seasonal occupation over a very long time. The mesquite and rice grass must have been the major attraction to the area. Mesquite Lake must have held fresh water periodically for long enough and in quantities large enough to support man around its shores during prehistoric times. Although this cannot be demonstrated, periods of available water in the Mesquite Valley might correspond to the times of "wetter than present" climates described for the post Pluvial Period (Mehringer 1977).

Summary and Recommendations

The data are presented above in a chronological framework and in a geographical framework. It is apparent that the prehistory of the Mojave Desert is not well known. We apparently do not even have the full round of seasonal activities for each period represented in the site data. Anything we can say about the chronology, the adaptation, the culture change in the Mojave Desert must be prefaced by a qualifier that notes the limitations in our knowledge and in the data.

However, in the broad perspective we can be fairly certain that the major problems in the chronology of the Mojave have been recognized. Also in a broad perspective we can see certain patterning of sites that might prove of major importance to the development of cultural resource management of the area. This patterning is apparent from the "bird's eye view" of the site distribution and supported by the "up close" look at the same distributions.

The pattern of site distribution in the Amargosa-Mojave Basin planning units is characterized by two areas of site concentration. The low elevation site concentration is found in valley bottoms usually in association with sand dunes and/or water sources (springs, rivers, lakes). Mesquite is a common element in these locations as is rice grass and in a more general sense the rather productive saltbush scrub. All periods are represented in low elevations sites, although there are some differences in the distribution of Mojave Period sites from later sites. What becomes apparent is that where sand dunes, mesquite and water occur or occurred together in valley bottoms, there is a high potential for dense site concentrations.

This high density of sites found in the valley bottoms is usually separated from the high elevation site concentration by a belt of creosote on the intervening pediments that produces only a few sites, most of which are flake scatters. The more rare midden site may occur in this zone, but probably always with some unusual feature such as large drainages, springs, rock shelter or desirable resource like turquoise.

The high elevation sites are usually found in the blackbush-Joshua tree and the pinon-juniper zones. These sites are limited in type primarily to roasting pits, flake scatters and small middens associated with rock shelters, springs and roasting pits. The high elevation sites are far less extensive, more widely distributed than valley bottom sites, and appear to represent short periods of occupation by small groups of people. A moderate high site density can be predicted for the blackbush-Joshua tree and some of the pinon-juniper zones.

Given this information and understanding of the site distribution in the Amargosa-Mojave Basin planning units a few specific areas with significant resources can be named that require some kind of protection or mitigation before the resources are completely destroyed. These are:

1. The Crucero Area described by Campbell in the 1920's as "probably at one time the richest site in the Mohave Desert for recent Indian artifacts." This area has been severely impacted by railroads and off road vehicles, however the sand dunes undoubtedly still contain much data and in some way should be protected.

2. Cronise Area is similar to Crucero Basin both in resources and in amount of impact suffered, although the Cronise lakes seem to be somewhat more intact. Both Cronise and Crucero areas are important because of the possibilities

of Anasazi occupations. Cronise is of further significance because of the occurrence of a late post-Pluvial lake that resulted in a high density occupation at its margin.

3. Salt Springs is another similar area that has a large concentration of sites that needs protection. These sites are especially significant because they relate to the numerous problems related to the Pinto and Gypsum periods and because they are associated with a spring that has no potable water at the present time. This suggests that the sites were occupied during different climatic conditions. This area requires special attention because it is accessible to anyone passing through the region due to its proximity to the paved highway.

4. Lake Mojave historically is a very important early man area. However, the sites which were described in 1937 are nearly all severely impacted by collectors. These were surface sites, with little buried material. The archaeological record lay as a fragile pattern on the surface of ancient beaches for about 9000 years. However, since 1937 the fragile pattern has been broken, the artifacts and flakes have been collected until nearly nothing is left and the surface features have been walked over, driven over, kicked about and generally badly disturbed if not destroyed. Most of the surface archaeology is gone--completely destroyed--but this does not mean that these sites are now without value. Quite the contrary the problems of geological relationship of the assemblage to the lake features can and should be dealt with, but the sites must be protected from further vandalism if these data are to be preserved so future archaeologists and geologists can deal with them.

5. Mesquite Lake is another low elevation area that has remarkable archaeological resources. However, these have not been evaluated in many years, but like the other low elevation site areas, the concentration of sites calls for some positive steps in cultural resource management.

6. The turquoise mines of Turquoise Mountains are unique and invaluable cultural resources that hold answers to many of the questions concerning the Anasazi occupation of the central Mojave Desert. These sites are being commercially mined and the archaeological resources are being destroyed in the process. A concerted effort to salvage the remaining archaeological resources should be made before it is too late--before the resources are completely destroyed.

7. The high elevation site concentration consists of widespread small sites which makes the concentrations (if they exist) more difficult to define. It appears that

the blackbush-Joshua tree and pinon-juniper zones are generally areas of site concentrations. The whole of these ecological zones may have to be considered areas of heavy site density. If that be the case, some different cultural resource management will be required, preferably a plan combining preservation, research designed excavation and salvage excavations (if needed).

These recommendations are made on the basis of limited data gathered via a biased sampling of several different archaeologists using different methods over a period of about 50 years. There are certain areas that we have defined as having high site density, however, we cannot identify with any degree of confidence areas of low site density. At the present time the creosote plant community appears to be such a zone, however, there are exceptions within that zone. Coombs (1978) identified at least two instances where localized resources within the creosote plant community resulted in a high density of sites. One such locality was centered about a source of chalcedony while the second was about a spring. A survey of major washes that feed into the Mojave Trench across the creosote zone from adjacent mountains may prove they contain a large number of sites (Coombs 1978). The Kingston Wash is an example of a wash that may prove to contain a relatively large number of sites and represent another aspect of the seasonal round of activities practiced by the prehistoric inhabitants of the central Mojave.

The major problem of the recommendations for cultural resource management can be summarized: We can recognize certain areas of high site density which call for cultural resource management, but in those areas not recognized as having a high site density we do not know whether the lack of recognition is in fact due to a paucity of archaeological sites or a paucity of archaeological surveys. Until the lack of sites is reported at least as rigorously as the presence of sites, there will be no way to distinguish between areas that have never been occupied by aboriginals and areas that have never been surveyed by archaeologists. Towards this end the archaeological surveys initiated by the Bureau of Land Management (cf. Coombs 1978, Brooks 1979) are much needed additions. The mapping of areas of low site density versus areas of high site density provides data that will aid in the management of cultural resources. However, those data alone are not adequate for making the kinds of decisions necessary to the management of those resources. There remains the very difficult problem of determining which sites are to be preserved in the multiple land use program of the Bureau of Land Management, and which sites are to be sacrificed (after proper archaeological investigation). Such decisions require the ranking of sites on the basis of their significance. The "proper" evaluation of significance is a process that is most difficult to achieve and any such evaluation is fraught with pitfalls because the significance of an archaeological site is relative to the problem which the archaeologist is investigating, the methods used, and the theoretical structure under which the program of research is developed. In short, the significance is relative to the bias of the investigator. Archaeologists of tomorrow will no doubt operate under biases that we have no way of predicting. The manager of culture resources must, therefore, attempt to preserve resources significant to research designs that have yet to be conceived. Consequently, cultural resource management must begin with the basic assumption that all sites are potentially significant and valuable, which recognizes that some sites must necessarily be destroyed. The problem, then is to determine the full range of variation of sites and to preserve an adequate sample of that range of variation.

We are obviously in basic agreement with the approach suggested by Glassow (1977) and elaborated on for the Mojave by Coombs (1978). As a basic principal to a management plan would be the preservation of the complete range of sites in the varying environmental settings. The determination of the range of variety of both sites and environmental setting requires a considerable knowledge of the archaeological and environmental resources and the Bureau of Land Management Desert Planning Staff is in the best position to evaluate the data accumulated by the recent surveys and overviews. Consequently, we will not address that problem.

Other variables that must be considered have been introduced by Coombs (1978:127) in this criteria of "accessibility, familiarity, value and delicacy". Again we are in essential agreement with Coombs' evaluation of these criteria. However, his term "delicacy" is somewhat misleading in that he has, in our view, confused two criteria, "delicacy" and "complexity". Delicacy is generally equated with complexity, however, large sites with deep middens fall on the "more complex" end of the continuum while in our view they are less delicate than the "fragile pattern" sites which may reflect a variety of activity areas on the ground surface and be destroyed easily and quite accidentally by off road vehicles, mining activities, campers, and a variety of other land use. Delicacy of a historic mining town and intaglios are comparable, while the large buried middens are less delicate. It seems quite clear that delicacy and complexity are essentially independent variables. Delicacy is the criteria Coombs means to use but the relationship between complexity and delicacy noted by Coombs is inaccurate and misleading. Coombs (1978:127) states:

> The criterion of delicacy brings up an important issue that we think should be considered. There are, of course two basic ways of preserving a site. The first involves leaving it intact and protecting it as best as possible. The alternative is to remove the site and place it in a collection. We bring up this point here because sites which are not delicate are ones in which very little, if any information is lost when the site is removed, provided of course that its precise provenience is recorded. Given the delicacy of isolates, in particular, we would strongly

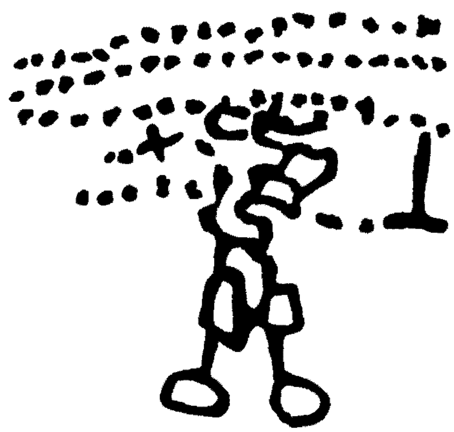
> recommend that the BLM consider collecting them as they are found. We are now convinced that leaving isolates in the field is all but insuring that any further information they may provide to archaeology will be lost forever... Conversely, more complex sites should not be collected unless necessary, since even most careful surface collection or excavation can destroy a considerable amount of information.

In the discussion Coombs is in fact discussing both complexity and delicacy. A large fragile pattern site containing several activity areas is delicate indeed, as is the ghost town. However, they are far more difficult to remove than isolated finds which are equally delicate. The difference is the number of elements involved and the interrelationships in space, the difference is in complexity of the site.

Coombs' four criteria are designed for classifying sites according to the relative potential for destruction or vandalism. Complexity is not relevant to that evaluation but must be considered as relevant to evaluation for possible preservation.

Glassow (1977) and Coombs (1978) present a convincing argument for their criteria of significance and criteria for possibility of vandalism and destruction. However, these criteria are at the level of individual sites. Archaeologists, too often view sites as independent units. However, sites were never independent units during the time of their occupation. It is a fact that the prehistoric cultural systems of the Mojave Desert were not limited to single sites, but extended networks over wide geographic areas and through various ecological zones. Any program of site preservation in the Mojave Desert, with a view toward future research, must include the criteria of area network integrity. Area network integrity recognizes that peoples throughout the Mojave utilized virtually all ecological zones, but they did not utilize them in the same manner in all places. The Owens Valley Paiute apparently had a different pattern of land use from the Death Valley Paiute or Reese River Shoshone. To attempt to test a hypothesis regarding settlement patterns or economic systems by utilizing lowland sites of Owens Valley and upland sites in the Funeral Range, regardless of the variety included, would only lead to erroneous results. In preserving sites for future research it is not enough to protect the variety of site types in the various ecological zones. The area in which they are preserved must also exhibit integrity in being at least geographically contiguous to the degree that it was usable within the context of a single prehistoric cultural system.

In the Amargosa-Mojave Basin planning units site preservation should include areas from all ecological zones. This sample might best be viewed in terms of several blocks in each ecological zone from the valley bottom to the high mountains forming discontinuous transects across the width of the basins. These discontinuous transects should be placed at several locations determined by applying criteria developed by Glassow (1977) and Coombs (1978) to the data retrieved by the Desert Planning Staff. Such sampling procedures would insure a high probability that sites within a given area would reflect the integrity of the cultural systems networks.

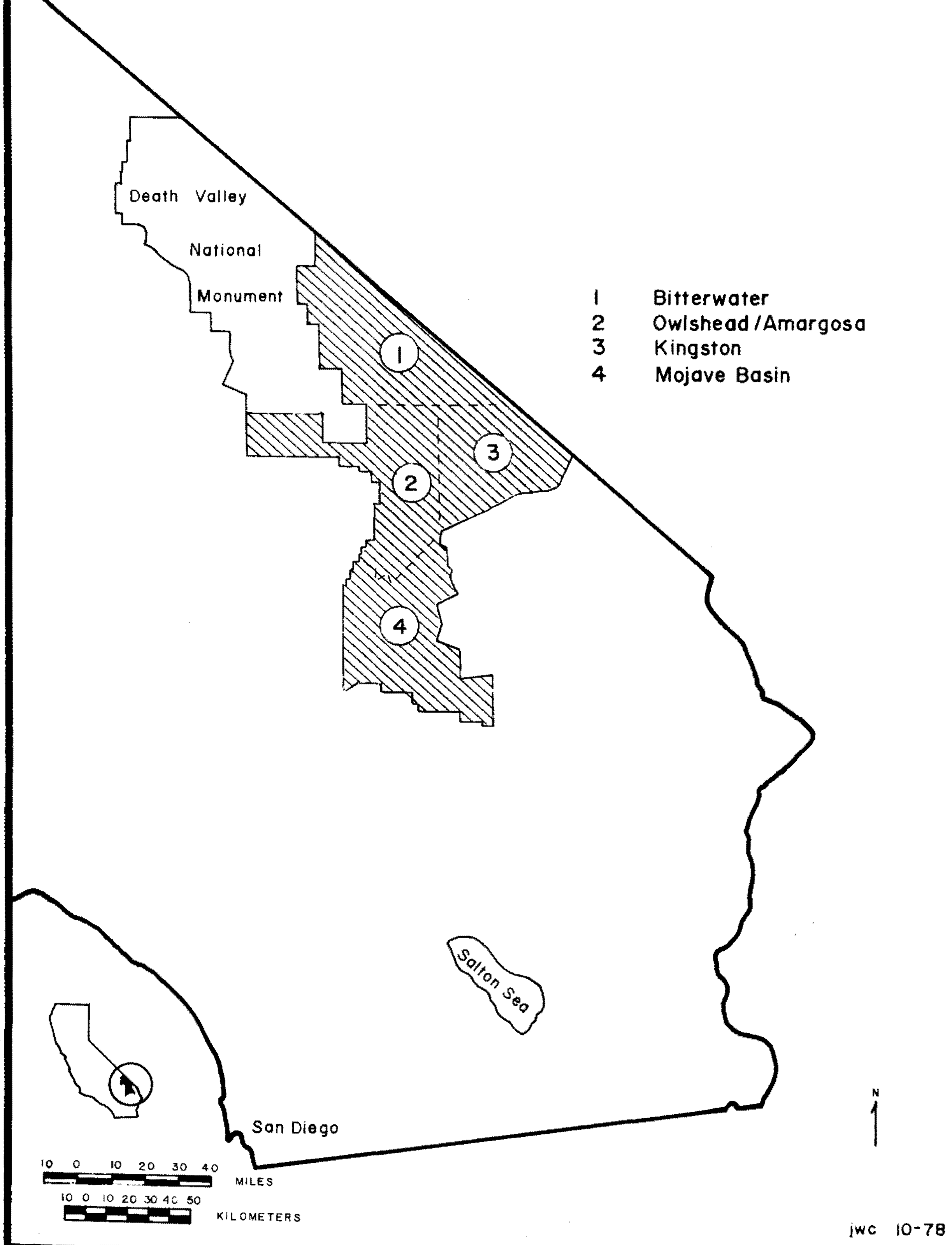


SAWTOOTH PETROGLYPH (NO SCALE)

Map 1

LOCATION OF THE AMARGOSA-MOJAVE BASIN PLANNING UNITS

LOCATION OF AMARGOSA - MOJAVE PLANNING UNITS



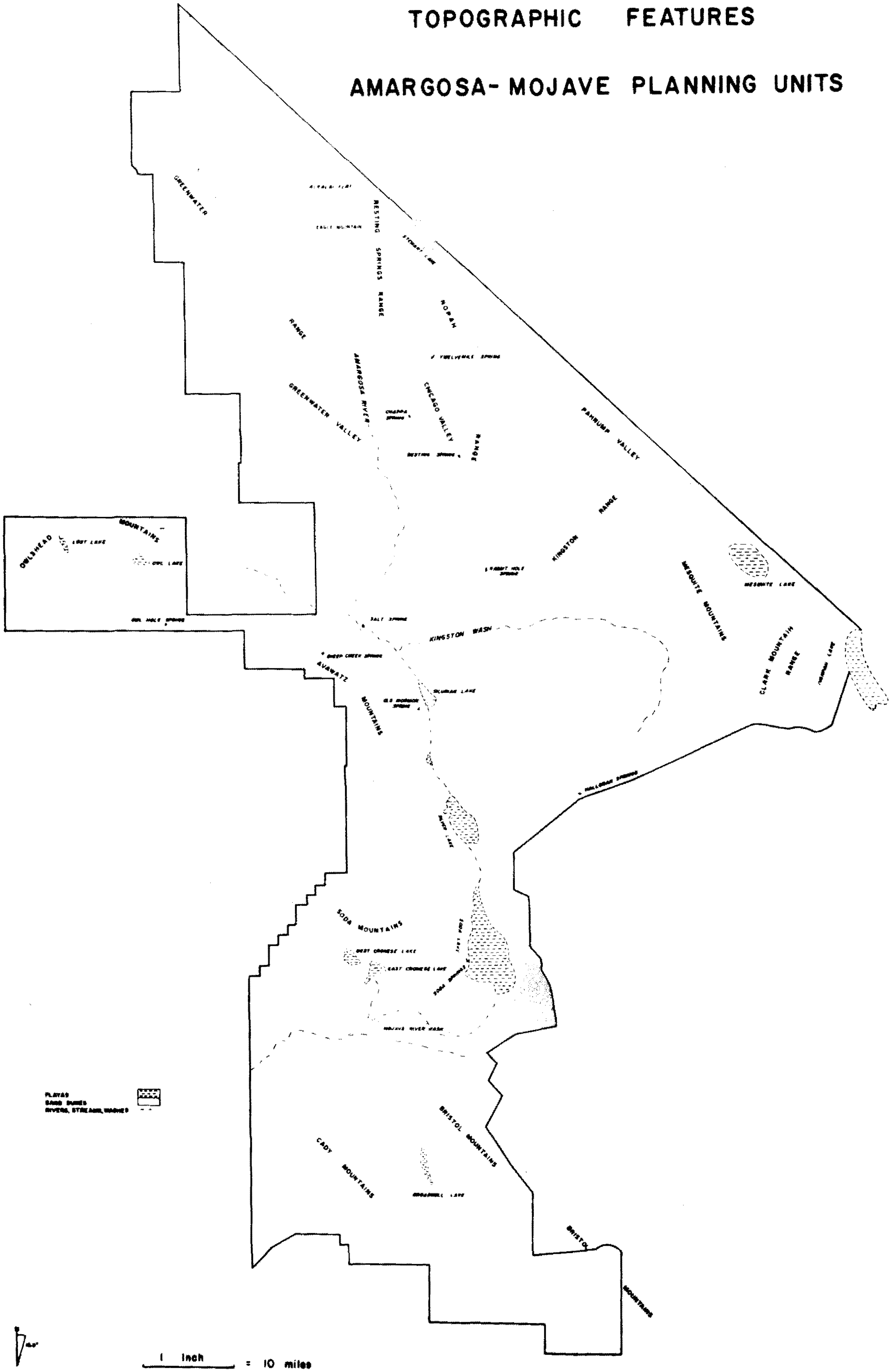
Map 2

TOPOGRAPHIC FEATURES OF THE

AMARGOSA-MOJAVE BASIN PLANNING UNITS

TOPOGRAPHIC FEATURES

AMARGOSA-MOJAVE PLANNING UNITS



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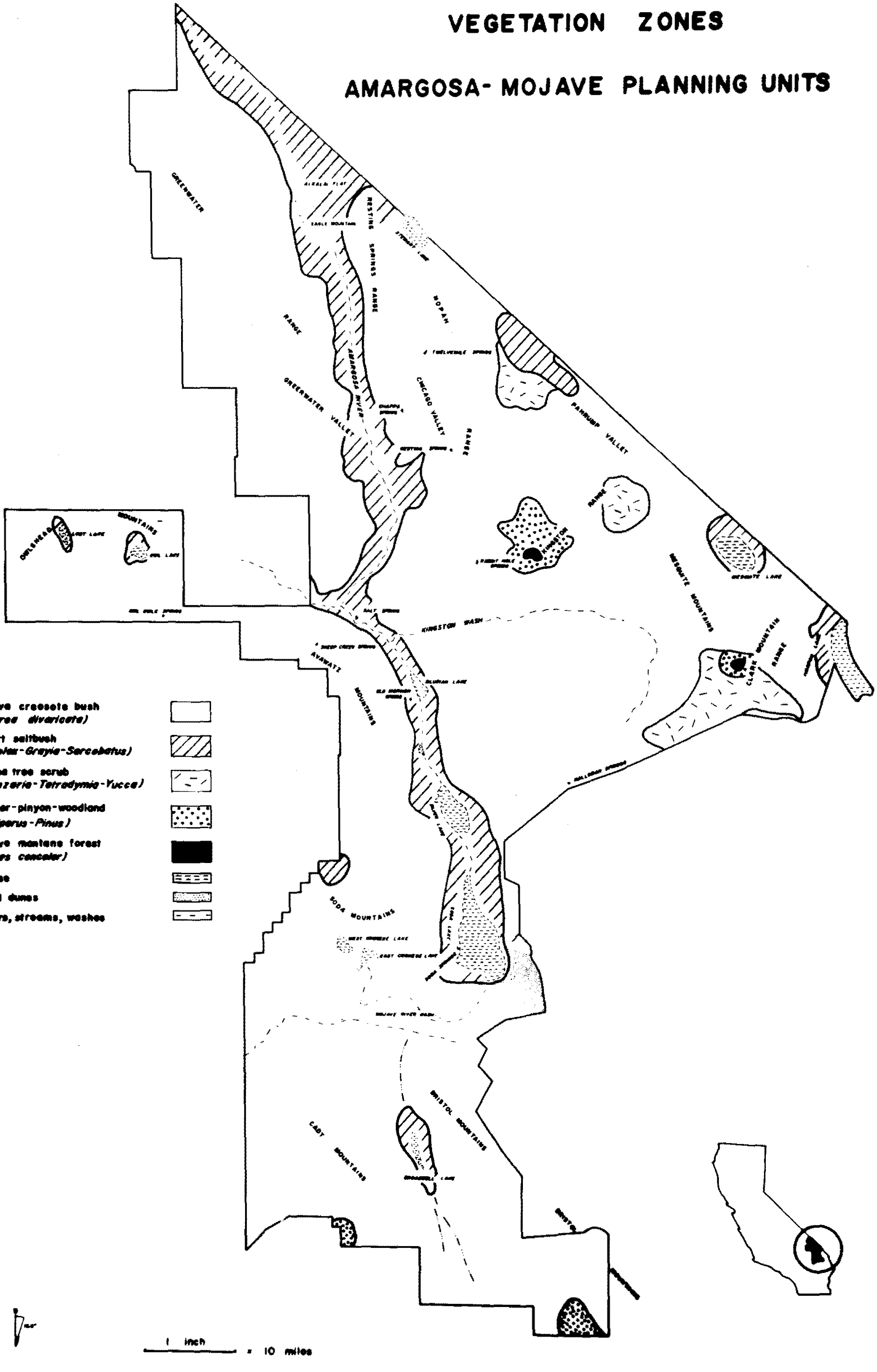
Map 3

VEGETATION ZONES OF THE AMARGOSA-MOJAVE BASIN PLANNING UNITS

VEGETATION ZONES

AMARGOSA-MOJAVE PLANNING UNITS



Map 4

MAJOR ARCHAEOLOGICAL SITE AREAS OF THE

AMARGOSA-MOJAVE BASIN PLANNING UNITS

MAJOR ARCHAEOLOGICAL SITE AREAS

AMARGOSA - MOJAVE PLANNING UNITS

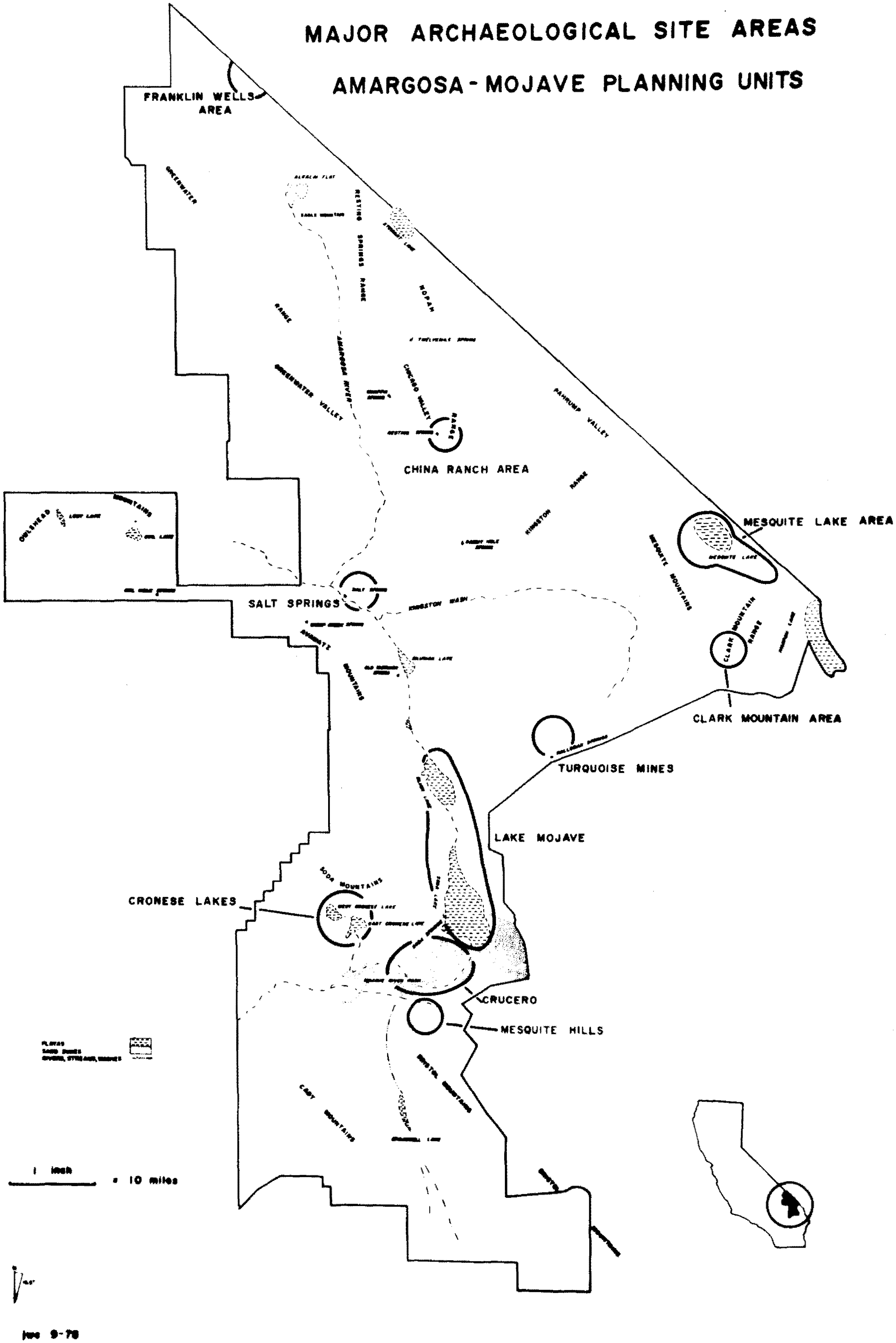


Figure 1

CULTURAL CHRONOLOGIES FOR THE CALIFORNIA DESERT

*Bettinger and Taylor (1974) have corrected their radiocarbon dates to the bristlecone pine dendro calibration. Therefore, the earlier periods are shown as older than they would be if not corrected.

**N.C. Yuman is abbreviation for non-ceramic Yuman.

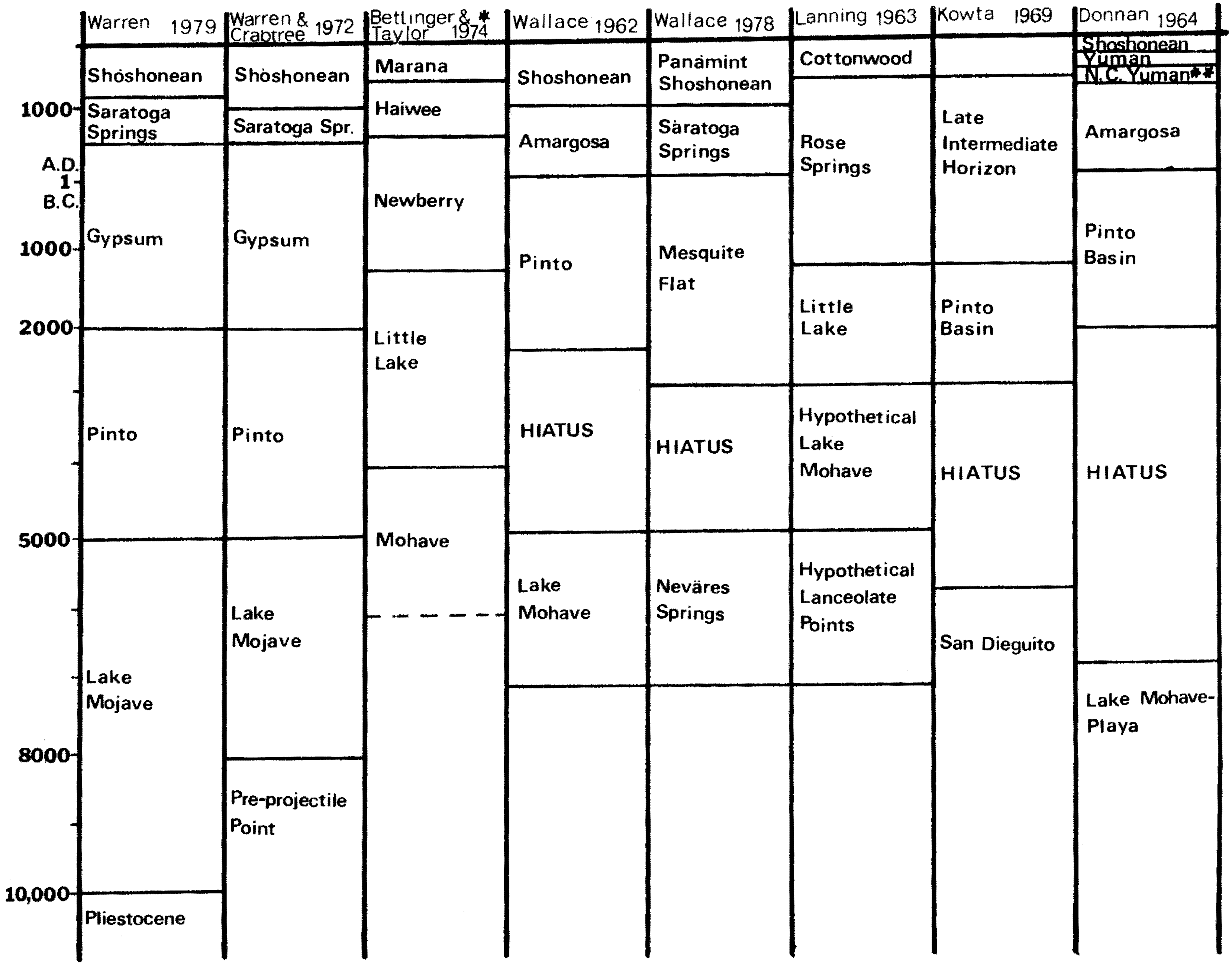
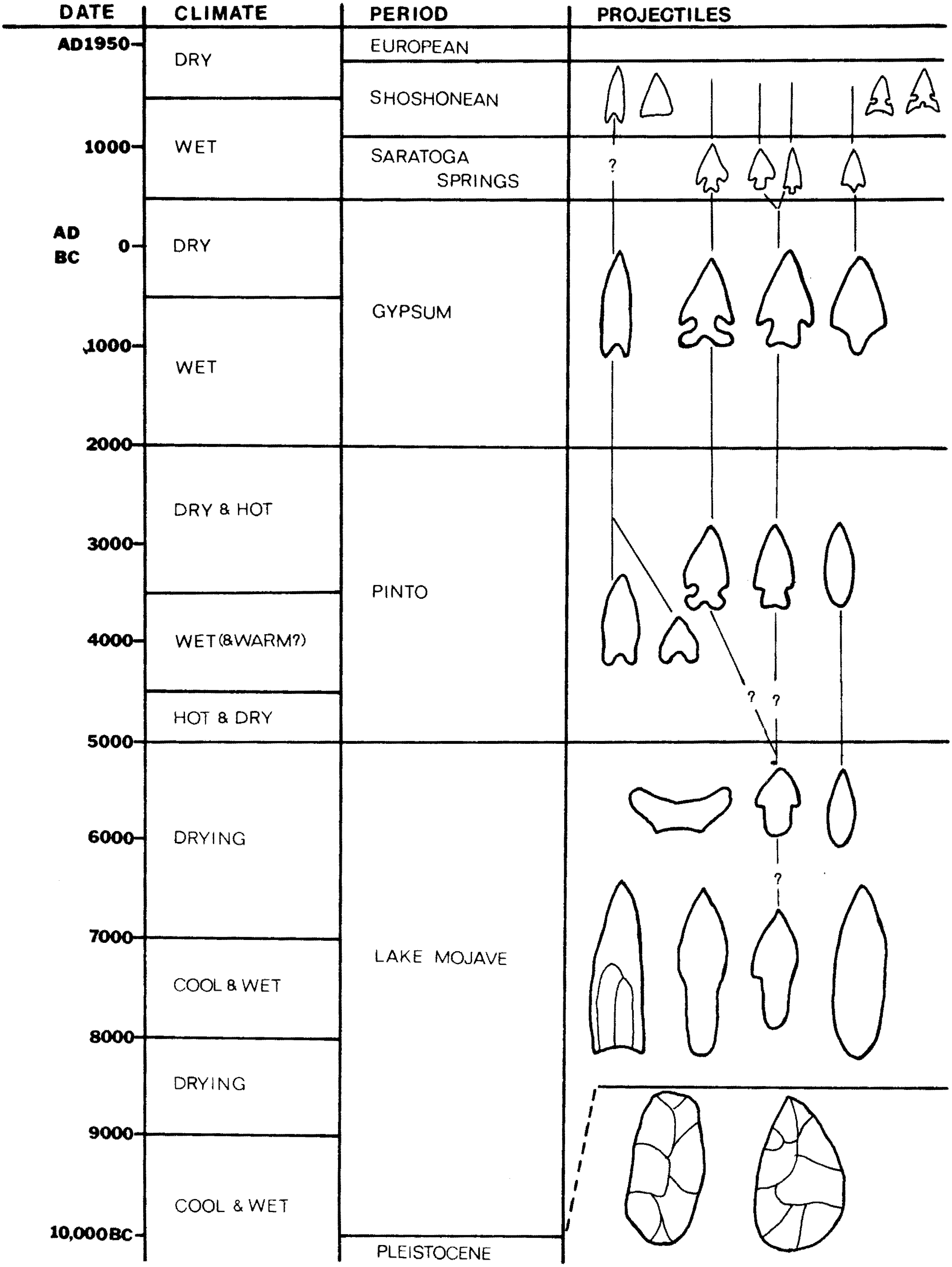

Warren 1979
Warren & Crabtree 1972
Bettinger & Taylor 1974 *
Wallace 1962
Wallace 1978
Lanning 1963
Kowta 1969
Donnan 1964
1000
A.D.
1
B.C.
1000
2000
5000
8000
10,000
Shoshonean
Saratoga Springs
Gypsum
Pinto
Lake Mojave
Pliestocene
Shoshonean
Saratoga Spr.
Gypsum
Pinto
Lake Mojave
Pre-projectile Point
Marana
Haiwee
Newberry
Little Lake
Mohave
Shoshonean
Amargosa
Pinto
HIATUS
Lake Mohave
Panamint Shoshonean
Saratoga Springs
Mesquite Flat
HIATUS
Neväres Springs
Cottonwood
Rose Springs
Little Lake
Hypothetical Lake Mohave
Hypothetical Lanceolate Points
Late Intermediate Horizon
Pinto Basin
HIATUS
San Dieguito
Shoshonean
Yuman
N.C. Yuman**
Amargosa
Pinto Basin
HIATUS
Lake Mohave-Playa

Figure 2

PREHISTORIC PERIODS AND DIAGNOSTIC PROJECTILES

CORRELATED WITH CLIMATIC SEQUENCE IN THE MOJAVE DESERT



DATE
CLIMATE
PERIOD
PROJECTILES
AD1950
1000
AD
BC
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000BC
DRY
WET
DRY
WET
DRY & HOT
WET(&WARM?)
HOT & DRY
DRYING
COOL & WET
DRYING
COOL & WET
EUROPEAN
SHOSHONEAN
SARATOGA
SPRINGS
GYPSUM
PINTO
LAKE MOJAVE
PLEISTOCENE
?
?
?
?

Figure 3

DIAGNOSTIC ARTIFACTS OF PLEISTOCENE AND LAKE MOJAVE PERIOD

A - G. Characteristic artifacts of Lake Mojave Period

- A-B. Lake Mojave Points
- C. Silver Lake Points
- D. Leaf Shaped Point
- E. Large Stemmed Point
- F. Large Leaf Shaped "Knife"
- G. Leaf Shaped Biface

H - K. Characteristic artifacts of the Pleistocene Period

- H-K. Bifaces (after Glennan 1976)

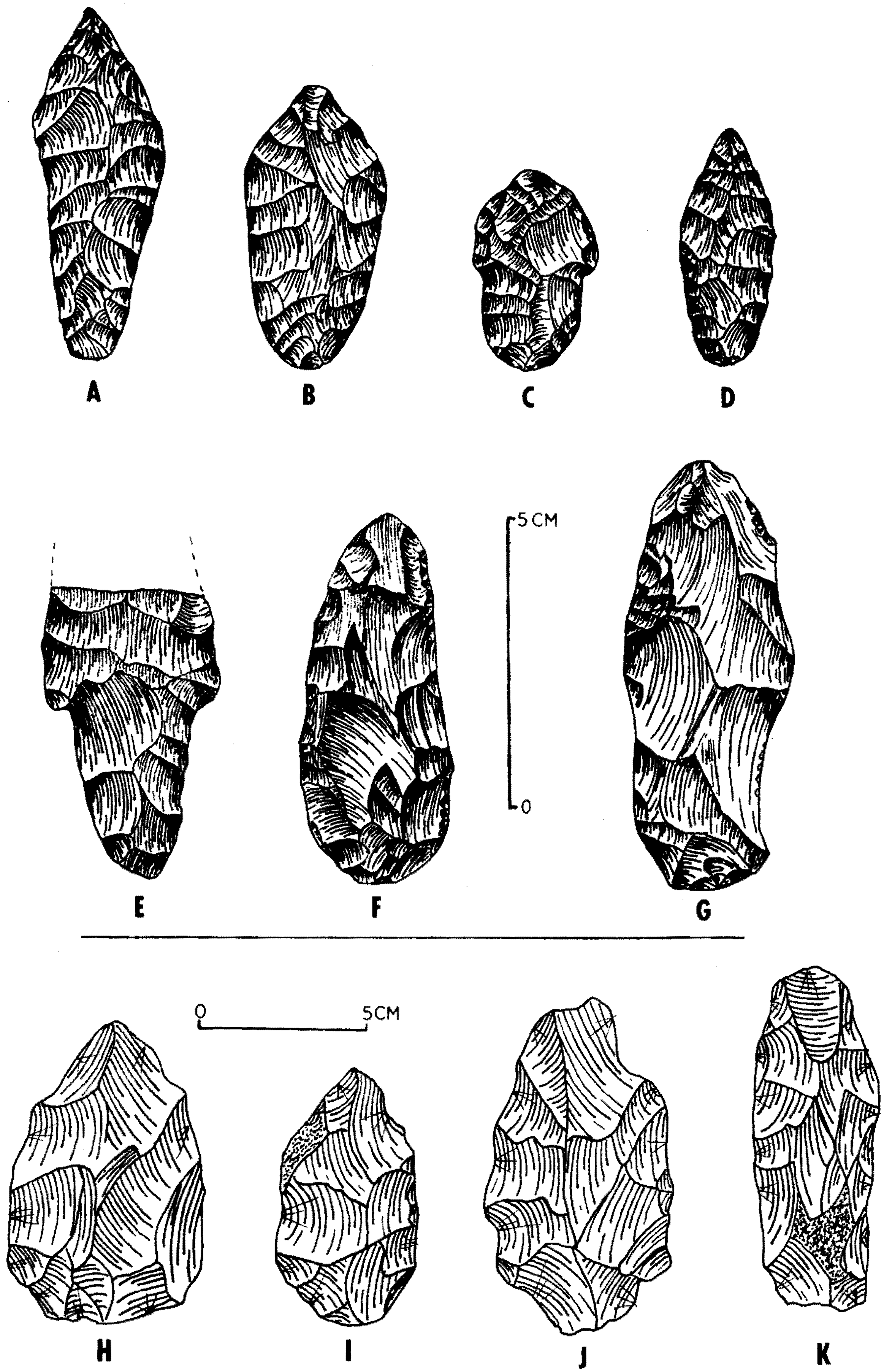

A
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Figure 4

DIAGNOSTIC POINTS OF THE PINTO AND GYPSUM PERIODS

Pinto Period Points A - I

A-E. Shoulderless Pinto Points
(Rogers Type 1 Pinto Points)
F & J. Sloping Shoulder Pinto Points
G. Single Shoulder Pinto Point
H-I. Straight Shoulder Pinto Points

Gypsum Period Points

K-L. Elko Eared Points
M. Gypsum Point
N-R. Humboldt Concave Base Point

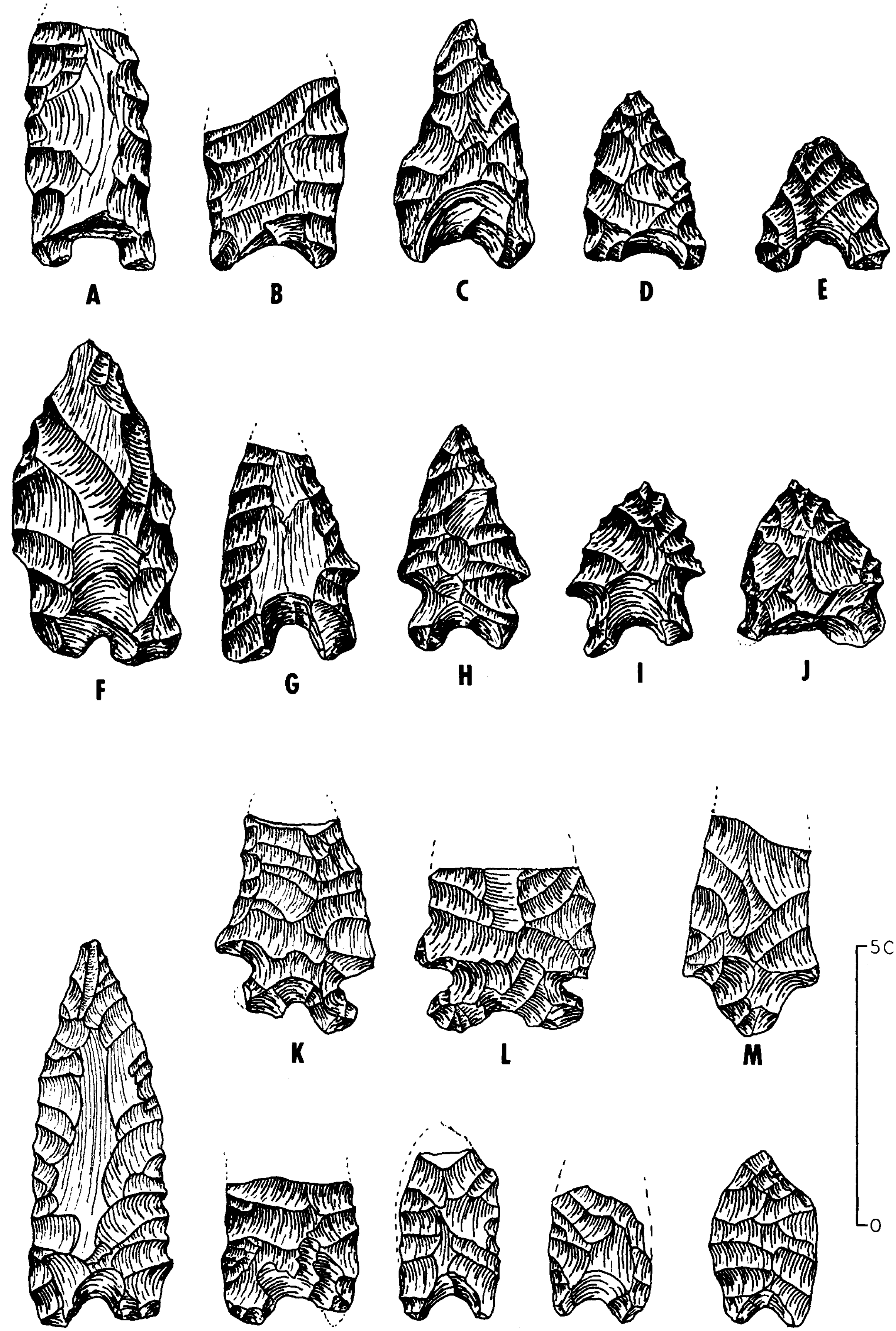
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Figure 5

DIAGNOSTIC POINTS OF THE

SARATOGA SPRINGS AND SHOSHONEAN PERIODS

A. Notched Base Triangular Point
B-G. Desert Side Notched Points
H-J. Cottonwood Triangular Points
K-N. Eastgate Series
O-S. Rose Springs Series

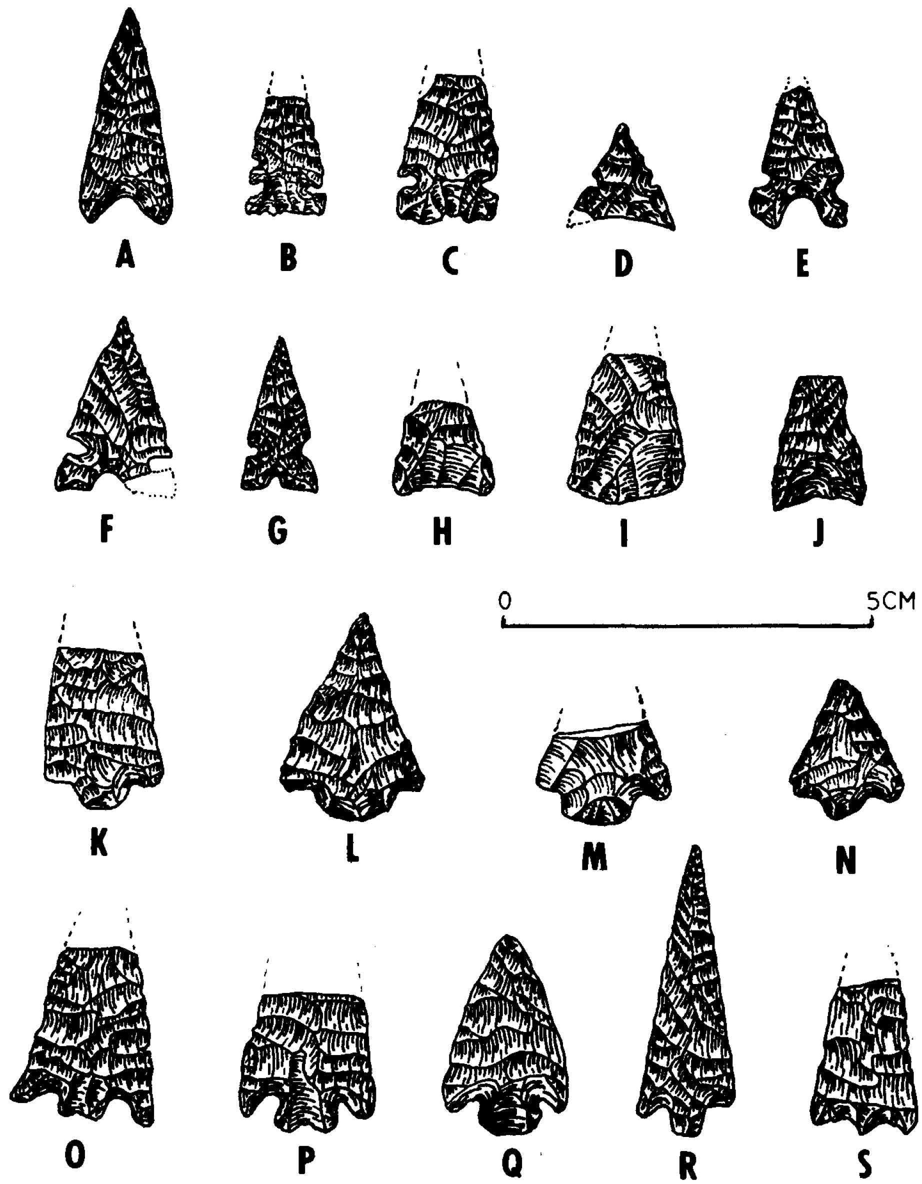
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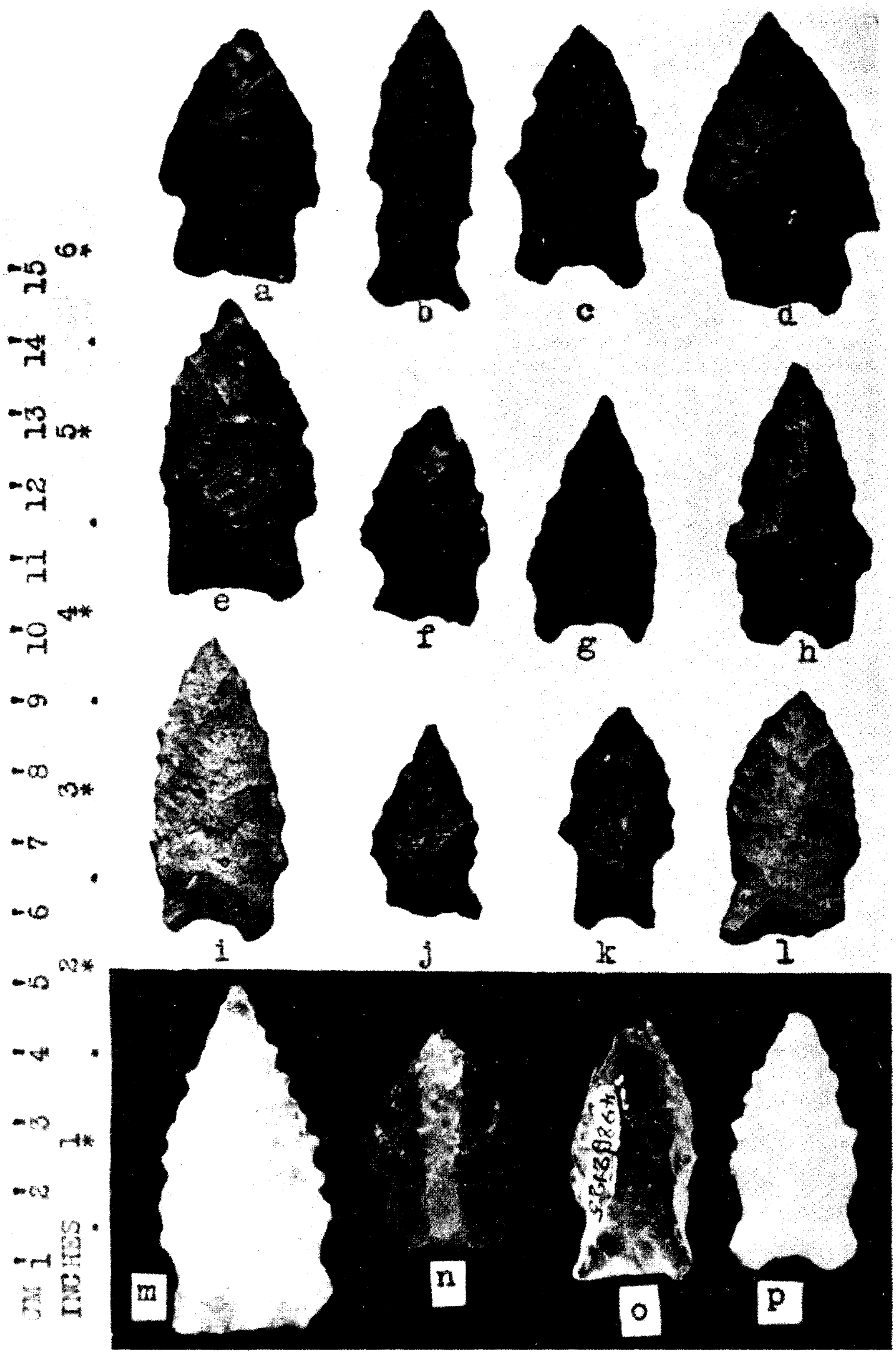
Figure 6

PINTO POINTS FROM PINTO BASIN
(Amsden 1935, Plate 13, p. 47)

Permission to publish photograph granted
by Southwest Museum, Los Angeles



CM 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
INCHES 1 2 3 4 5 6
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Figure 7

PINTO POINT TYPES FROM THE MOJAVE DESERT
(Rogers 1939, Plate 13, p. 55)

a-e	Type 1
f-g	Type 2
k-o	Type 3
p-q	Type 5
m-t	Type 4

Permission to publish photograph granted by San Diego Museum of Man, San Diego

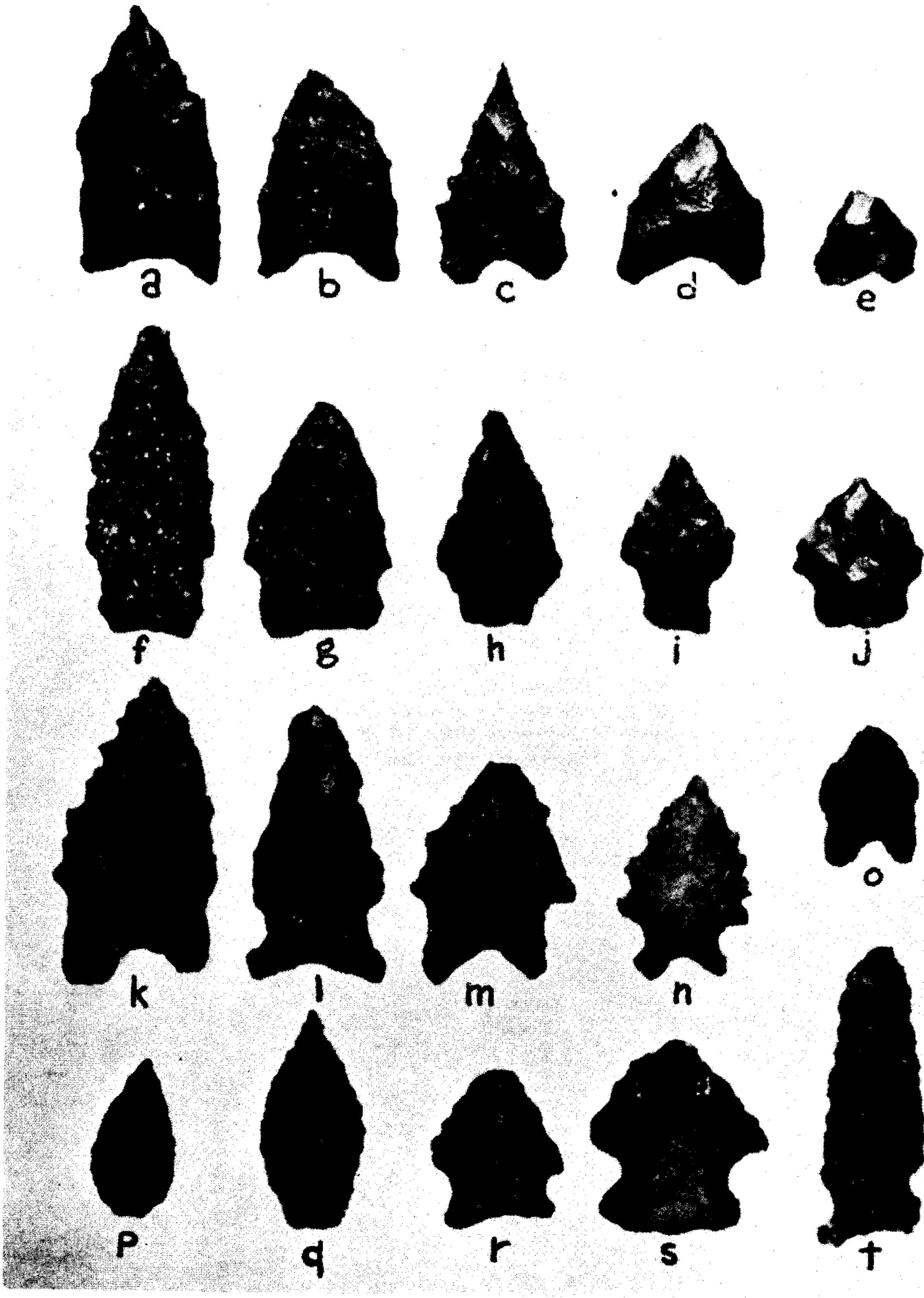
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Figure 8

PINTO POINT SUB-TYPES FROM THE STAHL SITE
(Harrington 1957, Figure 39, p. 50)

A-F	Shoulderless
G-L	Sloping Shoulder
M-R	Square Shoulder
S-X	Barbed Shoulder

Permission to publish photograph granted
by Southwest Museum, Los Angeles

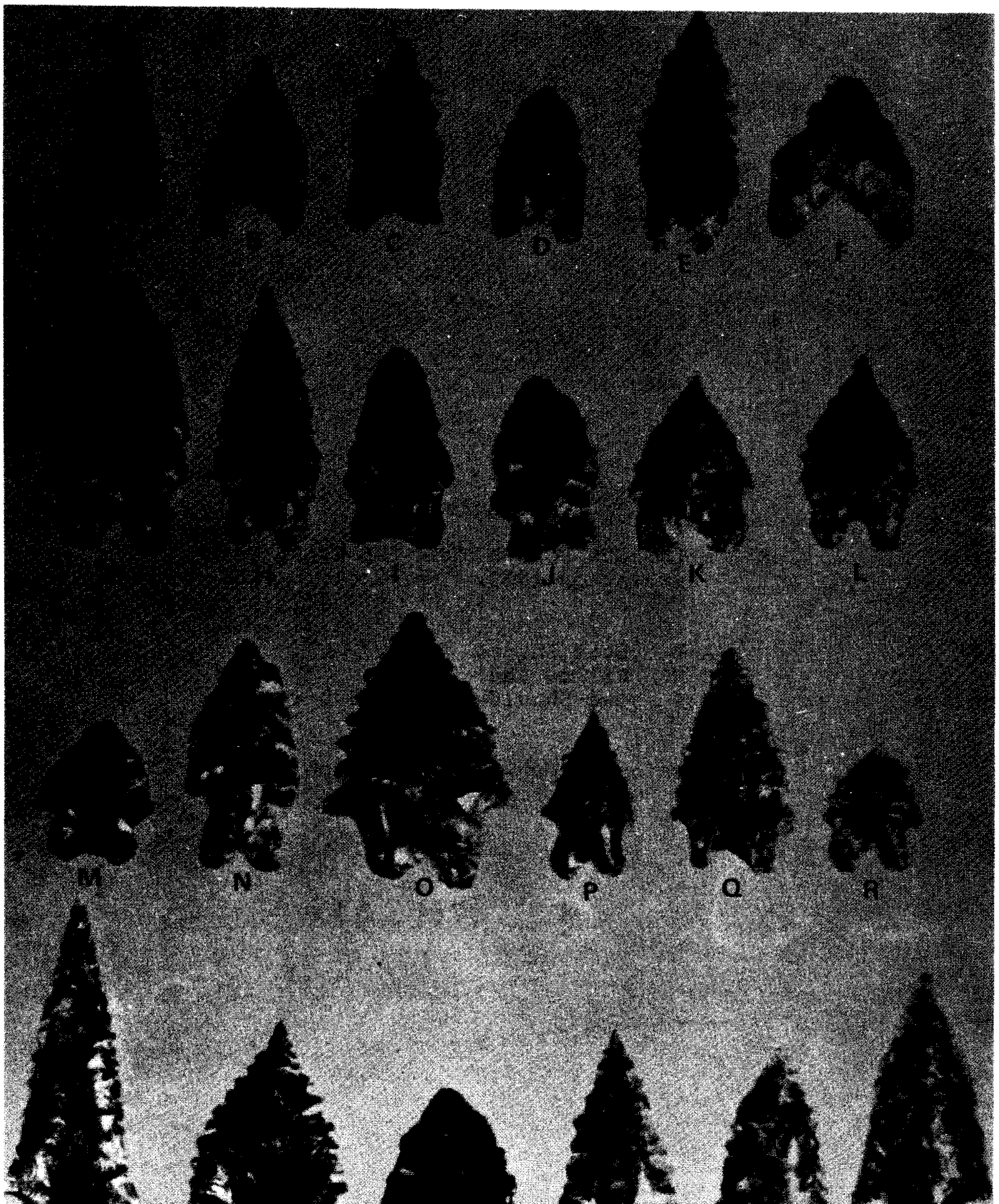

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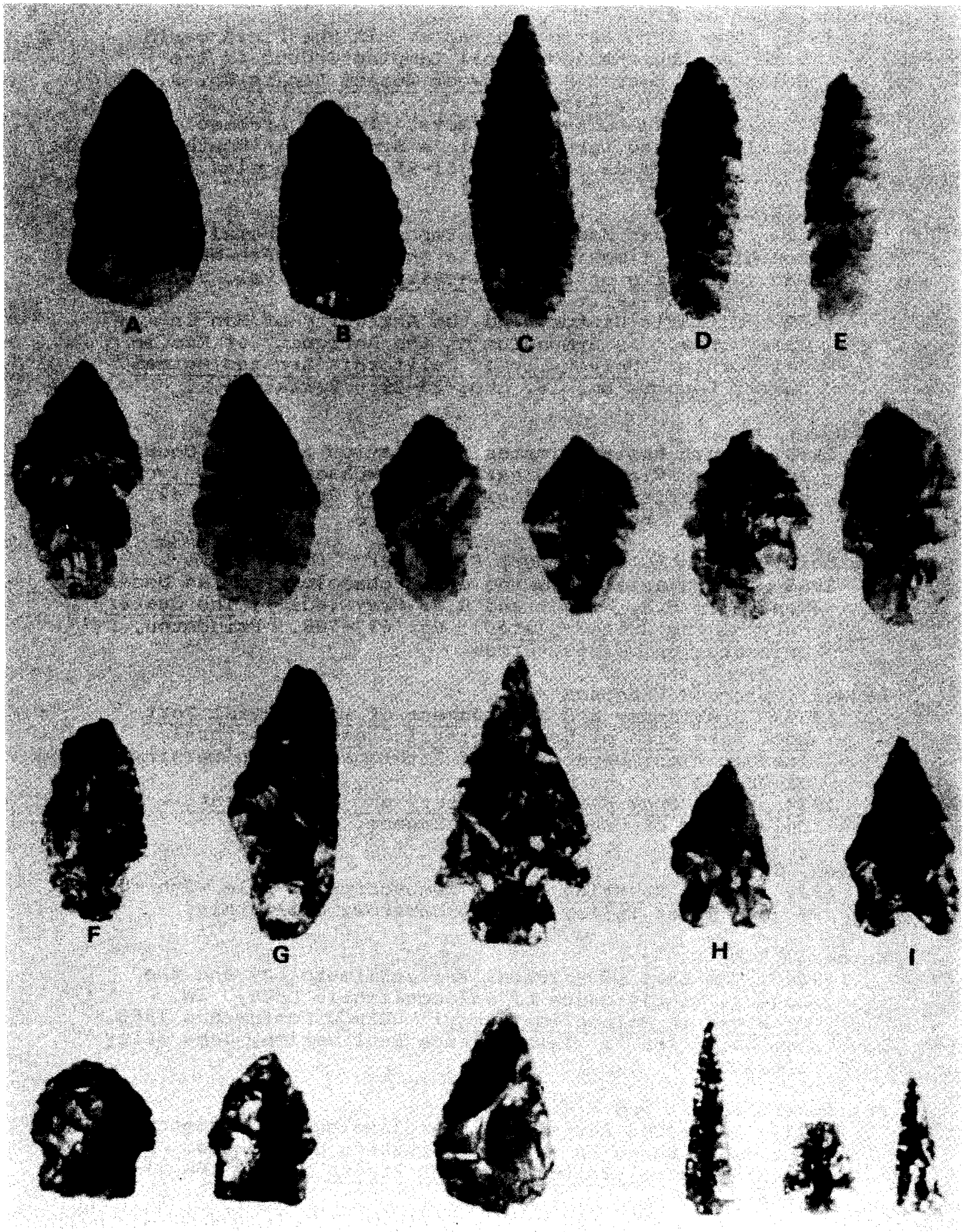
Figure 9

MISCELLANEOUS POINTS FROM THE STAHL SITE
(Harrington 1957, Figure 41, p. 55)

A-B Leaf Shaped
C-E Willow Leaf
F-I One-Shoulder Pinto Sub-Type

Permission to publish photograph granted by Southwest Museum, Los Angeles


A
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E
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I

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PART II: Ethnographic Overview cf the Amargosa-Mojave Basin Planning Units

by

Martha Knack

HALLORAN SPRING PETROGLYPH (NO SCALE)

Introduction

The central Mojave is very little known ethnographically. Reports are few and are very thin. Even the earliest ethnographers found it difficult to locate informants for this region. The one native group reputed to have most used this territory, Vanyume, had apparently always been small and had no living members in the twentieth century (Kroeber 1925:614). However, all the surrounding ethnic groups periodically used the desert, and from information on these groups a picture can be pieced together of what life was like in the central Mojave.

Chapter I: Territorial Occupancy

A number of ethnic groups lived within the designated territory either on a permanent or temporary basis. Some areas were occupied by only one group; other areas were apparently jointly used. Throughout boundaries were vague, a reflection of the prevailing social organization and the pattern of resource utilization.

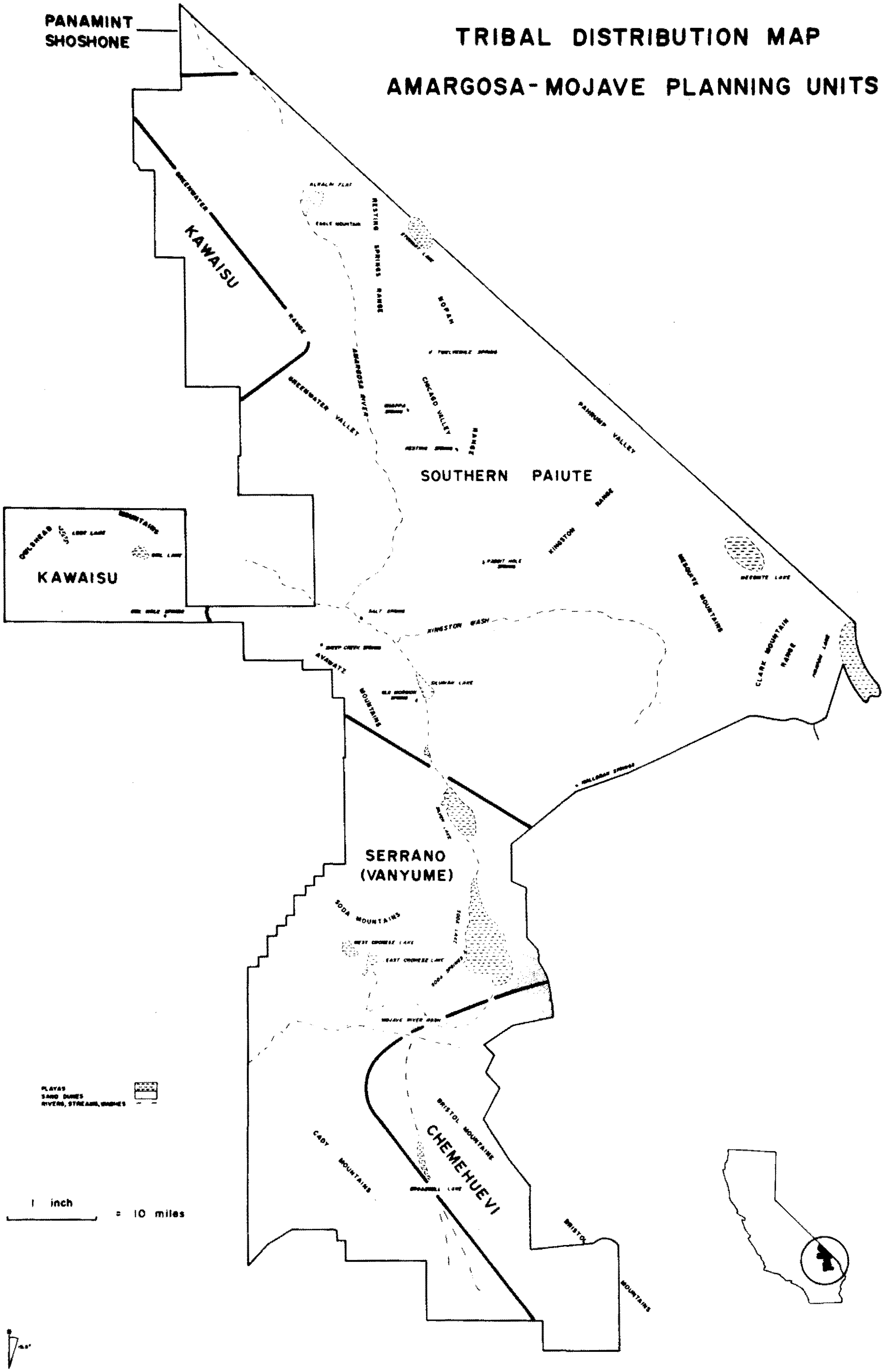
The ethnographically named territorial units were linguistic groups which were not, in toto, politically or socially cohesive entities. These distinct language areas were also internally divided into geographic dialects. All of these languages are members of the widespread Uto-Aztecan stock. Koso, or Panamint, is a member of the Central Numic branch, which also includes the various Shoshoni groups of the Great Basin. Southern Paiute, Chemehuevi and Kawaiisu are in the closely related Southern Numic branch. The remaining group, Vanyume, appears to have been a dialectic subgroup of Serrano, a member of the Southern California branch of Uto-Aztecan now called Takic (Kroeber 1925:574-580; Miller 1966; Fowler 1972:9). On the basis of glottochronology, some linguists believe that the original homeland of many of the Uto-Aztecan language groups living in the Great Basin at the time of white contact was, thousands of years previously, in precisely the study area south of Death Valley (Lamb 1958; Fowler 1972; Swanson 1968).

The distinction between Chemehuevi and Southern Paiute requires comment. Linguistically there is only dialectic difference between them. Speakers of these dialects interacted socially and intermarried. Culturally, those Chemehuevi groups which moved to the Colorado River Valley in the early 19th century (Kroeber 1925:594; Van Valkenburgh 1934) acquired a great number of Mohave tribal characteristics, including agriculture, geographically-oriented myth cycles, and new styles of shamanism. The Desert-dwelling bands residing in the study area retained their basically Great Basin culture and remained indistinguishable on cultural grounds from their Southern Paiute kinsmen. The division of these two groups is a result of the cultural distinctiveness of the riverine bands coupled with the chance historical distribution of anthropological observers.

TRIBAL DISTRIBUTION MAP

AMARGOSA-MOJAVE PLANNING UNITS

TRIBAL DISTRIBUTION MAP
AMARGOSA-MOJAVE PLANNING UNITS



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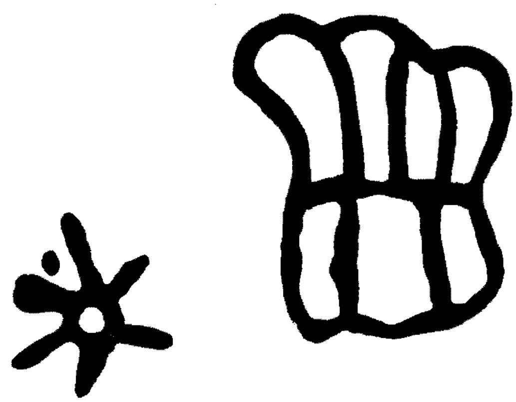


HALLORAN WASH PETROGLYPH (NO SCALE)

Even such a prominent scholar as A. L. Kroeber said, "In fact, the Chemehuevi are nothing but Southern Paiutes" (Kroeber 1925: 593), while in practice he divided the two because, he argued, "At the same time, the appellation is a convenient one to distinguish the Southern Paiute of California from their brethren of Nevada, Arizona, and Utah; and it will be used here in this geographical rather than in any essential ethnic sense" (Kroeber 1925:593). Subsequent workers have sometimes adhered to this modern political division, while others refer only to the native cultural difference between desert and riverine adaptations. Since all the speakers of Southern Paiute-Chemehuevi in the research area were culturally desert dwellers, they will be treated together as a single group and only data referring to desert Chemehuevis will be used.

Each one of the total linguistic entities was subdivided by anthropologists into smaller groups called bands of 25 to 50 individuals. These were autonomous political units. Members of a band usually moved together in search of the naturally growing foods upon which these non-agricultural peoples depended. Each group had a number of sites which it usually frequented. The aggregate of these customary use areas employed by bands of a linguistic group made up the so-called "tribal territory". Kroeber, in speaking of native land use in California generally notes, "Of this total, parts would be used intensively; other portions less intensively, or seasonally, or occasionally. The whole territory, however, formed a unit, some part of which was utilized in one way or another throughout the year" (1974:47). Referring to the study area in particular he said,

> The fact is that this region was habitable only in spots, in cases, if we can so call a spring or a short trickle down a rocky canyon. Between these minute patches in or at the foot of mountains were wide stretches of stony ranges, equally barren valleys, and alkaline flats. All through California it is the inhabited sites that are significant in the life of the Indians, rather than the territories; and boundaries are of least consequence of all. In the unchanging desert this condition applies with ten fold force; but ignorance prevents a distributional description that would be adequate (1925:590)

In drawing the border between Kawaiisu and Chemehuevi in our study area for his standard Handbook map, he said, "There is so little exact knowledge of ethnic relations that the map has had to be made almost at random (Kroeber 1925:590). The scattering of Indians native to this area and the death of those few old people who had ever lived on the desert here has meant that research since Kroeber's time has not been able to fill those gaps in knowledge which he bemoaned. The description which follows, while not quite random, of necessity leaves many unanswered questions, for the data is scanty at best.

Possession of the sites Kroeber referred to as intensively occupied are clear. For these and other concentrated areas the strictly localized nature of the productive niches is clear, but they are separated by far larger areas of much less regular economic utilization. It is the regions of light, but sometimes critically important, seasonal use which are debated. Julian Steward stated, "It is impossible to trace a boundary with any precision in an area like this" (1938:92). However, by analyzing the core use areas, we can roughly divide the intervening desert.

The Chemehuevi definitely occupied the Providence and New York Mountains to the east of the study area (Kroeber 1925:594, Laird 1976:7-9, 119-145). Kroeber hypothesized, "Somewhere along the middle of the southern half of this desert (Mojave) an ill-defined line must have run between the Chemehuevi and the Serrano divisions farther west" (1925:594). On the basis of the linguistic similarity of Kawaiisu with Chemehuevi he argued, "In the absence of knowledge the inherent probability would favor continuity of the territory of the two allied groups" (Idim). This line of reasoning led to an extension of their territory north of the Vanyume west to the foot of the Tehachapi Ranges through the central portion of the study area. It is this section which is most disputed, and exclusive Chemehuevi claim to this territory is no longer tenable. When the Chemehuevis filed claim against the federal government in 1950 for lands unjustly taken from them, extensive evidence was presented and debated. Their territorial claim was adjusted and accepted by both the tribal and federal governments before an out of court settlement of evaluation was reached (14 Ind. Cl. Comm. 651, Docket 351 & 351-A, 18 January 1965). This adjusted settlement, accepted by the tribe, recognized Chemehuevi claim to only the eastern half of the central Mojave. That territory, based on a specialized, exhaustive search of all available information I have used on the accompanying map. The same boundary was accepted under independent testimony in the Mohave tribe's case (7 Ind. Cl. Comm. 219, Docket 295, 19 March 1959).

The rather artificial division of Chemehuevis from Southern Paiutes, initiated by protohistoric population movements toward the river and perpetuated by separate reservation histories, ethnological researches, and separate Indian claims and case filings, is shown here as a weak internal boundary. Most authorities accept this approximate location. However, Laird claims that Chemehuevis "ranged freely to the Tehachapi Mountains, were "familiar" with the San Bernardino hunting trails, and had specific place names in their own language throughout Death Valley, and as far north as Mount Whitney, and that therefore their territory included all these places" (Laird 1976:7). This is based on fragmentary travel stories from the historical period, perhaps memorable specifically for their rarity. Her assertion that all of the Panamint Range was sacred for Chemehuevis and believed to be the source of shamanistic powers (Laird 1976:7, 87, 122, 134, 147) would imply that it was not the site of mundane regular food gathering expeditions. Her actual data show that individual parties did travel to these areas (Laird 1976:28), which does not contradict the boundary I have drawn for the customary use areas. In the case of all these ethnic groups, extraordinary expeditions undoubtedly did travel for trade goods, to flee drought and on other occasions, but this does not constitute occupation in the usual sense (Kroeber 1974). It is an outstanding characteristic of these tribal use areas that they were not exclusive, defended territories. Access was open, subject to certain customs and a few traditional amenities.

The Southern Paiutes had major population clusters in the Kingston Mountains and in the lower Amargosa Valley (Kroeber 1925:594-595). The population at Ash Meadows, on the Shoshone-Southern Paiute border, was a mixed population which occasionally visited the Black Mountains (Steward 1938:92; Steward 1941:212). The crest of the Black Mountains is generally accepted as dividing the Southern Paiutes to the east from the populations of Death Valley (Kelly 1934; Steward 1937:626). Shoshonis claimed the Funeral Range (Steward 1938:ix). Neither of these last two mountain ranges was much utilized (Steward 1938:92).

There is considerable anthropological argument over the southern half of Death Valley. While actually outside the study area, this argument is of importance to us. There is no direct mention in the literature of who possessed the Owlshead and Quail ranges or the dry lakes south of them. Whichever groups were in southern Death Valley were undoubtedly the users of the western slopes of the Black Mountains, as well as the adjoining Owlshead and Quail ranges to the south, which are in the study area. One candidate, the Kawaiisu, were culturally a mountain-dwelling people centered in the Tehachapi Mountains south of Kern River. However, they did utilize some desert resources, moving out some distance onto the Mojave. One of their major ethnographer's reports, "The desert was conceived of as an area for occasional excursions, never of permanent residence... Just how far Kawaiisu territory stretched eastward into the desert is impossible to say" (Zigmond 1939:635). A Kawaiisu informant told Kroeber that they held the central desert south as far as Victorville and east to the southern half of the Panamint Range (Kroeber 1925:602). Driver repeats this, but has evidence of only one desert band and one headman, and feels he must hypothesize more to account for the vast territory involved (Driver 1937:58). Steward makes the claim more strongly, stating that Panamint Valley south of Ballarat was Kawaiisu territory (1938:84), along the southern Panamint Range and Death Valley below Furnace Creek (1938:92). However, these places were only seasonally inhabitable. The largest springs in Panamint Valley are in the north, at Warm Springs, and at Wildrose, both clearly in Koso territory (Steward 1938:84; Davis 1860 in Casebier 1972a:41). All agree the Koso held southern Owens Lake, Koso Hot Springs, Little Lake, Olancha and northern Death Valley (Steward 1938:74, Zigmond 1939:638; Driver 1937:58), but Kroeber calls Koso one of the least defined territories in California (Kroeber 1925:589). Furnace Creek was also a Shoshone site, whose inhabitants ranged into the Grapevine and other northern ranges and west to the Panamint Mountains around Telescope Peak (Steward 1938:86-92; Kirk 1960: 4). Steward asserts that the area south of Furnace Creek was occupied by Kawaiisu (1938:92), but in evidence offers only the presence of three families who spoke that language, as well as Shoshoni. These camped at a site later called Shoshoni (Kirk 1953). In short, Driver and Steward's argument for exclusive Kawaiisu occupancy of southern Death Valley, and hence the ranges south and west toward the Tehachapi homeland is very weak. On the other hand, Zigmond flatly denies any Kawaiisu territorial claim east of Indian Wells Valley and Red Mountain (Zigmond 1939:637). He argues that because of their probable Great Basin origins and the lack of favorite pine nuts in the California mountains, Kawaiisus might have been willing to trek across the salt flats for this. This argument seems forced. If seasonal use is claimed, particularly for pine nut gathering in the fall, it is possible to accept, but proof of permanent residence and occupancy is lacking. All ethnographers attest to the intermarriage of Kawaiisus with Shoshonis or Paiutes at least after 1860, as many of the informants have mixed parentage proving that there was some social contact (Driver 1937:58; Kroeber 1925:602; Steward 1941:212). By 1941 even Steward had modified his position saying, "Southern Death Valley was <u>probably</u> inhabited by Southern Paiute and <u>possibly</u> some Kawaiisu" (Steward 1941:212; emphasis added).

The most reasonable resolution of the literature would be that, to the extent that it was used at all, the westward reaching arm of the study area, which embraces the Owlshead Range, was a joint use area. There is no ethnographic record of permanent camps in this area. Kawaiisus may have crossed it going east to the lower Amargosa Valley and on toward Furnace Creek. Kosos of Death Valley and the Panamint Range could have travelled south just as well. In all likelihood, the region was lightly and seasonally utilized at best. Regardless of the ethnic group involved, the resources used and the relationship of humans to the land would have been the same.

The Vanyume were the desert-dwelling branch of the Serrano, and resided on the lower Mojave River and its sinks. From there they ranged into the surrounding hills (Bean and Smith 1978:570; Kroeber 1925:614; Beals 1974:30). The population was very small and had disappeared well before the beginning of the twentieth century (Kroeber 1925:614; Strong 1929:5; Bean and Smith 1978:570). The Mohave trade trail passed through their territory following the river drainage. Interestingly, these desert-dwelling Vanyume had friendly relations with both the Chemehuevis and Mohaves, while the culturally distinct mountain-dwelling Serrano did not. It seems that the similarity of cultural adaptation to the desert environment overcame linguistic and political divisions, creating a uniformity of lifestyles and opportunity for peaceful social interaction among all the tribal groups on the desert floor.

Chapter II: Subsistence

In the desert West, flora and fauna have certain characteristics which influence the ability of human populations to use them for food. Plants, in particular, are affected by the water supply. Much of the rainfall comes as prolonged winter storms, useless for plant growth as it occurs during the dormant period. The remainder of the precipitation comes in mid-summer's roaring thunderstorms of brief duration and limited extent. In these, the water falls so fast that the sunbaked earth cannot absorb it and a great deal is quickly lost into arroyos and dry washes. These two rainfall patterns dictate that either plants must be perennial, able to endure prolonged drought, or be annuals able to utilize very quickly any water temporarily available. In either case, plant growth tends to be sparse. Since the tracks of summer storms in any one year are unpredictable, plant growth also will be unreliable. If rain comes to a given hillside at the right time, plants will produce lavishly. This does not mean that other plants with different growth cycles need be lush in that area later, nor that the first plant need be fruitful elsewhere in the region. This unpredictability of plant growth means that if human populations were to utilize flora successfully as food, their economic system had to be, first of all, mobile. The people had to move to those locations where a given plant was producing that year. Also, they had to get there before animal species which utilize that same plant would have eaten up the entire supply. Secondly, in case of failure of a given plant all together, the human economy had to be flexible enough to switch to other species. Because of this plant growth pattern in the area, no one location produced enough food at any one time to support a very large population. Therefore, the social group practicing this mobile economy had to be correspondingly small. Indeed, the native population in the central Mojave moved frequently and in small groups to utilize a broad variety of plants for food. By means of this kind of adaptation, plants became a dependable human resource.

Animal species also were used as food. Animal distributions depend on the availability of those plants they themselves use for food. However, most of the species on the desert are quite small and their populations fluctuate widely. With the technology available to the desert natives, hunting was only sporadically successful. Meat was in short supply, therefore an unreliable food base. It probably constituted only a small percentage of the diet, but an important percentage, providing protein otherwise quite scant in the vegetable bulk.

In the central Mojave specifically, the dominant plant species was notoriously non-edible. Creosote bush (*Larrea tridentata*) was only a medicinal herb and bursage (*Ambrosia dumosa*) was not used at all. The indicator plant for the Mojave Desert, the Joshua tree (*Yucca brevifolia*) was useful, but it grew only on the higher alluvial fans and yielded edible parts during only a portion of the year. Sticky ring (Boerhaavia annulata),false clover (Oxystylis lutea), viguiera (Viguiera reticulata), and sunray (Enceliopsis covillei) apparently were not useful food resources. By all accounts, the staple foods for the native groups in this region were pinon nuts (Pinus monophylla), Indian ricegrass (Oryzopsis hymenoides), mesquite (Prosopis juliflora glandulosa), and screwbean (Prosopis pubescens). Of these, only the latter two grew on the valley floors, and then only if the water table were within 50 feet of the surface. Pinon trees grew only in a few mountain ranges--Clark, Kingston and Avawatz--and in the Panamint, San Bernardino, Tehachapi, which ring the area. Rice grass flourished on alluvial fans and rocky slopes of the higher elevations. It seems that mesquite and ricegrass were the primary quarry of people entering the central Mojave, with other plants, particularly spring blooming annuals and early cactus, being gathered as they were found in small amounts along the way.

Mesquite, the staple food source, grew on the alluvial fans and in canyon bottoms, with screwbean in moister areas. They produced similar foods. People picked the blossoms that came out in June, roasted them in pits, and squeezed the resulting mass into balls for sundrying. The more valuable food, however, was the bean pods which ripened in July and August. Mesquite pods themselves are sweet, containing up to 30% sugar content (Bell and Castetter 1937:6). Pods and beans ground to flour contain 8% crude protein, 54% carbohydrate, and over 2% fat (Bean 1972:39). In favorable years, a single tree could produce large quantities. When a rich grove matured, the entire group descended upon it. Men knocked beans down with poles; children retrieved them from beneath spiny bushes; and women collected them in large conical carrying baskets. The sweet mesquite pods were eaten fresh. Beans were pounded in a mortar and pestle and the powder mixed with water for a nutritious drink. Surplus beans were sun dried. They were then either stored whole to be eaten as snacks, or pounded to flour. The flour was molded into cakes with a bit of water and then sun dried. This process resulted in portable, compact, and spoilage-resistant packages to be cached for future use. Pieces of these cakes would be broken off as needed and nibbled dry, mixed with water to boil as gruel, or kneaded into a dough and baked (Bean 1972:38-39; Bell and Castetter 1937; Casebier 1972a:23; Coues 1900:237; Fremont 1845:260; Kirk 1960:5).

Chemehuevis ground mesquite beans with their regular manos and metates. They cached the flour in baskets in dry caves and other sites. Kawaiisu and Serrano relied far more heavily on mesquite than the other groups, and they had developed a special technology for it. They sunk sections of cottonwood, or mesquite logs, with deep longitudinal depressions right into the ground as permanent milling stations. This kept the large mesquite beans from bouncing out as they were pounded with long cylindrical stone pestles. People stored the whole beans in specially made granaries, loosely woven like bird's nests. These were often four to six feet in diameter and two or three feet deep, set well off the ground on a square platform. Protected by a brush roof, these granaries kept seeds free of rodents and moisture for up to a year (Drucker 1937: 10; Bean 1972:38-39).

Another staple, pinon, occurred primarily in the higher mountains. Groups using the central Mojave flatlands traveled to these ranges for the erratically produced cones. In order to collect them before competing squirrels and chipmunks could commandeer the supply, bands flocked to the pine groves in August or September when the nuts were ripe, but the cones not yet open. Using hooked poles to snap off the cones, or climbing into the trees to shake branches, men and boys helped harvest. Women packed the cones in large baskets for transport to the camp. There the cones were pit roasted to encourage exfoliation and to burn off the sealing pitch. Then people used sticks to jolt nuts from the cones, picking out remaining reluctant ones with their fingers (Dutcher 1893). They then either stored the nuts at this stage (Bean 1972:40), or processed them further. Women roasted the nuts lightly by mixing them with hot coals and deftly tossing them together on basketry trays. They easily cracked the now brittle shells on a metate, rolling gently with a hand-held mano. The resultant mixture of cracked shells and whole nutmeats they placed back on the tray and tossed again, this time letting the wind blow away the shells. They then added coals for a final toasting before grinding the clean cooked nutmeats to flour on the metate. They stored this flour in baskets or, in areas with pottery, large crocks. Pinon meal is very nutritious, having 61% fat, 26% carbohydrate and 6.5% protein. It was mixed with water for soup, with or without meat, or baked into bread (Bean 1972:39).

The various species of yucca which grew primarily on well drained alluvial fans at higher elevations contributed a variety of useful foods. The buds of the Joshua trees (*Yucca brevifolia*) were ripe in April. Kosos roasted these in open fires, while Cahuillas parboiled them (Kroeber 1925:592; Bean 1972:42). Mohave yucca (*Yucca schidigera*) is almost entirely edible and all the tribes in the region utilized it. They prepared buds as with the Joshua trees. In summer months, women dug up the entire Mohave yucca and lopped off the leaves. From these they extracted fiber for basketry and saved the points for awls and pins. They took the stalks, roots, and leafless heart of the plant and placed them in heated earth ovens. Covered with grass and earth, and with fires built above, the plant parts were roasted for several days until reduced to a sweet fibrous mass. The women then laid this mass out in cakes to sun dry. In this form, it preserved well and provided a sweet, nutritious food. Virtually any yucca (*Yucca whipplei*, *Yucca bacatta*, *Nolina parryi*) could be prepared this way. In addition, the seed pods of the banana yucca (*Y. bacatta*, *palmita*) were edible as fleshy fruits or allowed to dry. Then they were cracked open and the rows of flat seeds poured out, sun dried, and ground to flour. Agave (Agave deserti) was utilized in the same ways; blossoms, fiber, flesh and seeds each used in season (Bean 1972:41-43; Kroeber 1925:597; Driver 1937:64; Coville 1892:356).

In addition to the major staples of mesquite, pinon, and yuccas, Indians who frequented the central Mojave utilized a broad variety of other plant species. The gathering process was unspecialized. As women searched a rich agave patch, they would collect a stem or cactus or a small lizard beneath the bushes. If gathering rice grass seed on a hillside, they would also strike with their digging stick a kangaroo mouse gathering that same grass seed. The less abundant food resources provided variety and a nutritional balance. When none of the staples were in season, these minor resources provided emergency rations until the next major crop came in. While information on these less important food resources is spotty, the following species have been reported for one or more of the tribes in the area. It seems likely that these same plants would have been utilized wherever they were found on the Mojave or its fringes.

In the lower desert regions and valley floors, the offerings were scanty. Some cacti provided edible sections, especially in the spring when new growth was most tender and succulent. Kosos and Cahuillas ate beavertail (Opuntia basilaris) sections. They either baked the joints in an open fire or a covered pit, or they sun dried them for later boiling. They rubbed the thorns off by rolling the pods in grass or sand (Coville 1892: 354; Bean 1972:40). Chemehuevis and Cahuillas boiled the new growth of jumping and buckhorn cholla (Opuntia bigelovii and O. acanthocarpa)(Laird 1976:109; Bean 1972:40). Prickly pear (Opuntia mohavensis and O. littoralis, O. megacantha and O. sp.) provided leaves cooked the same way (Bean 1972:40). Devil's pincushion (Echinocactus polycephalus) yielded seeds which, when sun dried, stored well and made a fine flour (Coville 1892:352; Bean 1972:40). At higher elevations Serrano and Cahuilla gatherers found barrel cactus (Echinocactus acanthodes), whose juicy buds they harvested in the spring. Leaves, flowers, buds and seeds of other unreported cactus species also were undoubtedly used.

In addition to cacti, the lower valleys offer a few other plant resources. Various crucifers (Stanleya elata, S. pinnata, Caulanthus crassicaulis) grow in moister areas. Kosos ate the shoots, leaves and stems by first boiling them, cold rinsing and then squeezing them dry. This processing removed the bitter taste and prevented diarrhea (Coville 1892:354). Desert thorn (Lycium andersonii) grew widely. Kosos and Cahuillas ate the berries fresh or sun dried them to be put in stews later (Coville 1892:359; Bean 1972:44). Wild tobacco (Nicotiana trigonophylla) occurred in dry washes late in summer. The leaves were smoked for both domestic and ritual purposes, or chewed with ground lime (Driver 1937:84, 125; Drucker 1937:25).

Peppergrass (Lepidium flavum) was eaten green and the seeds ground for flour (Bean 1972:46). All tribes except Kawaiisu are reported to have eaten chia (Salvia columbariae). These highly nutritious seeds were chewed whole, or ground to flour. Added to alkaline water, chia precipitates some of the salts and makes it more palatable (Bean 1972:47). Blazing star (Mentzelia albicaulis and M. reflexa) seeds also provided flour for breads and gruel (Steward 1938:88; Bean 1972:46). The more completely known Cahuilla ethnobotany included the following lowland food plants which were probably also known and used elsewhere on the central Mojave: seeds from palo verde (Cercidium floridum), desert willow (Chilopsis linearis), ironwood (Olneya tesota), pigweed (Amaranthus palmeri), milkweeds (fam. Asclepiadaceae), quailbrush (Atriplex lentiformis), goldfields (Baeria platycarpha), pincushions (Chaenactis carphoclinia and C. xantiana), buckwheats (Eriogonum sp.), tarweed (Hemizonia fasciculata), tidy tips (Layia glandulosa), desert dandelion (Malacothrix californica), tansy mustard (Descurania pinnata), and sea blight(Suaeda torreyana ramosissima) (Bean 1972:46-47; Jaeger 1940, Crampton 1974). Most such seeds were parched in basketry trays before being ground into flour. The milkweeds, buckwheat, tarweed, peppergrass, pigweed, tansy mustard, sea blight and California cloves (Trifolium gracilentum) also were eaten as greens when young and tender (Bean 1972:46; Kroeber 1925:592). Desert onion (Allium fimbriatum) and desert lily (Hesperocallis undulata) were dug for their tuberous roots (Bean 1972:42).

Marshy areas, as along the Mojave river, provided other specialized food sources. Koso women pounded reeds (Phragmites vulgaris) in early June; they then baked the flour in loaves (Coville 1892:355). Vanyumes, Serranos and Cahuillas ate tule (Scirpus sp.) roots early in the spring and later ate the seeds (Kroeber 1925:615; Bean 1972:47, 45; Coues 1900:237). Cahuillas gathered cattail (Typha latifolia) and panic grass (Panicum sp.) seeds. They also dug tubers of arrowweed (Saggitaria latifolia) and cattails.

At higher elevations and in the mountain ranges of the central Mojave, a different biota was available. The most important food here was Indian rice, or sand bunch grass (Oryzopsis hymenoides). Kosos, Chemehuevis, and Serranos are reported to have used it extensively as an early summer staple (Coville 1892:353; Steward 1938:84, 88; Laird 1976:109; Casebier 1972a:24, 37; Driver 1937:9). Gathered in April, they winnowed, parched and ground it similarly to other seeds. They made the flour into dough for breads or thinned to gruel for boiling. Mormon tea or joint pine (Ephedra nevadensis seeds also were gathered, as seeds of several of the evening primroses (Oenothera brevipes and Oenothera sp.) which grew at still higher altitudes (Coville 1892:353; Bean 1972:46). Mormon tea stems were brewed into a beverage, as were parts of wild rose (Bean 1972:47). Small quantities of the seeds from golden yarrow (Eriophyllum confertiflorum), goosefoot (Chenopodium fremontii), devil's claw (Martynia althaeifolia), locoweeds (Astragalus sp.) and goat nut (Simmondsia californica) were used seasonally. Both seeds and efflorescences of sagebrush (Artemisia tridentata) were eaten by Chemehuevis and Cahuillas as emergency foods (Laird 1976:107; Bean 1972:46). At least Cahuillas dug for Mariposa lily bulbs (Calochortus kennedyi) (Bean 1972:45). In small areas of the very highest mountains were highly valued berry patches. Indians ate the fruits raw or sun dried them to be used later as a rare, but prized, condiment. Among these were squawberry (Rhus trilobata), serviceberry (Amelanchier alnifolia), (Rhamnus crocea) and probably others (Laird 1976:108; Bean 1972:44). In extremely well favored pockets of canyons, and along the Mojave River, a few wild grapes (Vitis arizonica) grew. All of the Indian groups of the areas sought these out (Steward 1938:88; Laird 1976:107; Kroeber 1925:615; Coues 1900:237).

The overall pattern of plant food utilization in the central Mojave appears to have been based upon extensive exploitation of mesquite as a staple crop, a rich abundant and dependable food in early summer. Rice grass seed gave support in the spring months. Staple foods for the remainder of the year came from ecological zones bordering the area, primarily pinon nuts in the fall. Yucca fruits and vegetable cores were the other major desert resource. However, in addition to these primary plants, a wide variety of minor ones, often short-lived annuals, or ones with very limited productive seasons, were used. The great variety of available species and the numerous means of preparation assured that something edible, if not delectable, would be available throughout the year. This eclectic and flexible vegetable diet was an absolute necessity if these people were to survive in this region with their level of technology.

To a great degree the raw materials for that technology also came from the native flora. The mainstay of the technology was basketry. Light weight, sturdy, and easily manufactured, baskets were used for gathering, processing and storing foods. Techniques for basket manufacture varied. The primary construction material was willow (Salix lasiandra) found in moist places and washes. Women gathered the willows in the fall and dried them until they should have time for the laborious preparation and weaving processes (Wheat 1967:91-96; Coville 1892:359; Kroeber 1925:591; Laird 1976:106; Drucker 1937:20; Driver 1937:78). While willow constituted the major material for basketry, a wide variety of other plants from several ecological zones contributed additional fibers. Deer, or bunch grass (Muhlenbergia epicampes rigens), not only produced edible seeds in the late summer, but a long, whip-like panicle for the core of coiled baskets, especially caps (Coville 1892: 358; Driver 1937:78; Drucker 1937:20). Also from the mountains came devil's claw (Proboscidae althaeifolia). The long curving pods were peeled of their black fiber for weaving patterns in both coiled and twined basketry (Kirk 1952:78; Van Valkenburgh 1934:16). Shoots of the mountain squawbush (Rhus trilobata) provided Kosos with the warp and woof for a coarse twined basketry (Coville 1892:358; Kirk 1952:78) and the Serranos with design fiber once died black (Benedict 1924:387). Chemehuevis used split mulberry (Morus microphylla) twigs for a light colored coiled ware (Bartlett 1938:23). From the high alluvial fans, all the groups gathered Joshua tree roots whose peeled inner bark yielded a decorative red fiber (Coville 1892:355; Drucker 1937:21; Driver 1937:78; Laird 1976:108). The marshes, too, provided basketry materials. Tule roots, if gathered in winter and soaked in an ashy solution, gave a black fiber for patterns. Basal stems of rush, also collected in winter, gave a light brown pattern (Kirk 1952:78; Laird 1976:108; Benedict 1924:385, 387). The rush and tule stems themselves could be twined into mats for sleeping (Driver 1937:78; Drucker 1937:21). Thorns of the cotton top cactus growing on the valley floors were hafted to a cottonwood block with creosote resin to make a punching awl for coiled basketry manufacture (Kirk 1952:83-84).

The long tough fibers of the desert were not only made into baskets, but also into cordage for a wide variety of tasks. String for tying loads, making snares and bowstrings, knotting rabbit nets, weaving rabbitskin robes and a thousand other uses was manufactured in quantity. The long fibers were extracted by drying, pounding and separating. Then they were rolled on the thigh in double or triple ply of varying thicknesses depending on the desired use. Leaves of all the yuccas, wild hemp (Apocynum cannabinum), milkweed (Asclepias sp.) and agave, were the main fiber sources for such tasks (Coville 1892:355, 361; Driver 1937:78, 79; Laird 1976:108; Drucker 1937:21; Benedict 1924:388, 389; Coues 1900:237).

In a dry desert region such as this, wood was a relatively scarce commodity, and as a result, the inhabitants utilized a wide variety of sources. Primary usage was for weapons and houses. Bows were made of juniper (Juniperus osteosperma) wood from the high mountains (Coville 1892:359) and were often sinew backed (Drucker 1937:20; Driver 1937:71). If arrows were to be of simple construction, they were most often made of willow. Two or three feathered split quill from any large bird were either glued on with resin or tied with sinew. Often the willow was simply carved to a point and hardened in a fire, but occasionally stone points, chipped of obsidian or other rock was tied in place (Coville 1892:359; Driver 1937:78; Drucker 1937:20, Laird 1976:106). Compound arrows were also made in which the main section was of lightweight reed (Phragmites vulgaris) or carrizo (Kroeber 1925:591; Laird 1976:107; Driver 1937:71). A heavier hardwood foreshaft of sagebrush (Atriplex tridentata) was set into the reed (Coville 1892:359) for balance and to serve as a point. Women's digging sticks were of juniper, mesquite, or fire hardened cottonwood.

Wood also provided construction materials for housing. Cottonwood (Populus fremontii) gave corner poles for the ramadas of the Chemehuevis and lodges of Serranos (Laird 1976:106; Drucker 1937:12). These later were covered with tule or arrowweed mats, while Chemehuevis used lighter sage branches. Circular domed willow frames covered with mats, or brush and mud, were common to all groups.

Plants provided materials for a variety of other uses as well. For instance, Chemehuevis made a four-holed flute of tule (Laird 1976:108). All groups used yucca root, peeled and pounded, as a soap.

Compared with plants, animals provided little food and were relatively unreliable. All of the Indian groups highly valued mountain sheep, deer and antelope, but such big game was rare (Laird 1976:112; Steward 1938:92; Interview 1 and 2). These animals produced not only great quantities of meat, but also such valuable products as large hides for clothing, sinew for bow backing and sewing, horns to boil for glue and bone for awls and other tools. Useful though such a kill was, it happened rarely. Of far greater dietary importance was small game.

Of all the small game species, rabbits produced the most meat. Both cottontails (Sylvilagus audubonii) and jack rabbits (Lepus californicus) were hunted for meat and hides. Men removed the skin, then cut it in a spiral giving a long strip of fur 1-2" in width. They rolled this on their thigh along with fiber cordage. Allowed to dry, this produced a tough rabbit yarn. They looped these strips between stakes driven in the ground and twined them with cordage to produce square blankets, which were the main clothing for winter (Driver 1937:74, 79; Drucker 1937:18, 21). Virtually all animals in the lowlands were hunted for meat and furs, no matter how small--woodrats, kangaroo rats, gophers and mice. In the hills, squirrels and chipmunk provided meat. There was no cultural avoidance of reptiles as food. A wide variety of lizards were eaten, especially the large chuckwalla (Sauromalus obesus), desert tortoise (Gopherus agassizi), rattlesnake (Crotalus sp.), and various non-poisonous snakes. Indians of this area also gathered ants, grasshoppers, caterpillars, cicadae, cricket pupae, moth larvae, and insect scale (Carteria larreae), when these appeared in sufficient abundance to be economically profitable. Coyotes, not normally hunted, were eaten in cases of emergency. During those portions of the year, when people from the central Mojave were in the surrounding mountains, they hunted foxes, pumas, wildcats, doves and quails. The first three were valued primarily for their hides rather than meat. Indians killed bears if they came upon them, but did not actively seek them. Eagles and flickers were valued for their feathers, which were used ceremonially. Understandably, fishing is reported only for the Kawaiisu, inhabiting the western mountains (Driver 1937:63-64; Drucker 1937:7-8).

Despite the great variety of plants and animals that Indians utilized in this region there were still some species they avoided as food (Fowler 1972:81-87, 99-111). Several plants were seen as useless, producing no edible parts, such as poverty weed, dodder, lupine, paintbrush, salt grass, rye grass, moss and rabbitbrush. Animals not eaten included wolves, skunks, buzzards, hawks, owls, most songbirds, black birds (such as ravens, crows, and blackbirds), bumble bees, yellowjackets, horned toads, frogs and most water dwelling animals (Fowler, 1972; Driver 1937:62; Drucker 1937:8; Knack 1978). Further, some foods were forbidden to certain age groups; for instance, animal fetuses and eggs were forbidden to children (Drucker 1937:8). There is little evidence for the division of labor customary among people in the central Mojave. Women for the most part performed the gathering of plant materials, including seeds, berries, and roots. This task was not exclusively a female one, however, men also helped when intensive joint effort was necessary or useful to increasing production. This was especially true when tree crops were involved--pinon and mesquite. Such crops had to be harvested quickly and men often aided by climbing the trees and knocking the seeds down (Bean 1972:36-40; Willoughby 1974:20). However, the steady day-to-day gathering was left to women. Most often women carried their food products to the camp where they prepared and cooked them. Women also gathered wood and water. They built lighter types of houses, cared for children, and manufactured those artifacts made from plant materials, such as baskets and fiber skirts. They were responsible for the drying and storage of foods for future use.

Men, on the other hand, performed nearly all the formal hunting. This included both the stalking and the communal driving of game. Men generally butchered and skinned their kill. Most often they also cut up the meat for eating or for storage in the form of jerky. They prepared the hides for use as garments (sewn together by women - Willoughby 1974:53), and made the rabbitskin blankets (Willoughby 1974:51). Male influence on hunting was not complete, however. The women definitely gathered whatever small game they found while plant collecting. The most usual female weapon was the digging stick, which they would use as a club as well as for digging animals from their holes. More sophisticated hunting techniques requiring more technology than this were left to men (Willoughby 1974:8).

Hunting and gathering techniques were, for the most part, simple. As already mentioned, the primary means of gathering plants was with seed beaters and catching baskets, with the results being thrown into a conical burden basket carried on the back. For the larger and heavier foods such as agave, the women cut and dug out the fleshy plants with a wooden digging stick and a small chipped stone knife hafted onto a wooden handle. Men shot game with bow and arrow. They pulled burrowing animals from their holes with a short stick twisted into their fur. They ambushed large game, such as deer and mountain sheep, along the game trails. Sometimes hunters worked in teams, one openly approaching the game, frightening it toward another in ambush. They sometimes used heads and hides as disguises to enable closer approach to wary game in this area of scant natural cover. The most common cooperative hunting activity was the game drives, usually for rabbits. For this the largest possible group of men gathered in an area known to have a high rabbit population. Each brought his rabbit net woven 2½ to 3 feet high and as long as 30 feet. Each man's net was strung as part of a continuous arch supported on brush or upright poles across the valley floor. Hunters stood behind this net with clubs and other weapons while young boys, or even women and girls, looped out in a large circle. Shouting and beating the bushes, this moving line gradually closed, frightening rabbits out of their lairs and driving them into the nets. There the rabbits became entangled and were easy prey for the waiting clubbers (See also Ritual, below). A very large harvest of meat could be gathered in a short time, but required the cooperation of a fairly large number of people and an unusually ample amount of plant food to support them. The presence of a rabbit population large enough to warrant such a large scale effort was fairly rare in the central Mojave. In addition to direct attack a large amount of small game was killed through a combination of spring snares, nooses, deadfalls, and other traps of various and ingenious kinds (Driver 1937:61; Drucker 1937: 7).

Once the food had been brought to camp, a variety of means existed for preserving and storing it. Women roasted small game whole. Any excess, which was sure to be limited, they split down the center and laid in the sun to dry. This would preserve it for a week or so, until such time as it was consumed. In the case of a rabbit drive or the killing of a large animal, such as a deer, producing more meat than would be immediately consumed, men stripped the meat from the bone, thin sliced it, and sun dried it as jerky. This meat was either stored in these dried strips, or ground on the metate and mano into flour powder and kept in this form. The larger animal bones were cracked for marrow and then saved as raw material for awls, needles and other small tools. Bones of small game were pulverized on the metate to a rich powder and added to many boiled foods. The blood of animals was drunk raw or cooked to a jell in the stomach sack of the animal. The bones, hides and hooves provided raw materials for tools, clothing, glue and ceremonial rattles. Virtually no part of any animal was wasted.

As a rule, plant foods with their periodic and seasonally rich harvest were far more likely to produce a storable surplus than were meat foods. Women brought small seeds to camp in burden baskets, then winnowed and separated them from the chaff to reduce them to their nutritious kernel. If heavy shells had to be cracked, as with acorns and pinon nuts, they removed these by a preliminary cracking with a mortar and pestle, or with a mano and metate. They then winnowed away the shell fragments and lightly roasted the clean seeds by tossing them with hot coals in their triangular trays. They then ground the roasted seeds to flour on the metate before storage. Seeds, either as the toasted whole grain or in the finished flour form, kept for long periods of time.

Larger plants whose bodies, rather than seeds, were eaten were prepared in an earth oven in a manner similar to that used by Kosos. Agave prepared in this way produced a highly nutritious cake that kept virtually indefinitely.

When the Indians found berries they either ate them fresh on the spot, or if there was a surplus, sun dried them. Later women ground them and added them to stews and soups as a luxurious condiment (Driver 1937:62-65; Drucker 1937:7-10).

Foods prepared in these ways were stored for future use. Chemehuevis and Panamints used primarily an earth cache in which they excavated a hole in a cave or other dry location, lined it with pieces of broken basket or layers of grass and stocked in the prepared foods. They covered the cache with more basket fragments or grass, and then earth finished in such a way as to be unobtrusive. In dry regions of the Great Basin such caches are known to have survived for hundreds of years, raided only by rodents and other burrowing animals. Serranos and Kawaiisus used a more characteristically Californian granary for food storage as well as earth caches and hidden pottery crocks buried in various handy locations around their traditional gathering terrain (Drucker 1937:10; Driver 1937:65).

Once foods had been stored most kept adequately until wanted. Women removed small amounts for a day's or a week's meals. If grains had been stored in the whole form, the cooks first ground them to flour. The most common preparation of any grain flours was to mix them with water into a soup or a thicker gruel, or thicker still into a bread dough. Breads were cooked directly in hot ashes as a heavy loaf. Gruels, on the other hand, were cooked in tightly woven baskets. The Serrano and riverine Chemehuevi were the only groups which had pottery. This permitted them to cook soups directly on the fire (Drucker 1937:22: Driver 1937:80). Since pottery is both heavy and fragile and requires a sophisticated multistage manufacturing process, it is highly unlikely that mobile desert groups in the Mojave used pottery to any extent.

Virtually all groups in the Great Basin used basketry as their primary cooking utensil. In such case, then the gruel was placed in the basket, the moisture swelled the tightly woven basket meshes nearly closed, making them virtually water tight. Then rocks heated in the fire were lifted with wooden tongs, placed in the basket and stirred rapidly. The problem was to bring the gruel to a boil without letting the rock drop to the bottom of the basket and burn its way out. As the rocks cooled, they were removed and replaced with hotter ones until the food had been cooked sufficiently. It was then served in individual basketry bowls or eaten directly from the main container.

As mentioned above, most meat was eaten either baked whole on the coals or broiled directly in the fire. Dried meat and jerky were chewed from the dried strips, or pulverized as a powder and added as a flavoring to the basic vegetable gruels. Berries in their powdered form were also added as a condiment to the otherwise rather flat, monotonous but nutritious whole grain soups. Spring greens, a rare and seasonal treat, were boiled or eaten green. Many of these greens were used as herbs or additives to soups to break the monotony of the diet.

Virtually the only other condiment added to food was salt. While a problem in many native areas of North America it was not one for the central Mojave dwellers. All groups here used mineral salt from the salt flats extensively (Driver 1937:64; Drucker 1937:10). They pried up chunks and ground it on the metate. Salt often formed a trade item moving out of the central Mojave both to the east and the west.

The central Mojave diet reconstructed here was primarily a vegetarian one, meat serving as a luxurious protein additive. Throughout the area, meat was a very high status food, the one involved in feasts. When guests were in camp, they were offered meat as appropriate to the prestige of the host and to honor the guest. At these and other times there was a great deal of food sharing among families, reinforcing kinship ties and assuring generosity in case of future scarcity (Knack 1975). Plant foods formed the vast majority of the daily intake and was considered ordinary food. The high oil content made it a high energy diet. In all probability the eclectic nature of the plant gathering technique and the broad variety of these seasonal resources prevented imbalance of the diet. The one dietary defect was the ever present threat of periodic scarcity. However, the broad variety of resources utilized, a strategy demanded by the natural sparseness of plant growth, was the best defense against famine.

Chapter III: Social Organization

The direct evidence for population groups and settlement pattern in the central Mojave is non-existent. However, by extrapolation we can extend the ethnographic picture from surrounding similar environments with a fair degree of confidence. In the Great Basin the plants upon which so much of the diet depended had several noticeable features. First, they tended to grow at specific sites only rather than being widespread throughout the territory. Second, most of these plants tended to produce during short seasons only. As a result, human populations which relied upon these plants had to have certain corresponding characteristics. Throughout this region populations were small and mobile, moving, fragmenting and reassembling in a flexible manner. The normal day-to-day production and consumption group was a small band of bilaterally related individuals. In periods of luxuriant resources, groups of twenty-five to fifty could aggregate on the sites of ample plant growth. At other times, when food was scant and widely scattered, these groups would fragment into single nuclear families. This minimal unit encompassed the necessary labor force to utilize the entire environment including as it did both an adult female and an adult male.

In the Great Basin generally the typical annual pattern involved utilization of many ecological zones, such as we find represented in the central Mojave and its mountain fringes. Seasonal exploitation varied with altitude more than any other factor. Plant food gathered from several of these ecozones was stored at a central location, very often at a contact point between one or more of these plant communities. Both the uphill and the downhill products, for instance, could be stored at this one spot with minimal effort. This central site was the most frequently used camping location and invariably was near a reliable spring, stream, or seep (Steward 1938). From such a base camp, small foraging expeditions sought out seasonally productive plants in their specific growth areas. After two or three days, the party returned to the base camp. Sometimes the family unit split, the women gathering plant foods in one area, while the men hunted in distant mountain regions. Each work group brought their products back to share with others. In some areas there was one base camp throughout the year (O'Connell 1975); in others there were two, one for summer and one for winter (Thomas 1973), depending on the particular subsistence resources in that area, their relative importance, and distance from each other. Without knowing more precisely the diet of the central Mojave peoples, it is impossible to assert the seasonal pattern they practiced. In all likelihood it was a shifting pattern, adjusting to the particular availability in a given year. If a particular area was known to produce well in a given year, word would spread rapidly with many bands gathering to utilize it, sharing the seasonal richness before it should pass away. Throughout the Great Basin group territories were vaguely defined, often crossed by groups for seasonal gathering activities (Stewart 1939; Kelly 1934). It seems most likely that in an area of such chronic scarcity as the central Mojave a similar pattern would pertain.

Not only were customary use areas regularly shared with neighboring bands, but the band membership itself most likely was not stable. There seems to be little evidence anywhere in the Great Basin that the localized group which wintered together at a particular camp was identical from year to year. Kinship was bilaterally reckoned in this area (Laird 1976:53-81; Benedict 1924:368-373; Gifford 1917:219-248; Strong 1929:11-16). Since bands were most often family groups in one form or another, it is most probable that winter camp groups were bilateral kindred clusters (Knack 1975). Judging from behavior in other Great Basin areas, it is very likely that after fragmentation into smaller summer groups, identical bilateral kindred clusters did not reform the following winter. Rather other bilateral kin ties were utilized and new groups formed, reducing community tensions and the monotony which would result from living in the identical small isolated groups year after year (Lee and Devore 1968:99-162; Damas 1969; Marshall 1960). This characteristically Great Basin pattern of mobile bands was most certainly true of Koso and Chemehuevi groups (Laird 1976; Steward 1938:80-93).

The Kawaiisu and Serrano groups in the more favored Californian mountains experienced a far greater degree of permanency which resulted in a quite different form of social organization. Camps were located on flowing streams and the geographical extent of gathering excursions was much more limited. Although direct ethnographic statement is lacking, apparently Serrano base camps were permanent. This can be inferred from the explicit ethnographic statements concerning the culturally similar Cahuilla (Bean 1972:71), as well as from particular Serrano traits. These latter include such things as community houses, sweat houses, localized lineages with place name affiliations, ritual reciprocity between localized lineage groups, and fixed geographic intermarriage patterns (Strong 1929:12-25). There may have been stable groups of perhaps 75 to 100 persons permanently localized at rich resource points. For Cahuillas these sites were along the lower edges of alluvial fans bordering the desert areas. Here water was available from springs and yet the desert resources farther out in the valleys were easily exploited (Bean 1972:74). Each Serrano village contained a core membership of a patrilineage. These lineages were grouped together into two exogamous moieties, Wildcat and Coyote (Drucker 1937:28; Strong 1929:20-25; c.f. Benedict 1924:371). Since marriage was patrilocal, the women of the village were primarily from other more distant areas. The use areas associated with these villages were much more clearly specified in the Cahuilla case than in the groups to the north and east. The lineage residence patterns produced inheritance of the rights to use certain resource areas through the patriline (Drucker 1937:27; Bean 1972:90-91). Each such lineage was firmly associated with an inherited leadership position, inherited ritual position, a sacred bundle, a sweat house, and a communal ceremonial house. The physical structures of the villages themselves were much more elaborate and work intensive, involving the excavation of floors, the erection of upright posts and square roofs not demanded by the quickly constructed circular karnees of the Great Basin. These all reflect far greater permanency of occupation in a particular village and far less fluid movement of men over the landscape and between social groups. In addition to intermarriage, the geographically associated moiety groupings performed a variety of reciprocal ritual services for each other. Funeral rites for members of one moiety were performed by members of the opposite. Feasts were often organized on moiety lines. The all important annual mourning ceremony was hosted in alternate years by the two groups. The rigidity of this duality permeates the Serrano ritual cycle and bespeaks a stability of membership for the moieties and their component lineages quite in contrast with Great Basin bands. Based as it is on geographic permanency, it seems unlikely for economic reasons that the Vanyume, the Serrano dialect group of the study area, could have maintained such a pattern.

Chapter IV: Leadership

Like their social organization, Chemehuevi, Koso and Kawaiisu leadership was flexible and kinship based. During those portions of the year when very small groups or even individual families were the sole social unit, the head of the family, the eldest male, was the unquestioned leader. This leadership was based on his kinship status and seniority alone. His duties were multi-faceted as with any household head, but focused on satisfaction of the economic needs of the group as a whole. During these periods there were no leaders of the larger community at all. Each family was responsible for and to itself for its own actions.

When larger social groups gathered in response to temporarily rich food resources, a more developed form of authority was manifest. Since ties of bilateral kinship united families into these larger groups, it was both consistent and logical that the community leaders also had their authority based at least in part upon their kinship position. Headmen were the senior, most able, and most respected members, and were usually the geneological focus of the largest network of kin ties within the group. The additional qualifications for headmanship were personal; he should be calm, non-aggressive, knowledgeable in the tasks which he was to fulfill, senior, but not aged. Senility disqualified him, leading people to seek a more able leader in whose judgement they could trust. These additional psychological qualifications assured that inheritance of the role was not strict. However, the need to have widespread kinship ties in order to function effectively meant that, in fact, a succeeding headman was often kinsman to his predecessor. It was also believed that a son, brother, cousin, or other close relative was more likely to have learned those things a headman should know, making succession often *de facto* inherited.

The transitory nature of authority was directly related to the duties and functions of the headman. "His task was principally to keep informed about the ripening of plants in different localities, impart his information to the villagers, and, if all the families traveled to the same pine nut area, to manage the trip and help arrange where each was to harvest" (Steward 1938: 247). Thus the headman was an economic manager, leading the group as a whole to the various seasonally ripening food resources. As such he was responsible for the success or failure of the group to procure subsistence. In addition, it was customary for a neighboring group, if desiring to enter the normal use area of another, to contact the headman of that group. He directed them to areas where their activities would not interfere with those of the home group. The permission to enter and gather was never refused for it was well realized that, due to the unpredictability of wild food production in this area, the host group itself would probably need temporary use of the visitors' terrain in turn some day. Thus to assure the future availability of emergency food resources, periodic overproduction was cheerfully shared with neighboring groups. This permitted an easy adjustment of the human population to the waxing and waning of localized food resources, by redistributing the population density over the landscape in a very broad manner.

The headman also had social functions to perform. Often he rose early in the morning and expounded to all the people within hearing on the moral duties of hard work, marital faithfulness, economic cooperation, and other community values. In cases of dispute within the community, stemming from marital infidelity or other untoward events leading to conflict, the headman was sought out to mediate and offer advice because he was a kinsman, most often with ties to both parties, a man of respected wisdom, and of moral standing. This advice he gave not on his own personal authority, but as an interpreter of community traditions. His conclusions could either be accepted by the parties or rejected. In this, as in all things, the individual families retained the right to agree with the headman and therefore stay in the community in peaceful cooperation, or to leave the group, utilizing their extended bilateral kin ties with other groups, and thereby affiliating themselves with a different locale under another leader. The authority of a headman was not absolute; it was not political power. The number of occasions into which the headman could justly intrude was strictly limited; when he did so it was as a respected member of the community rather than as a ruler of any kind.

There were other men in the community whose influence was also enhanced by special recognized social roles. Outstanding among these were the game drive leaders. Certain members of the community received visions granting them power over the actions of either rabbits or antelope through the voluntary assistance of the supernatural spirit of those species. When several human groups gathered to hold a communal game drive, such an individual directed the activities in accordance with the dictates of his spiritual helper. Spiritual preparation was held to be as important for success as material actions. His leadership not only enlisted the aid of the spiritual beings, but also assured that uninformed community members did not unwittingly disobey the ritual dictates of the supernatural powers. These, if offended by ritual violations, would withhold the game and starvation would result. Thus the game drive leader was for the duration of the drive itself the practical as well as the spiritual leader of the group, superseding the headman. However, his special authority was restricted specifically to this period of communal activity and ceased directly at its conclusion. Similarly, shamans while performing ritual cures had a right to order people's compliance with the behavioral dictates of his spiritual assistant in order to assure the efficiency of the ritual. Upon its completion he once again became simply a respected member of the community.

In all cases the authority of community leaders was strictly limited in duration or in area of application. Leadership brought little or no economic reward. Headmen hunted and gathered for their own families, being given no support by the community in return for their services. Respect and social status were their only rewards, while the responsibilities were many (Steward 1938:246, 248; Driver 1937: 91-94; Drucker 1937:28-30). Thus authority varied with the situation, season, and the social group involved, but throughout was intimately concerned with the relations between fluctuating population and fluctuating resources. The headman was often the mediator and the coordinator of this interrelationship.

In the Serrano area the leadership pattern was more elaborate. The head of the localized lineage village was the kika, who had both ritual and economic functions. He was most often the geneological head of the lineage. Although rigid inheritance was not maintained, community consensus chose the most able descendant to fill the role (Strong 1929:17; Drucker 1937:28). The kika's functions were to serve as an economic leader to determine when, where and who should leave the village to gather the wild plants as they ripened on an annual basis. He was also a ritual head, initiating first fruit ceremonies for the major staples. He was most knowledgeable in the location and availability of wild foods, as well as the extent of the territory to which the group could claim primary customary use rights. He was the nominal owner of that tract (Drucker 1937:28). If another group desired to share that produce of that terrain, it was to the kika to which they applied for formal permission to enter. He was a mediator in disputes within the group on a wide variety of issues; he made his decisions according to traditional values and only after consultation with council of community elders. Thus, in many ways, the kika performed functions similar to those of a Great Basin headman, but on a more formalized basis (Bean 1972:104-105; Strong 1929:17; Drucker 1937:28).

In addition to the headmanship there were other recognized positions of authority; the most important of these was the ritual leader called the paha (paxaa?). This also was a position generally inherited from father to son, although modified according to abilities. The paha was the keeper and protector of the bundle of sacred paraphernalia owned by the lineage as a whole; symbol of its unit and source of spiritual protection displayed during nearly all lineage-based ritual occasions (Strong 1929:18). The paha served as the kika's messenger, announcer and assistant in various ritual functions. He also may have been the rabbit drive boss (Drucker 1937:29; Bean 1972:105).

Another hereditary office was that of the singer (tcaka, takwa). He was responsible for perpetuating the oral tradition, an elaborate collection of chants, songs and myths. These he had to sing at such occasions as the annual mourning ceremony and funerals absolutely without error in order for the rituals to be effective. As the keeper of the religious traditions of the group, he was a highly respected member of the community (Strong 1929:18-19; Drucker 1937:29; Bean 1972:106-107).

It is very suggestive that the eastern Serrano in a less productive environment lacked full elaboration of this system. Recorded often as breakdown or attributed to the late post-contact sources of the data (Strong 1929:19), such confusion of statuses may also have been the result of very low population density and simple necessity. Thus, for instance, near Twenty-nine Palms, a Serrano oasis, the paha of one moiety kept the ritual paraphernalia of the other. There was only one kika for all the Serrano living in the area regardless of lineage. These, and other data, indicate to me a simplification of the social organization in the face of more stringent environmental circumstances where the population was not able to culturally "afford" the structural overhead. Thus, it seems very likely that those Serrano groups which lived in the Mojave Basin, namely Vanyume, were most likely to have been structurally very simple, resembling more closely the Chemehuevi-Koso pattern of organization rather than that of their more florescent California language-mates to the south. Despite the great formalization of the Serrano public positions, the actual functions of the Californian and of the Great Basin headmen and shamans were very similar.

Chapter V: Ritual

When turning to the association between ritual and land use in the central Mojave, it becomes difficult to separate those rituals specifically pertaining to land utilization from all others. Further, even the most practical and mundane activities often had a ritual overcast, or an associated ritual. For this reason any separation of religious activities from others is purely artificial.

Some (Chemehuevi, Koso and Kawaiisu) ritual activities were clearly associated with food production. The Northern Paiutes generally visited a promising pinon grove in mid-summer when the cones were still tight and hard. They ritually picked a few cones, held a dance, and performed ceremonies believed to enhance the harvest and assure great productivity (Wheat 1967: 12-14). At least the Kosos probably engaged in a ritual of this type.

Kosos held what has been called a fall festival during the pinon harvest itself when large numbers of people came together at the most productive groves. While the harvest provided temporarily a luxurious food source, social dances and general inter-group activities were very much heightened. All recorded groups perceived these as times of great joy. In Death Valley a number of groups gathered and the visiting group performed dances all night for the hosts who, in return for this favor, gave them gifts. This dance was followed by the burning of personal possessions in memory of those who had died during the year (Steward 1938:88-90). Such a specific dance and mourning ceremony are very reminiscent of a more Californian pattern, while general social dances are common for many Great Basin groups.

Other events which had ceremonial overtones were the game drives. Throughout the Great Basin, the material preparation of the nets, the runners, the beaters and the clubs, were considered impotent without the additional ritual. The leader of the game drives was invariably a man with shamanistic powers, and his preparations included chants and prayers (Steward 1938:90).

In addition to the marked annual cycle of these large group activities, there were a number of rituals timed by individual life events which also had ecological importance. For instance, when a young man killed his first animal of each important species, his kill was tabooed to him and his family; it had to be given away to other members of the group (Driver 1937:63; Drucker 1937:8).

Females also experienced ritualistic limitations, but of another type. Particularly during a girl's first menstruation, but also subsequently throughout her life, her physical mobility was restricted either to the home or to a special menstrual lodge, depending on the group involved. Her gathering production was thus decreased. Of more importance to us here were the dietary taboos. For four or five days of each month, she could not eat meat or oils, including pinon nuts. All groups except Koso further forbade her consumption of salt. She could not eat or drink hot substances. These same restrictions were imposed upon her for the month following childbirth, at which time they extended to her husband as well (Drucker 1937:34; Driver 1937:97-98). Such restrictions eased the burden upon the limited meat production of the economy by decreasing consumption by the female half of the population.

Other ritual associations with the land appear to be related not to individual or group use of its products, but to locations themselves. Such hints are scant but frequent enough to be enticing. For instance, it has been recorded that riverine Chemehuevi to the east considered the Panamint Mountains, specifically the southern portion of that range, to be the holy retreat of the creators and the source of all shamanistic power (Laird 1976:87, 134, 147). Similarly, a riverine Chemehuevi myth cycle, which appears to be the result of a very strong Yuman influence in that region, records the trail of the mythic being Southern Fox. He is specifically mentioned as retreating from the Dead Mountains to the Ivanpah Range near Pahrump. From there he went north and west into Death Valley, crossing at least a portion of the study area (Laird 1976:159-160, map I).

There is some indication that petroglyph sites were also ritually associated. While the status of petroglyphs is very confusing in this area, they were, like hot springs, seen as an extranormal circumstance. Universally tribes in the Mojave as in the Great Basin as a whole, denied that they themselves had manufactured them. While tribes to the east in the Puebloid area generally attributed petroglyphs to the previous agricultural residents, Chemehuevis may have interpreted them as the products of shamans' supernatural helpers. Since many of the non-symbolic objects depicted area animals, this interpretation seems very natural (Laird 1976:123).

For the Serrano, rituals are better recorded, more elaborated and more structured. Of these, a great number of annual events had a direct ecological import. Like the Great Basin tribes the Serrano also practiced game drives here under the control of the <u>paha</u> ritual leader rather than a special rabbit shaman (Drucker 1937:29; Bean 1972:105, 147). The Serrano practiced formal first-fruits ceremonies for the major food resources--mesquite, agave and pinon. These rituals expressed appreciation to the supernatural beings who controlled the fertility of these food sources. In this way, it was believed that productivity would be assured and would continue the following year. The <u>paha</u> was the master of ceremonies and he made the announcement that sent families to the gathering area to pick a limited amount. Without eating this, they returned to the village where extensive chants and all night dances took place for as much as three days. Then each member of the lineage ate a portion of these first gathered fruits. The paha announced the harvest open, removing the interdiction which had previously protected the unripe food sources from premature consumption under supernatural threat of illness or death (Drucker 1937:40-41; Benedict 1924; Bean 1972:105, 142-143).

All Serrano social gatherings, for whatever purpose, required a social sharing of food in the form of a feast. Unlike the rather spontaneous reciprocity of the Great Basin bands, each Serrano family had to bring a standard sized basket of prepared mesquite flour. From these a feast was prepared in which all took part (Benedict 1924).

Some anthropological theorists see such events to be of great importance. Bean says in the Cahuilla case that "the ritual activity kept the environment in proper balance" (Bean 1972: 105). These theorists believe that ritual is one of the primary means for redistributing localized surpluses by bringing large groups of people together during times of peak productivity and by insisting upon the exchange of food goods through feast and gifts. As such, social groups from different ecological zones have a mechanism for exchanging products from their different areas (Suttles 1968).

The Serrano also practiced a male initiation rite which involved one major plant, datura, or jimsonweed (Datura meteloides). In this ritual the paha gave boys a decoction of datura which induced vivid visions interpreted as supernatural experiences assuring the boy's future life successes. Three days of dancing and chanting followed publically announcing their coming of age as adult men (Benedict 1924:383; Strong 1929:31-32; Drucker 1937:35-36).

Occasionally, or perhaps every time, a hunter killed a deer he brought it to the ceremonial house of the village. There every member of the lineage gathered and they sang throughout the night. In the morning the meat was distributed among all present. In this way large game was rapidly shared and used before spoilage. This sort of ritual investment of time and labor could hardly have taken place if deer game were bagged regularly (Benedict 1924:379; Bean 1972:147; Strong 1929:135). Bears also had a special place in Serrano belief. One of the most powerful expressions of shamanistic might was the ability of a shaman to turn himself physically into a bear, the strongest and most feared animal in the mountains (Benedict 1924:383-384; Strong 1929:35).

The Serrano shamans also had other economic functions. As in Chemehuevi, Koso, and Kawaiisu belief, shamans acquired their power through dreams, either in natural circumstances of sleep or under the influence of datura drinking. During the vision, spiritual beings agreed voluntarily to aid these men in their earthly endeavors. The spirit helper taught the shaman the songs, chants, dances, and ritual manipulations which he could utilize in specific circumstances. The most common power was to cure illnesses, often of a very specific type, such as only rattlesnake bites, only puncture wounds, or only pains of the stomach or back. Other shamans had the power to find lost objects or to foretell the future while still others could charm rabbits or antelope. In all these groups, there were some shamans believed to control both wind and rain, bringing it or driving it away.

Often their powers were utilized to protect the harvest from premature cloudbursts which would spoil the crop. To the south, the Cahuilla, and perhaps Serrano, considered some shamans effective in assuring the fertility of wild plants and animal species. "The economic actions of the puul shaman were critical. He was able to "create food" (Bean 1972:110-111). Ritual beliefs concerning menstruation, birth and a young hunter's first kill were similar to those of the Chemehuevis, Kosos, and Kawaiisus (Drucker 1937:34; Bean 1972:148).

In addition to rituals aimed at increasing or controlling productivity, such as the above, there were a number of Serrano rituals which required specific products of their environment. Outstanding were the use of eagle and flicker feathers for the production of ritual paraphernalia critical in the Serrano ritual cycle (Benedict 1924).

There is some indication that the Serrano and Koso, along with native groups to the west of the San Bernardino Mountains, particularly valued hot springs as an unusual feature in nature; a product of supernatural power. They were viewed with veneration and highly valued for curative properties. In addition, they were used in certain very pragmatic ways. Shinn recounts how the groups near San Bernardino used the hot springs for warmth in the winter, reclining in them during the coldest winter nights (Shinn 1941:77; Ritter 1978).

Thus it is clear that a wide variety of ritual activity in the central Mojave area had either consequences to or resulted directly from the relation between the human population and the landscape. For the Cahuilla to the south one scholar flatly states: "All statuses having to do with the economic welfare of the people were supported by supernatural power" (Bean 1972:119).

Chapter VI: Exchange and Trade

Exchange of environmental products took place among the groups of the Mojave desert in the form of trade. The Mohaves, a well known and well travelled trading tribe on the Colorado River, maintained a trail to the West Coast which crossed the study area. It roughly followed the route that later became a wagon road, and still later Interstate Highway 15 and State 68 (Bean 1972:map facing p. 1). Along this trail, Mohave entrepreneurs carried large amounts of coastal goods into the interior and eventually as far as the Pueblo Southwest. All along their trail local trade took place. Some of the recorded local exchanges were between the Chemehuevi and Cahuilla, in which basketry caps and conical burden baskets of the Southern Paiutes were traded for mountain goods (Davis 1974:18). Chemehuevis also traded with Yavapais on their eastern boundaries. Kawaiisus traded north out of our area. Kosos exchanged salt with the Monos to the west (Davis 1974:27; Steward 1938:78). Serrano trade is only recorded to the south and west, out of our area (Davis 1974:36). The Mohave traders acquired the down of eagles and chicken hawks and finished rabbitskin blankets from Chemehuevis. Because of the very great Southwestern cultural concern with salt involving much ritual and extensive expenditure of effort (Titiev 1937; Simmons 1942:232-246, 252-255, 433-435), I would suspect that Mohave trade involved more salt than appears to have been recorded. Thus, although the harsh central Mojave area offered only a scant living, it still produced both raw materials and manufactured goods valued and desired by more distant groups.

Thus, plants and animal species, scant in quantity but rich in variety, provided the raw materials for the economy, manufacturers and ritual of the central Mojave tribes. The distribution of those species effected the lives of these people by determining the number which could gather at any one time, probably influencing in turn their political and social organization. Products of the desert pervaded their subsistence as well as their non-subsistence cultural base. In other words, their cultures were founded very firmly in both the characteristics of the desert itself and in its products.

Chapter VII: Ethnohistory

The expansion of competing colonial powers into southern California in the 18th and 19th centuries brought about drastic changes in the native lifestyle. This external influence was channeled down existing routes of movement, the trade trails, which crossed the Mojave through the study area.

The initial impetus to change was the construction of Spanish missions on the southern coast. As was their custom, the Spaniards consolidated the nearby Indian tribes into working agricultural communities, converted these neophytes to the Catholic faith, and introduced European cultural behaviors. This process was resisted actively, but unsuccessfully, throughout Spanish California; the military often being called in to acquire fresh manpower or retrieve runaways from the missions (Phillips 1975; Forbes 1969:27-38). For a variety of reasons, the tribes in the hinterlands east of the coastal ranges were not successfully missionized. These areas proved a constant refuge for escapees who brought tales of mission life, determination to resist,as well as pursuing expeditions (Bean and Mason 1962; Fremont 1845:260).

Both Serrano and Cahuilla groups in the mountains to the south were directly missionized through the 1840s, losing men to San Bernardino and San Luis Rey missions (Strong 1929:8, 149; Cook 1976:194). This, and subsequent epidemics of European diseases, such as smallpox (Strong 1929:151), may have reduced population pressure in the mountains sufficiently to allow the Vanyume to retreat to the more lush northern mountain spaces. Throughout southern California the native population dropped drastically (Cook 1976a, 1976b). At least one ethnohistorian suggests that mission influence depopulated the Mojave River drainage, allowing Chemehuevis to accomplish their south and eastward movements, eventually returning to the Colorado River (Forbes 1969:37).

In addition to such indirect influences, the presence of the missions also had direct effect upon the Indians of the study area. In an attempt to find an overland route from the New Mexico to the California missions, Father Francisco Garces became the first European on record to cross the Mojave Desert. In 1776, led by Mohave guides, he traversed the Mojave River drainage (Coues 1900:237-243). Crossing in early spring, he found one rancheria of 25 persons and another of 40 along its entire route before entering the far more populated mountains. The Indians were gathering tule roots and wild grapes. The trail was well known to his guides, and local Indians agreed it was the only practical route westward.

The Garces route was little used for the next 50 years; the Spaniards preferring the Gila River track into San Diego (Warren 1974:46). However, in 1826, Jedediah Smith proved the possibility of entry from the expanding American frontier and Spanish authorities began to take greater interest in the area. Smith's guides were two mission runaways. In his trip into California in November he mentions seeing no Indians in the study area, while the following August on his return he met two families near the center of the river gathering and processing agave (Morgan 1953:200).

In 1830, Armijo proved the practicality of the Amargosa trail, traversing the northern section of the study area to join the Mojave Trail just outside the western boundary. Armijo, travelling in January, reports seeing Indians only at the bend of the Amargosa, and nowhere else on the desert. He gives no details (Warren 1974:33, 73).

These explorers are important for a number of reasons. First, they prove that the native population was small, thinly scattered and mobile. Second, the groups varied in size, probably being largest in the spring. The food resources utilized fluctuated over the year. But far more important than the information they give us about the inhabitants is the historical effect they had. Between 1829 and 1844, at least sixteen major parties of Europeans travelled the Mojave Desert on these two routes (Warren 1974:122, 179). These were trade caravans and horse stealing expeditions, all utilizing large numbers of grazing animals. These transients did have environmental impact, for when Fremont crossed in 1844 he commented that he must be there ahead of the annual trade caravan as there was still grass for his 140 horses (Fremont 1845:259). Further, he knew when he lost his way because all trails in this area were already marked by the bleaching bones of horses. The massive number of horses and other livestock must have had tremendous impact on the native subsistence, as the same grasses the horses ate had previously provided them major grain for flour.

In 1844, John Fremont led the expedition which first circumscribed the Great Basin. On his return in April he traversed the Mojave-Amargosa river route. The only Indians he saw were Mohave traders, although there were others in the area trying to steal horses. His reports and maps received extensive distribution in the East. The route thus publicized became a favorite of wagon travellers seeking a snow-free winter passage to California. The rush westward after the discovery of gold in 1849 funneled hundreds of people through the study area. The resident Indians had learned to avoid these groups, however. Of the eight wagon trains represented in a collection of diaries from the winter of 1849, not a single one mentions seeing Indians along this stretch of trail (Hafen and Hafen 1954; Manly 1894; Nusbaumer 1967).

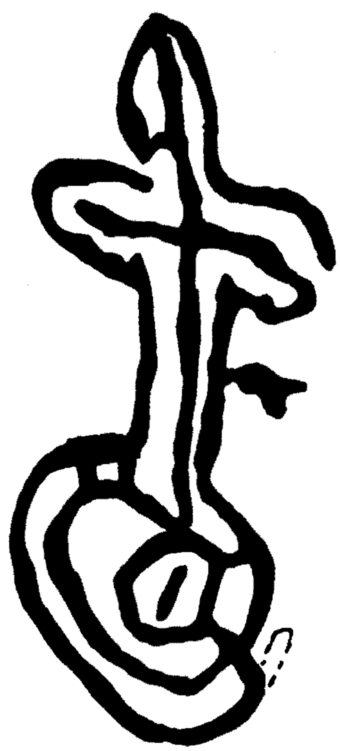
One would be led to suspect that this region had already become depopulated by 1850 were it not for later reports. The scarcity of sightings requires explanation. The region had always been thinly occupied and winter, when most travellers passed by, was the least productive season. Inhabitants had probably sought protected canyons with water, well away from the now regularly traveled winter trails along the riverbeds. Non-local Indians, the Mohave traders, had traversed the study area for years without major incident, but a new complication had been added by 1840. Mounted bands of Utes from northeastern Utah now regularly raided into southern California on a massive scale for stock (Warren 1974:123; Fremont 1845:272; Hancock c. 1862: 43-45). Well reported raids into the San Bernardino area took place in 1833, 1836, 1840 and 1850 (Warren 1974:123; Hancock Idim). These thefts generated retaliatory pursuit across the central Mojave. The pursuers were often not too precise and fell upon resident bands there merely to gather food. Not only did local groups fear retaliation brought on by the Utes, but they also feared the Utes themselves well known to have raided Paiute and Chemehuevi camps along their way throughout Utah and Nevada, and presumably California as well. They took women and children to be sold as slaves in California and New Mexico. The annual Spanish caravan often served as middleman, buying the human chattels at isolated desert campsites (Malouf and Malouf 1945; Sales 1865). Thus, before 1849, the small defenseless bands of the deserts had learned to avoid large mounted groups of all kinds. They fled upon approach; travellers often mention seeing recently abandoned campsites and comment on the shyness of the natives in this area. It was a shyness in sharp contrast with the generous hospitality shown Garces, a shyness brought about by the historical events since his time.

The violence against natives in this area exhibited by both Europeans and other Indian groups is perhaps best exemplified by the activities of the Camp Cady garrisons. The desert fort was built in 1860 to protect the wagon road to Fort Mohave and to serve as a post for pursuing Indian horse thiefs from Utah. By this time, large cattle herds were grazing near the River. In that spring three white men, all from small parties with large numbers of livestock, were killed by unidentified Indians. Public outcry demanded retaliation, and in April Captain Carleton was sent out with a group of about 85 dragoons. His orders read,

> On the commission of every murder and as soon thereafter as practicable to send a force and punish the Indians, and as it is impossible to ascertain the individuals or the particular band in each case of murder, and as it is certain that their acts are connived at by the tribes in the vicinity, the punishment must fall on those dwelling nearest to the place of murder or frequenting the water course in its vicinity (Mackall 1860).

Although his orders further stated that he was to make the Indians clearly understand the retaliatory nature of his strikes, Carleton took it as an unrestricted opportunity to kill. He proceeded to Bitter Springs, attacked a group on sight without warning, killing two. He hung their bodies on a scaffold by the main spring on the trail as a "warning". He sent his men on scouting expeditions to the Providence Mountains and Soda Lake with orders to attack on sight and bring back heads to join the corpses. This was done. They hung at Bitter Springs until passing Mormons reported the barbarism to the Salt Lake City press. By the first of June not an Indian remained in the district (Casebier 1972a). The spring resources were gone and bloodthirsty ghouls were loose on the desert, indiscriminately killing everyone in sight. Carleton interpreted their disappearance as success. The Indians were fleeing one of the most brutal examples of American frontier violence, being driven away from the wagon roads which housed the only springs able to sustain life in the Central Mojave. Whites insisted that their own small unprotected parties of herdsmen, travellers, and prospectors should be able to wander at will in safety. They refused to acknowledge that this was occupied territory belonging to another people who just resented its expropriation. The common white reaction to this natural resentment was outrage and aggressive violence against the small native bands. This pattern was repeated several times over the next 10 years (Casebier 1972b).

Soon whites began to stay in the area rather than just travel through. As mines opened, especially the Borax works near Death Valley, Indian populations shifted again (Steward 1938: 92-93; Coville 1892:352). With the opportunity to work for wages came access to manufactured goods, such as woven cloth, and new food resources, such as wheat flour, to replace the disrupted native subsistence. When ranches sprang up in the Amargosa Valley and Mojave River area, Indians attached themselves to ranches as laborers. Remnants of native behavior remained even as clothing and housing changed (Coville 1892: 357). Even to this day the few remaining Indian families in the area of mixed Paiute-Shoshoni ancestry gather a few wild foods as a minor supplement to their diet. They know a few Indian place names and the winding fragments of the old trails, and they keep alive the memory of their ethnic past.



PACHALKA SPRING PETROGLYPH (NO SCALE)

TABLE I

PLANTS USED AS FOOD

COMMON NAME	LATIN NAME	USE	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
Joshua tree	Yucca brevifolia	buds - roasted in open fire, in April	K:592			
reed	Phragmites vulgaris	stalks pounded in wooden mortars in June, cakes of flour baked	K:592; Cov:355			
pinon nuts	Pinus monophylla	nuts - ground to flour and stored	K:591; Cov:352-3; Sd:84,88; Kn	L:109;Dr:9	Ben:391 (B:39)	
Indian rice grass	Oryzopsis hymenoides	important grain, April, ground to flour and stored	K:592; Cov:353; Sd:84,88	L:109;DR:9	Dr:9	
evening primrose	Oenothera brevipes	seeds ground and parched, made into bread	K:592; Cov:353; Kn			
joint pine or Mormon tea	Ephedra nevadensis	seeds eaten	K:592; Cov:352; Kn		(B:46)	
devil's pin-cushion or cottontop	Echinocactus polycephalus	seeds pried out, store well	Cov:352: K:592; Kn		(B:40)	
mesquite	Prosopis juliflora glandulosa	beans eaten whole, or pounded to flour - eaten dry or as cakes	K:592; Cov:355; Sd:84; Dv:64;Kn	L:106; Vv:16; Dr:9	Ben:374,388; K:615 (B:38)	Dv:64
beavertail prickly pear	Opuntia basilaris	joints open fire cooked or sun dried, thorns rubbed off with grass - later boiled - keeps a long time - can be pit cooked also	K:592; Cov:354		(B:40)	

TABLE I

PLANTS USED AS FOOD

COMMON NAME	LATIN NAME	USE	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
crucifers	Stanleya elata, S. pinnata, Caulanthus crassicaulis	shoots eaten; leaves and stems boiled, cold rinsed and squeezed to remove bitter taste and prevent diarrhea	K:592		(B:40)	
California clover	Trifolium gracilentum	eaten raw	K:592		(B:46)	
other greens		eaten raw	K:592			
desert thorn	Lycium andersonii	berry eaten fresh or dried for storage, added to stews	Cov:354; Sd:88;Kn		(B:44)	
mescal, or agave	Agave deserti	all but tips pit toasted, hearts pounded flat and sun dried		K:597;Dr:9; L:108;Vv:16	(B:41)	
sagebrush	Artemisia tridentata	seeds and inflorescences eaten		L:107	(B:46)	
creosote bush	Larrea tridentata	general medicine	Kn	L:107		
palmita, or banana yucca	Yucca bacatta	seeds		L:107		
wild grape	Vitis arizonica	fruit	Sd:88	L:107	K:615	
jimson weed	Datura meteloides	root as hallucinogen		L:108; Vv:11	Ben:375	K:604
Indian asparagas	Anemopsis californica		Kn			
squawberries	Rhus trilobata	fruit eaten, sun dried		L:109	(B:40)	

TABLE I

PLANTS USED AS FOOD

COMMON NAME	LATIN NAME	USE	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
jumping and buckthorn cholla	*Opuntia bigelovii* and *O. acanthocarpa*	new growth boiled and eaten		L:109		
acorn	*Quercus dumosa turbinella*	shelled, pounded and leached for flour	Dv:64	L:104	Ben:387; K:615; (B:37); Dr:8	Dv:64
wild tobacco	*Nicotiana trigonophylla*	smoked, domestic and ritual	Dv:84	Dr:25	Dr: Ben:	Dv:84
screwbean	*Prosopis pubescens*	beans pounded to flour		Vv:16	K:615; (B:38)	
tule	*Scirpus acutus*	roots eaten			K:615; (B:45)	
Chia	*Salvia columbariae*	seeds, eaten as flour	Sd:88; Kn	Dr:9	Dr:9; (B:47)	R
blazing star	*Mentzelia albicaulis* & *M. reflexa*	seeds, eaten as flour	Sd:88		(B:46)	
barrel cactus	*Ferocactus acanthodes* & *Sclerocactus polyancistrus*	seeds and leaves		Vv:17	(B:40)	
tuna	*Opuntia megacantha*	seeds and leaves	Dv:64		(B:40)	Dv:64
prickly pear	*Opuntia Phaeacantha mojavensis*	seeds and leaves			(B:40)	
yucca	*Yucca schidigera*	flower, stalk and root	Dv:64	Dr:9	(B:42); Dr:9	Dv:64

TABLE I
PLANTS USED AS FOOD

COMMON NAME	LATIN NAME	USE	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
catclaw	Acacia greggii	seeds			(B:42)	
locoweed	Astragalus sp.	seeds			(B:43)	
palo verde	Cercidium floridum	seeds			(B:43)	
desert willow	Chilopsis linearis	seeds			(B:43)	
ironwood	Olneya tesota	seeds			(B:43)	
desert lily	Hesperocallis undulata	root			(B:45)	
cattail	Typha latifolia	root and seeds			(B:45)	
Mariposa lily	Calochortus kennedyi	root			(B:45)	

TABLE II

PLANTS USED FOR RAW MATERIALS

COMMON NAME	LATIN NAME	USE	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
deer grass (bunch grass)	Muhlenbergia rigens	above joint only - used as willow-core for coiled basket, especially caps	Cov:358; K:591; Dv:78	Dr:20	Dr:20	Dv:78
willow	Salix lasiandra	coiled basketry, arrow shaft (simple), twining fiber	CoV:359; K:591; Kk:77; Dv:78;Kn	L:106; Br:23; Dr:20		Dv:78
devil's claw	Proboscidea althaeifolia	pod's horns black for basket patterns (coiled and twined)	K:591; Kk:78;Kn	Vv:16		
bullrush, tule	Scirpus sp.	roots, black pattern for coiled basketry	K:591; Kk:78; Dv:78;Kn	L:108	Ben:385; K:618	Dv:78
Joshua tree	Yucca brevifolia	inner root, red pattern for basketry (coiled and twined); cordage, especially for rabbit skin weaving	Kk:78; Cov:355; Dv:78;Kn	B:23; Laird:108; Vv:16	Dr:21	Dv:78
squawbush	Rhus trilobata	shoots for warp and woof of basketry	K:591; Kk:78; Cov:358		Ben:387	
arrowweed	Pluchea sericea	a layer under the mud to cover sweat lodge; arrows, unpointed	K:591	Dr:16	Dr:16	
juniper	Juniperus osteosperma	trunk or large limb for bow	K:591; CoV:359			
wild hemp	Apocynum cannabinum	cordage, bowstrings	K:591; CoV:361	Vv:12	Ben:388; K:615	

TABLE II
PLANTS USED FOR RAW MATERIALS

COMMON NAME	LATIN NAME	USE	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
reed	*Phragmites vulgaris*	arrow shafts	K:591; Dv:71	L:107		Dv:71
sagebrush	*Artemisia tridentata*	foreshaft for compound arrows, brush for house construction	K:591; Cov:359; Kn	L:107		
rush	*Juncus* sp.	basal stem for light brown decoration on coiled basketry	Kk:78		Ben:387; Dr:21	
cottontop	*Echinocactus polycephalus*	thorns used as hafted-awl for basketry	Kk:83			
creosote bush	*Larrea tridentata*	resin for hafting tools	K:84			
mulberry	*Morus* sp.	light color for coiled basketry		Bt:23		
cottonwood	*Populus fremontii*	poles for house construction		L:106		
		arrow shafts (required heated stones to straighten)		L:107		
wild grape	*Vitis arizonica*	vine for tying		L:107		
agave	*Agave deserti*	fiber for sandals, cordage			Ben:389	
milkweed	*Asclepias* sp.	cordage	Dv:79			Dv:79

TABLE III

ANIMALS USED

ANIMAL	LATIN NAME	USE-PREPARATION	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
eagle (golden)	Aquila chrysaetos	feathers, ceremonially	K:590-1	L:115	Ben:377	
cottontail	Sylvilagus audubonii, S. nuttalii	meat, robe materials	K:591; Sd:90; Kn	K:597; Dr:7; L:112	Ben:375; K:615; (B:58); Dr:7	
jack rabbit (black-tailed)	Lepus californicus	meat	K:591; Kn	K:597; L:112	(B:58)	
wood rats	Neotoma sp.	meat	K:591; CoV:352; Dv:62;Kn	K:597; Dr:7	(B:58); Dr:7	Dv:62
kangaroo rat	Dipodomys sp.	meat	K:591: CoV:352; Kn			
lizards	Sceloporus sp., Cnemidophorus sp., Gerrhonotus sp.	meat	K:592; CoV:352	K:597; L:116; Dr:8		
bighorn sheep	Ovis canadensis	meat - chief big game - horns boiled for glue	K:592; CoV:352, 361;Sd:84, 90; Kn	L:112	(B:57)	
common red-shafted flicker	Colaptes auratus	feathers used for basket decoration - salmon tan	Kk:78;M:8; Kn		Ben:391	
Gambel's quail	Lophortyx gambelii	meat	CoV:352; Kn	Dr:7; Vv:17	(B:60)	

TABLE III
ANIMALS USED

ANIMAL	LATIN NAME	USE-PREPARATION	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
chuckwalla	Sauromalus obesus	meat	Cov:352	L:116	(B:61)	
blacktailed or mule deer	Odocoileus hemionus	sometimes caught - meat, sinew for bow backing and bowstring	Cov:352; Sd:90; Dv:62	L:112; Dr:7	Ben:379; (B:57); Dr:7	Dv:62
insect scale	Carteria larreae	deposits amber on creosote bush, used as glue, especially attaching arrowheads	Cov:361			
coyote	Canis latrans	eaten in extreme famine		L:111		
antelope	Antilocapra americana	a major big game animal		L:112	(B:57)	
desert tortoise	Gopherus agassizi	meat	Dv:62	L:116 Dr:8	(B:61)	Dv:62
black spider	(Arachnidae)	bite used as counterirritant in shamanistic cures			Ben:385	
squirrels	Spermophilus sp., Sciurus sp., Ammospermophilus sp.	meat	Kn		(B:58)	
chipmunks	Eutamias sp.	meat		Dr:8	(B:58)	
ducks	various	meat, and probably eggs	Sd:88		(B:60)	
rattlesnakes	Crotalus sp.	meat	Dv:62		(B:61)	Dv:62
ants	(Formicidae)	meat			(B:61)	
grasshoppers	(Acrididae)	meat	Kn		(B:61)	

TABLE III
ANIMALS USED

ANIMAL	LATIN NAME	USE-PREPARATION	KOSO	CHEMEHUEVI	SERRANO/ (CAHUILLA)	KAWAIISU
cicada	(Cicadidae)	meat	Kn		(B:61)	
cricket pupae	(Gryllidae)	meat			(B:61)	
moth larvae	(Lepidoptera)	meat			(B:61)	
fox	*Vulpes* sp. *Urocyon* sp.	hide	Dv:62			Dv:62
bear	*Ursus* sp.	not sought - hide, sometimes meat	Dv:62			Dv:62
mountain lion	*Felis concolor*	not sought - hide	Dv:62			Dv:62
bobcat	*Lynx rufus*	not sought - hide	Dv:62			Dv:62
crow	*Corvus brachyrhynchos*	feathers	Dv:62	Dr:8	Dr:8	Dv:62
great horned owl	*Bubo virginianus*	feathers	Dv:62			Dv:62
gopher	*Thomomys bottae*, *T.* sp.		Dv:62	Dr:8		Dv:62
dove	*Zenaida macroura*		Kn	Dr:8		
non-poisonous snakes	various		Dv:62			Dv:62
caterpillars	various		Kn			Dv:62

REFERENCE ABBREVIATIONS

KOSO

CoV	Coville	1892
Dv	Driver	1937
K	Kroeber	1925
Kk	Kirk	1952
Kn	Knack	1978
Sd	Steward	1938

CHEMEHUEVI

Bt	Bartlett	1938
Dr	Drucker	1937
K	Kroeber	1925
L	Laird	1976
Vv	Van Valkenburgh	1934

SERRANO/(CAHUILLA references in parentheses)

Ben	Benedict	1924
Dr	Drucker	1937
K	Kroeber	1925
(B)	Bean	1972

KAWAIISU

Dv	Driver	1937
K	Kroeber	1925

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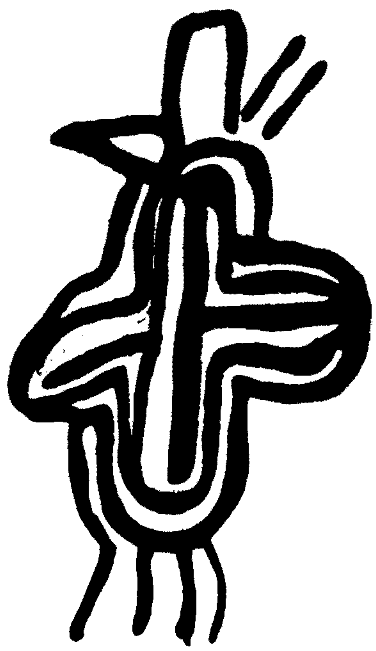
HISTORY OF THE AMARGOSA-MOJAVE BASIN

by

Elizabeth von Till Warren



PACHALKA SPRING PETROGLYPH (NO SCALE)

Chapter I: Introduction

The forbidding character of the planning units comprising the subject of this study long protected them from significant intrusion by non-native peoples. In few other regions of the American West has the climate, topography and geography played so important and direct a role in its development. Only in the second half of the 19th century would the area attract any non-Indian settlers, and then mainly for brief periods of mining activity, or to construct a railroad. When the mines played out or the mineral was devalued, most of the small communities they supported died also. The railroads that served them declined and finally discontinued as well.

In the early historic period, between 1776 and 1880, only agriculture or precious metals attracted Spanish-Mexican and American settlers. The Amargosa-Mojave Basin region lacks sufficient water supply to make farming profitable. Stock ranching was a risky business that required thousands of acres of brushlands for the herds or flocks based at a small "home ranch." Very few of these could succeed in the northern and central Mojave Desert region.

Much of the history of the region turns on its use as a corridor. It is this characteristic that makes the region's history so difficult to deal with--few communities of any time depth, and many ephemeral developments. Before the first whites arrived, Indian traders and couriers traversed the territory bent on their own commerce and communication. In the early 19th century, following the ancient Indian trails "discovered by fur trappers," Mexican caravans began to ply the old Mojave Indian trade route between Needles and the Mojave Sink, and occasional use was made of the more northerly route later designated the Old Spanish Trail. Within 100 years, wagon roads, railroads, and modern highways superseded this early traffic. Many of the early settlements and mining camps were linked to these routes and stimulated by their development. Railroad lines which were dependent on these ephemeral developments declined when the towns died.

Communication corridors were developed also via telegraph and telephone transmission lines; power was transmitted over the network of giant lines stretching from the Colorado River to coastal southern California, but these developments had little direct impact on the region itself. Military activity in the mid 19th century began with exploration and scientific investigations, diverted into an offensive stance against hostile Indians, and subsided in the late 1870's. This portion of the Mojave would become important to America's military developments and posture only near the mid 20th century, with the opening of various military camps for training and weapons research which required large stretches of relatively uninhabited, isolated land.

The hot, dry climate attracted health seekers at the Zzyzx and Tecopa Resorts. In Death Valley, outside the boundaries of this study but very influential in it, scenic values finally triumphed over mining and culminated in the creation of Death Valley National Monument in 1933. Numerous recent proposals for preservation of important portions of the desert have been presented. Developing awareness of the fragility of the desert and its irreplaceability has become the concern of increasing numbers of Americans. A new movement is underway to declare the great, virtually untouched eastern Mojave a new national park. A portion of the proposed park is located in the Kingston Planning Unit.

Management of the region has largely consisted of permissive policies established by the United States Grazing Service and Government Land Office. The Bureau of Land Management was given the desert lands to manage in 1946, but only in recent years has there been an attempt to systematically gather data relative to the cultural resources of the area and the impact of management policies on these non-renewable resources. This study, which is a part of this recent effort, will provide a framework of historic development so that the policy makers may operate in an informed context. It is intended that determination of which areas to set aside, in which to allow mining, construction of utilities, urban development, or other activities may be made more sensible with the information contained in this report. The intent is to provide a tool for the wise use and management of the nation's public desert lands.

Chapter II: Corridors of Travel

A. Spanish 1540-1822

For the Spanish, who claimed the interior California desert lands but never occupied them, the Mojave Desert was virtually unknown. With the unsuccessful expeditions of Coronado and Alarcon in 1540, all these deserts were written off as the lands of "Northern Mysteries" (Cline 1963). Finally in 1776, Father Francisco Garces, guided by two Mohave Indians, passed through the region, thereby guaranteeing himself a firm niche in California history as the "first" to make the trip. Garces was guided along one of several Mohave Indian trails through the dry region between the Mojave River sink and the Colorado River (Casebier 1975; Coues 1900; Wood 1969; Van Dyke 1927). The precise route taken by this intrepid padre is still a matter of some discussion. Dennis Casebier is now undertaking a new analysis of the Garces diary. His new research may be able to detail the trip more accurately than previous writers, and should be consulted when available.

Garces's knowledge of the Mohave Indian route died with him in the Yuma Massacre of 1781. Disheartened by the extraordinary difficulties of maintaining frontier outposts along the Yuma route, by far the best known land route between California and the Spanish settlements in New Mexico and Sonora, the California officials decreed in 1786 that the borders would be closed to further travel across the desert (Forbes 1964). Not only was the Yuma route affected by this decree, but the Mohave Indian trail as well. In fact, during the Spanish hegemony, it appears that no further attention was paid to this route other than one punitive expedition by Gabriel Moraga in 1819 (Forbes 1965). Moraga managed to penetrate only one day's journey beyond the Mojave Sink (Forbes 1965; Casebier 1975; Bancroft 1885; Martinez 1819). The desert's lack of water and grass to sustain his animals defeated Moraga only 70-80 miles from his assigned goal, the Mohave Indian villages at the Needles.

There are two rock carvings reported from the North and East Mojave region that bear dates within the period of Spanish occupation. One is found southeast of the China Ranch near Tecopa, California. The inscription, now vandalized and changed, originally read "AQUI ANO" and below the partial date "170" (McKinney 1971). East of the units under study here at a point not far south of the "Old Government Road" between Rock Spring and Paiute Creek, a variant of the old Mojave Trail (Casebier 1975), there is another alleged Spanish inscription: "Agua 1751." This site has been identified in the San Bernardino County Museum archaeological files as SBCM 1049B, and was reported by McKinney to museum authorities.

It is highly improbable that either of these dates was made by unknown explorers in the years inscribed on the rocks. First, a check of Spanish calligraphy of the period reveals that the use of the stroke through the digit 7 was not found until the 19th century, and prevails throughout the 20th (Cappelli 1973). Second, there is absolutely no documentary evidence of any expedition moving through these two desert localities at such early dates. Both of these dates are earlier than the first known Spanish foothold in California--the San Diego Mission of 1769. The only earlier explorer who might have penetrated to a point within striking distance of these sites was Father Kino of Arizona. His northernmost entrada into the California desert was to the Colorado/Gila junction in the year 1699-1701. Forbes reports a trip in 1750 by Jesuit priest Jacobo Sedelmayr that might account for the inscription near Paiute Pass (1964:103). Sedelmayr and Ignacio Keler explored to the Colorado River area in 1744, 1749, and 1750. The priests were accompanied by soldiers and native guides. (Forbes does not identify which natives, but apparently they were Quechans. Forbes' article also does not reveal if the explorers pushed beyond the Blythe region.) On the last expedition, three horses were lost on the Colorado and the Quechans recovered and returned the animals to Sonoitac in 1751 (Forbes 1964:103). However, it is not at all clear:

(a) why the Quechan Indians who recovered the lost horses for the Spanish would find the animals so far north of the expedition route, which terminated at the Colorado end of the Maricopa trail from San Bernardino;

(b) why the horses would not have been killed and eaten, the usual fate of these animals at the hands of Indians during the period;

(c) why Quechans would inscribe Spanish words on rock faces at all, since writing was not a traditional mode of communication, and certainly not writing in Spanish. Quechan Indians would not need to communicate to other Indians the presence of water, as the Mojave Indian route was long established before the Spanish ever arrived.

B. Mexican Period

Mexico succeeded Spain in Alta California following the Revolution of 1821. Throughout the remainder of the decade, however, the Mexican authorities in California were preoccupied with replacing the Spanish. There was scant attention paid to the California Desert, and especially the remoter portions well off the known Yuma Road. Few travelers even traversed the eastern foothills of the Sierra Nevada Mountains, let alone penetrated the uninviting desert to the east. For the Mexicans, as for their predecessors, the Mojave Desert was an unknown region lacking any redeeming qualities, such as gold and silver, and inhabited by "wild" Indians whose presence represented a constant threat to the peace and security of the coastal settlements (Warren and Roske 1978).

The surprise shown by the Mexican governor Echeandia upon notification of the arrival of Jedediah Strong Smith via the Mojave Indian trail in 1826 (Hafen and Hafen 1954; Warren 1974) is thus understandable. Since Garces 50 years earlier, none but Indians had made the difficult journey down the Mojave and across the nearly waterless desert to the Colorado. Smith made the trip twice, both times traveling from east to west only. Much has been written of this pioneer and his two journeys, 1826 and 1827 (Cline 1963; Morgan 1965). With the recent publication of a previously unknown Smith account of his 1826 journey (Brooks 1977), a great many new details are now available.

Smith's journey was followed in August of 1829 by Ewing Young; Kit Carson was a member of this party. Thomas L. "Peg-Leg" Smith also may have used the Mohave Indian trail to California in early 1829, but there is no documentation (Voelker 1971). Warren (1974) discusses the problems of determining the exact routes of these fur trappers. Peter Skene Ogden also made his way between coastal California and the Colorado via the Mojave Trail in 1829-30. Richard Campbell may have used this route (cf. new discussion in Brooks 1977) but no details are available.

Antonio Armijo's commercial caravan from Santa Fe, New Mexico was the first documented to have traveled over a different route between the Colorado and the Mojave River. While given the name "Old Spanish Trail," the Armijo route actually was little used by the commercial caravan traffic from New Mexico. It was rather the path chosen by parties that wanted or had to travel fast: official couriers, horse thieves, and slavers. The effective discoverers of the caravan route that served the commercial traffic between California and New Mexico were William Wolfskill and George C. Yount in 1830-31. Most of the caravans that followed during the Spanish Trail era, 1830-48, used the same trail as the Yount and Wolfskill party. A relatively complete discussion of the Spanish Trail routes and use by commercial and other parties between 1826 and 1848 is found in Warren (1974).

Walkara or Walker, the Ute leader, and American mountain men turned horse thieves used the northern branch of the trail through the northeastern Mojave. Theirs was surreptitious use, planned to avoid detection, and hence there is little documentation (cf. Chalfant 1933:97; Lawrence 1931; Warren 1974; Weinman 1979:176).

The first American emigrants known to have passed over the "Spanish Trail" were William Slover and Isaac Pope, accompanied by their families, and John Wolfskill, brother of the William Wolfskill who had already become established in southern California. Americans Slover and Pope, by then naturalized citizens of Mexico, set out from New Mexico via the Cochetopa Pass and traveled in wagons. This party is the first ever cited as having successfully brought wagons to California across the Mojave Desert. The bulk of the literature on the period attributes the first wagons across the Great Basin to the Chiles party of 1843 (Cline 1963). The Mormons returning to Salt Lake via the Amargosa River routes have been credited with bringing the first wagons across the Mojave Desert. This "honor" rightfully belongs to Slover and Pope.

Another "first" historically is the inclusion of women in the Slover-Pope party (Cline 1963; Warren 1974). Pope and Slover became important citizens of Mexican California. The record of the route is not clear and a determination cannot be made if they traveled via the Needles crossing or the Amargosa River route (cf. Warren 1974:119 for a discussion of this party).

The Antonio Armijo party of 1829-30, the first caravan to complete a trip between Santa Fe and Los Angeles, has been the subject of some discussion in the literature (Hafen and Hafen 1954; Warren 1974; King and Casebier 1976). Norris and Carrico (1978:19) have confused Armijo's route in 1829-30, citing Casebier (1975:31-2) for a change in interpretation so that Armijo was heading toward Kingston Springs. It would be difficult to move Armijo so far south of the Amargosa River, if Armijo's journal account is to be considered (cf. Schmiedel translation in Warren 1974:32-33). Neither could Armijo have traveled south from Las Vegas Wash to Piute Valley, because the 1829-30 diary descriptions do not match that topography. Armijo traveled down the "River of the Payuches" /Amargosa River/ for two days, to the Saltpeter River /Salt Creek/ (Hafen 1954; Warren 1974). Kingston Springs was neither a river nor a creek (Carvalho 1857; Kenderdine 1888). The Amargosa River route still seems the soundest interpretation of that portion of the Armijo trace. Norris and Carrico's interpretation (1978:20), based on Casebier's speculation, thus is erroneous.

A second "alternative" route proposed by Norris and Carrico (1978) is supposed to have entered California

> north of Armijo's route between Death Valley and Shadow Mountain, crossed the Amargosa River, entered Greenwater Valley, skirted the Saddle Peak Hills and linked up with Armijo's route southeast of Saratoga Springs and north of Silurian Lake.

Further, Norris and Carrico state this route was "no doubt used during the 1830-1840 period," and that it was "probably as popular as the more southern route unless travelers came from the Salt Lake area. In later years this route became the Salt Lake-Los Angeles Wagon Road."

The Los Angeles-Salt Lake Wagon Road, usually called the Mormon Road in early years, and later simply the "Salt Lake Road" is well documented over a long period of time. It passed via

Kingston Springs and later Riggs Wash to Mountain Springs Pass in the Spring Mountain Range, Clark County, Nevada (Warren and Roske 1978). Since Norris and Carrico cite no references it is not possible to discuss the sources of their unusual interpretation.

The third "Old Spanish Trail" route described by Norris and Carrico is the Fremont route of 1844. Warren has previously (1974:182) stated that Fremont's route was the path later named the Old Spanish Trail, a confusion begun by Fremont himself. The Old Spanish Trail caravan route, on the other hand, was apparently a modified version of the Wolfskill-Yount trace of 1830-31. Casebier (King and Casebier 1976:286) has confused Warren's statements (1974) regarding the distinction between caravan and other traffic between Santa Fe and Los Angeles. Caravan traffic indeed moved mainly along some variant of the Mojave Trail, following Wolfskill and Yount. Horse thieves, slave traders, and illegal groups that wished to avoid official government representatives leading caravans, took the northerly route. Fremont's rescue of the Hernandez-Fuentes party in 1844 may have been a case of his rescuing just such an illegal group. There are no documents in the California Archives permitting the Hernandez party to leave California, nor record of brand inspection. The securing of such permits by the legally constituted party of 1841, returning to New Mexico in 1842, took well-known leaders Vigil and Rowland several months to accomplish (Warren 1974:147).

Norris and Carrico cite Bard (1973:43) for reference respecting the "first Americans to enter Southern California on an overland trail." The caravan cited by Bard was the Workman-Rowland party of 1841, which for some reason Bard attributed to Given and Toomes, members of the party but not its leaders. Further, Workman and Rowland were not leading just another trading caravan in 1841, but a large party composed of several different groups of settlers destined for California (Hafen and Hafen 1954; Warren 1974). Some Americans had come over the trail to California prior to 1841.

However, the first American settlers over the "southern overland trail" through the northeast Mojave were not Isaac Given and Albert Toomes as cited by Bard (1973:43). Albert Toomes was a member of an <u>1833</u> party that entered California. However, this group did not come by way of the Mojave River, as Bard indicated, but by the Gila River/Yuma route (Warner 1907-8:190). The Toomes listed by Bard is evidently the Juan Toomes noted in the records of the 1841 expedition (Warren 1974:132). The 1841 party passed through the Amargosa-Mojave Basin planning units via the Needles crossing, not the Amargosa. Given was a member of this party.

American familiarity with the "Old Spanish" Trail increased significantly following the passage by John C. Fremont in 1844. Fremont had sought and found the trail where it paralleled the

Mojave River near today's Oro Grande. He moved along it some eight miles past the point he subsequently identified (cf. Fremont 1887:369-76; Jackson and Spence 1970:676-7) as the place where the main trail leaves the river.[1] At that spot, near the future site of Camp Cady, Fremont's party was intercepted by the survivors of an Indian massacre at Resting Springs, some fifty miles to the north. Scouts Gody and Carson backtracked over the trail left by the survivors in their dash to safety, encountering Paiutes in the vicinity of the China Ranch springs (McKinney 1971). Near Resting Springs /close to modern Tecopa/ the unfortunate Fuentes-Hernandez party was found dead, only a small dog left alive in the gloomy camp. Apparently Fremont did not bury the bodies[2] (Brewerton 1930: 93-94).

Fremont's account of this incident was written into the narrative of his 1844 expedition, and consequently the tale was repeated many times by pioneer diarists of this trail (Carvalho 1857; Foy 1930). Fremont's party, guided by the survivor Fuentes, left the planning area by way of an indefinable route toward the northeast, toward the Spring Mountain Range. He may have traveled by way of Tule Spring and Chicago Valley, or headed more northerly from Resting Spring, which he named Hernandez Spring for the family murdered there, and exited via the Nopah Range into the Pahrump Valley of Southern Nevada.

Regarding post-Fremont traffic along the Amargosa Route, there is another important error to correct in Bard's work. On page 44, he cites Edwin Bryant's party as the first known to have crossed into California via this Fremont route. The Edwin Bryant party, however, was one of three in 1846 enticed by Lansford Hastings into taking his infamous cut-off from the Humboldt Trail. The three parties were the Donners, the Russell train, and the Edwin Bryant party. Russell and Bryant teamed up and were led safely through the treacherous cut-off because, before crossing the Great Basin, the group sold their wagons and oxen and bought mules. Free of the need for passage for wagon wheels, the group was capable of faster travel and went through without major incident (Edwards 1978:84). In any event, all three parties traveled across northern Nevada to Donner Pass. Bard has confused Fletcher's description (1929:170) of

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[1]Casebier thinks the Fremont route was the main trail because of the 60 mile jornada. However, it is unclear whose description of the trail Fremont referred to. Fremont had generally unreliable sources (cf. Fremont 1845:398-9) and there is confusion in the literature regarding the caravan trail and that followed by other users (Warren 1974).

[2]It was not unusual in the period for bodies to be left where they fell; many travelers had not the strength nor the time for such niceties, which might threaten their own survival.

Bryant's route, "south of Great Salt Lake" following Fremont, with Fremont's 1844 trip through the Mojave Desert. Actually, the Fremont route mentioned by Fletcher was that of Fremont's third expedition (1845) which passed along the southern shore of the Great Salt Lake (Nevins 1955, I:209).

Following entry of the American military into California in 1845 and the War with Mexico in 1846, Mexican commercial caravan traffic ceased entirely. The last caravan officially recorded was led by experienced guide Francisco Vigil in 1848. It was passed along the way back to New Mexico by famous frontiersman Kit Carson, acting as official courier to the U.S. Government in Washington. Among the dispatches in his pouch was a brief announcement of the finding of gold at Sutter's Mill--the consequences of which were to change the character of California and the West for all time because of the flood-tide of people attracted by the lure of sudden wealth.

While it is not at all certain that the Amargosa River route was indeed the trail of the Spanish caravans, it did become in later years the preferred route of the Mormons between Salt Lake City and San Bernardino. Thus, following the abandonment in 1848 of the caravan traffic between Santa Fe and Los Angeles, Mormon freighting activity resulted in the continued use of this portion of the trail. Their familiarity with the route developed out of the need to connect two distant Mormon communities, Salt Lake City and San Bernardino. Mormon wagon requirements played a key role in determining the ultimate form of the trail. Early diarists along the route plainly followed the Fremont path described in his report of the expedition, and drawn by Preuss on his map of Fremont's travels that was published in 1848 (Nevins 1955:509). By 1855, however, shortcuts were being discovered and broken through for wagons. Carvalho (1857) reported that in 1854 his party was the second ever to pass over the newly opened Kingston Cutoff (and as far as he was concerned, he hoped he never had to pass that way again). Mowry mapped the cutoff in 1855, recommending it as the best road for the U.S. Army to develop (cf. Bailey, L. R. 1965). San Bernardino County freighter, Silas C. Cox, is credited with cutting through a still shorter route in the early 1860's (Ingersoll's Century Annals, 1904). Cox's Cutoff led via Riggs Wash to Mesquite Wells to Crystal Springs (Potosi Townsite, Nevada), and rejoined the earlier version of the road on the east slopes of the Spring Mountain Range, Nevada. A summary of the early development of the Old Spanish Trail-Salt Lake Road is found in Warren (1974), and Warren and Roske (1978).

For a short period in 1851-52, the overland mail between San Francisco and Salt Lake was carried via the Mormon Road under a contract held by Chorpenning. He received permission to use such a circuitous route because it was open to travel year round while the Humboldt route was clogged with snow in the winter (Cleland 1918:62).

Across the southern edge of the Amargosa-Mojave Basin planning units area, the second major Mojave Desert crossing traversed from east to west. This road, the ancient Mojave Indian Trail known at least as far east as the Hopi lands (Armijo diary in Warren 1974), was first traveled by Anglos in 1776. The redoubtable Father Francisco Garces, guided by Mojave Indians from the Needles area, made his way that year to California from the Colorado via the Mojave River to San Gabriel. He returned to the Colorado along nearly the same route a few months later, demonstrating that the trip was feasible for other than the hardy Mojave Indians who traveled along the length of it in only four days (Coues 1900).

The preference of the Santa Fe caravan leaders for the Mojave Trail over the Amargosa River route was undoubtedly because of its superiority in terms of water supply. Indians were not a problem on the 1830 Amargosa route (Armijo in Warren 1974).[3] By the 1830's the Mojaves were causing major trouble. Smith lost ten men in 1827 after J.O. Pattie had skirmished with them earlier in the same year. Despite the Mojave Indian threat at Needles, caravans continued to cross at Needles throughout the 18 year period of caravan usage. Availability of water must have overridden considerations of safety from Mojave attacks.

The Mojave Trail water holes were nearly all about one day's travel apart and the water was usually potable. The northern or Amargosa trail, as first traced, featured several dry camps, jornadas of 45-50 miles, alkaline or saline water and other disadvantages. Cheesman (Foy 1930:296) saw carcasses of a Santa Fe-bound pack train that had "mired down /in mud of a "dry" lake?/ and perished on the northern route. Few caravan leaders would try to take their valuable cargoes on such a risky route. Since all travel across the Mojave was precariously carried out by mule, horse and burro in the period 1826-48, the certain availability of water along the Mohave Trail was the most important factor in determining not only the route itself, but the preference for its use. The Mohave trail was somewhat longer than the Amargosa route, but more extensively used nonetheless by traffic between Los Angeles and Santa Fe between 1830 and 1848.

C. American Period 1849-1899

Gold Rush

California-bound gold rush travelers usually chose the northerly Humboldt Trail which would deposit them directly in the Mother Lode country. The southern route, via the Utah and Nevada portions of the Old Spanish trail and Fremont's

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[3]This picture changed by 1844, as Fremont's experience attests. Between 1830 and 1844, the numerous caravans had caused severe pressure on Southern Paiutes, victims of slave raids (Bailey, P.D. 1954; Smith and Walker 1965).

path, was used during the first years of the period by gold seekers who arrived in Salt Lake City too late to make the trek across the Great Basin and over the Sierra Nevada Mountains before the heavy snows of winter. By 1849, two Mormon parties had laboriously made their way across the Mojave between San Pedro and Salt Lake City (Cline 1963; Tyler 1964). The eager gold seekers of 1849, facing the prospect of spending a dreary winter in Salt Lake City, convinced Jefferson Hunt to guide them to California over the southern route. The adventures of this mixed party of late Fall, 1849 have been covered in the literature in greater detail than usual because groups which split off from the main party stumbled into a valley of extraordinary features which nearly caused the demise of all of them. Death Valley was the name later bestowed on this geologist's paradise (Palmer 1948:1). Hunt and his party made it through via the Las Vegas Valley-Amargosa River route to California without any trouble and were joined in Southern Nevada by one of the original dissidents, Sheldon Stoddard. Another splinter group, the Wade party, unknowingly followed the Armijo trace when they exited Death Valley via the southern end, passing through the planning units along the Amargosa River, Salt Creek, Silver Lake and up the Mojave River drainage (Long 1950). Little use of the Amargosa River ("Old Spanish Trail") route was made by later gold seekers, possibly deterred by the difficulties reported for wagons on this route. The far more popular alternate to the Humboldt Trail was the Yuma route easily reached via Santa Fe and the Gila River (Foreman 1968).

Exploration and Survey

The record of travel through the planning units has been compiled by Warren and Roske (1978) for the period 1776-1880. A map of these trails is on file with the Bureau of Land Management in Riverside. That study focused on development of the trails and accounts of travel by official parties of exploring, scientific, military, railroad, boundary, geographic and wagon road surveys. Part III contains a compendium of 88 separate trips across the Mojave Desert made by unofficial travelers. A summary of the significant expeditions is included below. "Significant" trips are here judged to be those that had important influence on the development of travel, the establishment of boundaries, or increasing the knowledge of the character of this portion of the desert. The reader is referred to the earlier work for more complete treatment of the subject to 1880.

The exploring, scientific and railroad survey expeditions dispatched to the Mojave Desert beginning in the 1840's (e.g. Fremont's 1843-44 expedition) were sent out under the auspices of the U.S. Corps of Topographical Engineers. They were authorized by Congress to explore, survey, and map the western territories of the United States. Some of the best minds in the country were put to these tasks, for the organization was composed of the highest-standing members of each graduating class at West Point (Warren and Roske 1978:IIa). The fine work completed by this "brain trust" immeasurably added to the body of scientific knowledge about the desert, provided the army with information on possible wagon road routes, established U.S. boundaries, and produced volumes of detailed information on possible railroad routes across the west.

Captain Fremont's exploring trip of 1843-44 was undoubtedly the most influential through the planning unit in the period to 1880. The report,produced as a result of his exploration, was published simultaneously by both houses of Congress in 1845. Twenty thousand copies of this report were distributed to the literate public. After 1848, the Fremont-Preuss map was also made available by the government for public use. The information and map were seized upon by publishers of guides to the West for the hordes of emigrants departing for the gold fields of California (Warren 1974:157 n. 75). While other exploring expeditions of the period to 1880 were also very important in the history of the region, no other report was made so widely available to the public nor served their immediate needs so well.

Railroad Surveys

Following the acquisition of the territory from Mexico in 1848, it soon became imperative to join together the two coasts of the nation by both wagon and railroads. Throughout the 1850's hot battles waged in Congress about the route the U.S. would subsidize. Information on the potential of the various routes through this portion of the desert was provided by the surveys listed below.

The Amargosa-Mojave planning units were visited by Lt. R.S. Williamson in 1853 (1867). Williamson's party traveled down the Mojave to its sink and followed the chain of dry lakes northward to the vicinity of Death Valley. He demonstrated conclusively thereby that the Mojave River was not a tributary of the Colorado River as had previously been supposed, but of the ancient drainage system of Death Valley.

Lt. Amiel Weeks Whipple's party, guided by trapper Antoine Leroux, crossed the Colorado River also in 1853 from the east at Needles and proceeded west along the Mojave Trail through the study area (Foreman 1941). This portion of the journey was led by an exceptionally knowledgeable Mohave Indian guide who took this large party by a different, better watered route than the Indians normally used so that the expedition would not suffer from lack of water. The slight variations of the Whipple party from the later established Government Road are covered in Casebier (1975:54). The descriptions of the country, and the modification of the trail for the Whipple wagons, are the main contributions of this expedition. A fine description and drawings of the route were also made by the expedition's artist, Heinrich Baldwin Mollhausen (1858).

After the Civil War, which interrupted the Congressional discussions about railroads, a decision was finally made to subsidize a line from Springfield, Missouri to the Pacific Ocean. The Atlantic and Pacific line was surveyed in 1868 by General William J. Palmer (Bell 1870; Palmer 1869). The route he mapped out was so well surveyed that the actual construction varied from the line in only a few places.

Survey records for later railroad lines are not available in the archives. Two major routes were built after the turn of the century, although they had been envisioned prior to it. The San Pedro, Los Angeles and Salt Lake line, predecessor of the Union Pacific through the Mojave Desert, was completed and open for business in May 1905. Survey teams and construction crews had been busy in the desert since 1900, however. Complicated financial and political haggling held up the completion of the first line to traverse the central Mojave. In 1907, the famed Tonopah and Tidewater finished its line from Ludlow on the A & P via Death Valley Junction to Beatty, Nevada, opening still another new region to less sturdy miners, travelers and settlers than had previously penetrated these remote regions on foot, horseback or buggy. The impact of these lines and the small feeder lines built to serve mining camps of the region has been assessed by Roske in Brooks, Wilson and Brooks (1978), Bard (1973), Myrick (1963), Norris and Carrico (1978), and King and Casebier (1976). This writer sees little point in reiterating the analyses. The impact on development of certain camps and townsites will be included in the settlements and mining camps section.

Boundary Surveys

The boundary with Mexico was an important political problem that was given attention in 1849, when Emory, Whipple and Bartlett began their survey of the southern border of California. It was not until 1861, however, that anyone got around to defining the eastern border of the state above the Colorado River. The Colorado River was designated as the border between Arizona and California, so there was little problem in recognizing who had jurisdiction in that region. The long, oblique line that was described in the 1850 charters of the State of California and the territories of Utah and New Mexico proved far more difficult to identify and mark. Four different survey teams passed through the Amargosa-Mojave Basin planning units in the course of conducting boundary surveys.

The first was led by Dr. J.R.N. Owen, with Edward Beale accompanying on his famous camels. The surveyors traveled through the planning units along the Mojave Trail to Fort Mohave in January 1861. On February 13, 1861, it left for the north, moving out along first the Mojave Trail stops, then pushing more northerly until they intercepted the Nevada camp of Potosi. From here they pushed out over the Fremont Route, stopping at Stump Spring. They then moved into Death Valley via Furnace Creek Wash, passing the 49ers tracks, and stopped at Furnace Creek. Lack of water forced abandonment of the survey at this point. The party returned to Los Angeles. They left the area via a different route from their entry and passed out of the planning units (Farquhar 1966; Whitney 1865).

Again in 1863, an attempt was made by Butler Ives, J.F. Houghton and J.F. Kidder to complete this boundary survey. The work was only partly completed, however (see U.S. Treasury Department 1901:267-8) with the point of stopping at the Mt. Diablo Base Line. Consequently, in 1865, James S. Lawson ran an additional 70 mile survey along the border (U.S. Treasury Department 1901:270). When problems developed in using these surveys, still another was done. Alexis Von Schmidt resurveyed the boundary in 1872 and 1873, marking the border with stone monuments rather than the wood stakes previously used (U.S. Treasury Department 1901:275-76). These markers are still in place and occasionally a wooden marker is discovered from earlier survey. Surveyors using modern instruments have now determined there is an error in the Von Schmidt survey of up to 3/4 miles in favor of Nevada. While no new boundary survey is yet planned for the entire border, California has recently challenged the State of Nevada in the courts for possession of Lake Tahoe's eastern shore because of this error. The potential remains high for court action to correct this surveying error. Disruption from this source would be minor in the Amargosa-Mojave Basin Planning unit; mainly, more of Death Valley Monument's northeastern portion would be taken into California if the border were changed in favor of California.

<u>Geological Surveys</u>

In the 1860's, the State of California launched a geological survey ambitiously intended to cover the entire state. The survey was to study and map all of California, with particular attention to possible precious metal deposits. (Understandably, higher interest was shown by California in these possibilities, as the Mother Lode began to lose its first importance and Nevada was enjoying the boom of the Comstock.) At the same time, the U.S. Army continued its appointed job of exploration. Few of these activities actually brought these intrepid scientists into the study area.

In 1867, the Army and California State Geological Survey forces were combined, as the army was short of funds that fiscal year. Lt. Charles Emil Bendire's party escorted William M. Gabb's surveying party from Independence, California across to Resting Springs via the Leach's Point Road. The party continued past Death Valley to Oasis Valley, Nevada and returned. This was the only official party to travel this road in the decade. The road from the Owens Valley road to the Death Valley area had been broken through by miners headed for the Amargosa District from Visalia. The report is found in the Report of Bvt. Lt. Col. R.S. Williamson to Brig. General A.A. Humphreys (1867).

Several of the sorties of Lt. George M. Wheeler's famous "Surveys West of the 100th Meridian" were conducted through the Amargosa-Mojave planning units. In 1871, two divisions, one led by Wheeler and the other by Lt. Daniel Alfred Lyle, penetrated the study area in Death Valley and vicinity. The 1871 expeditions were plagued with misfortune. Two guides, locally well-known in the Owens Valley area and very familiar with the desert and desert travel, were lost on these trips. Wheeler and Lyle were always suspected of having deserted the two men (Chalfant 1933), and their disappearance gave the army leaders an unfortunately bad reputation for some years. The areas explored by the two parties included Grapevine Canyon in the north end of Death Valley, Death Valley and Furnace Creek, Ash Meadows and Cottonwood Springs in Southern Nevada. Lyle's party also crossed the Visalia-Amargosa Road, and turned down the "old California trail" to Ivanpah. From Ivanpah he moved on to rendezvous with Wheeler at Cottonwood Springs, a short march across Mesquite Dry Lake and up the Mormon Road previously described in this paper. The reports are found in Wheeler (1872 1889), and Dorothy Cragen (1975) has a fine analysis of the Wheeler movements and the reaction of the local Owens Valley population to the loss of Hahn and Egan.

In the late fall of 1875, Wheeler sent a division back to Death Valley to study and survey the inhospitable region. The party, led by Lt. Rogers Birnie, Jr., established a base camp at "bellerin' Tex" Bennett's Greenland Ranch in Death Valley (possibly thereby hastening the day that Bennett would take off for less populated regions (Lee 1963). From this base camp, a pleasant oasis of trees, shrubs and irrigated crops established in the early 1870's, Birnie's men fanned out to survey in all directions. Reports and accounts may be found in Wheeler (1876, 1889), Palmer (1940, 1948), and Cragen (1975).

Throughout the 1850's and 1860's, there was much Indian raiding along the newly opened trails through the desert. Mails, emigration and commerce were all interrupted by the nearly constant attacks. Casebier's study of the Mojave Road (1975) and of the "Pah-Ute Campaign" of Major James Henry Carleton (1972) illustrate quite vividly the dimensions of the problem and the military response. The activities of Carleton's men throughout this period had a long-lasting impact on the Amargosa-Mojave Basin planning units because of the construction of several redoubts and camps at important watering holes along the Mojave Trail and the Mormon Road. Small structures were built at Soda Springs (see below), Bitter Springs (just west of the boundary of the study area), at Rock Springs, some miles to the east of it, Resting Springs, and Marl Springs (Casebier 1973). These buildings were used by travelers after the troops were withdrawn in the late 1860's.

Wagon Road Surveys

Undoubtedly one of the oldest wagon road surveying parties ever to be fielded in the Mojave Desert was the 1857 camel expedition of Edward F. Beale which traversed the Old Government Road through the study area. Unfortunately, however, Beale did not include the Mojave Desert portion of the trip in his report to the Secretary of War (1857). While Beale was convinced of the utility of camels in making desert crossings, few of his peers were similarly persuaded and the ordinary miner and horse wrangler were definitely convinced otherwise. The army finally disposed of all the animals at auction. They were purchased by suppliers of salt and other commodities and were in use for many years in Nevada where they carried such goods to mining camps. The camel experiment is well documented and the literature easily available (Bonsal 1912, Lesley 1924). While its permanent impact on the area was minimal, the strange beasts and their handlers have provided many writers with material and desert residents with tall tales.

While the federal and county governments spent considerable sums of money on desert road survey and construction and water resource development along them in the 1850's and 1860's (Casebier 1975; Cleland 1918) major work on the roads by the state and federal agencies would come in the 20th century. Bard includes some information on this topic in his 1972 thesis. However, a new work by economist Gerhard A. Fenzke (in press) examines the full story of the development of California highways between 1895 and 1945. Water resources along the early routes of travel were mapped, analyzed, and information about them published by the United States Geological Survey. These materials will be included below in discussion of 20th century developments.

Scientific Expeditions

The U.S. Geological Survey was established in 1879. Charged with examining "geological structures, mineral resources and products of the national domain" the competing and overlapping survey activities of the Departments of the Army and of the Interior were brought to an end. Lt. Wheeler had to leave the field of geographical reconnaissance to his arch-rival, John Wesley Powell. Thereafter the U.S. Geological Survey fielded teams of scientists and engineers to collect detailed data about the nature of the Desert West.

The fascination of Death Valley and the strange flora and fauna of its environs drew another multi-disciplinary study team to the area in 1891. This group, sponsored by the U.S. Department of Agriculture, was led by C. Hart Merriam, newly appointed Chief of the Division of Ornithology and Mammalogy. Other members of the party included Frederick Vernon Coville, botanist, and a young reporter for the New York Sun, John R. Spears. The record of the trip, which produced much new information on life forms in the region, was to be published in two parts. Part II was issued in 1893; it contained the special reports of the different scientists who comprised the party. Unfortunately, Part I was never published, and so the historian has lost the data of special interest to regional history. The historical record lacks the expedition's itinerary and their general description of the region. Discussion of life zones, botany and other works were published separately (e.g. Coville 1892). Part II was published under the auspices of the U.S. Department of Agriculture in 1893 (Fisher, A.C. et al.). The map of the expedition's routes was also made available in the publication of Part II, section 8 (Palmer,T.S. 1893). Spears published a remarkable Illustrated Sketches of Death Valley and other Borax Districts of the Pacific Coast on his return from the desert. The volume contains much invaluable material about the desert including photographs of its nature and inhabitants in 1891 (Spears 1892).

In the 20th century scientific interests continued to lure specialists into the region of the Amargosa-Mojave Basin planning unit. The fledgling science of archaeology was represented by Malcolm J. Rogers, with his important early study of sites in the Mojave Sink, Alice Hunt in Death Valley, and William and Elizabeth Crozier Campbell collected materials around the Pleistocene lake beds. Charles B. Hunt, husband of Alice, conducted geological surveys of the Death Valley region. Bennie Truxell has also made significant contributions. Dr. Carl T. Hubbs, ichthyologist at Scripps Institute of Oceanography, conducted work on early fishes of the region. The list continues to grow as the work of training students goes on at the nation's universities. More and more persons are now turning their attention to the resources of this still remote, still forbidding region in an effort to provide the base data needed by the Bureau of Land Management, National Park Service and other federal agencies for plans to manage the vast area.

Commerce

Coincidentally with the commencement of gold country-bound traffic through the northeastern Mojave, a more prosaic but longer lived stream of wagons began to ply between the Mormon commercial center of Salt Lake City and their Southern California settlement. The port of San Pedro was an important source of goods for the Mormons in Utah, and converts who arrived in Southern California by ship from Europe would embark on the overland trip eastward across the Great Basin from San Pedro via the northeastern Mojave.

The southern trail via Las Vegas, Nevada (then in New Mexico territory), the Amargosa River and Bitter Springs was an all-year route of travel, open in the winter when the preferred northerly Humboldt Trail was clogged by snow in the Sierra Nevada Mountains. Summer was the period of greatest hardship on the southern route, because of the extreme temperatures and lack of water on the trail. This seasonal pattern jibed well with the farming cycle of the Mormons, who could put their otherwise idle teams to gainful employment in freighting during the winter months when agricultural activities were suspended.

Throughout the period 1850-70 the region comprising the study area was used primarily as a corridor between Southern California and Utah. Phineas Banning, noted freighter of Southern California, began to run teams to Salt Springs in the early 1850's (Beattie and Beattie 1939:198). Wagon traffic began to grow significantly between Salt Lake City and San Pedro following the establishment by the Mormons of the town of San Bernardino. In late 1855, numerous wagon trains plied the Mormon Road between coastal California and Salt Lake City (Guinn 1907: 215). These trains were able to make a safe rest stop to recruit men and animals at the newly established Las Vegas Fort in today's southern Nevada. Freighting was very important to the local economy in San Bernardino. One of the region's foremost freighters, Silas C. Cox, listed 43 residents of the valley who were engaged in freighting "on a large scale between Los Angeles and Utah, Idaho and Montana by way of Cajon Pass" (Beattie and Beattie 1939:419). Cox's name is memorialized in the name of a cutoff from the old Kingston Springs route which was first broken through in 1854 (Carvalho 1857) and mapped by Lt. Sylvester Mowry in 1855 as the best route between Silver Lake and Cottonwood Springs (Bailey 1965).

According to Beattie and Beattie, freighting continued through the region throughout the Civil War until 1869, when the transcontinental railroad was completed. While there may have been some decline in the number of teams moving through the region, freighting continued as the main form of transportation through the region even after the construction of the Atlantic and Pacific (later Santa Fe) lines in 1883, and the newer Salt Lake Line (now UPRR) in 1905. Freighting routes changed to terminate at convenient stops on the railroad, but freight wagons drawn by horses and mules were the important means of transport throughout the region until replaced by trucks in the early 20th century.

A significant new road was opened in the 1880's between the Death Valley area and Daggett. The new road traveled northeast from the Mojave River via Garlic Springs and Cave Springs to Saratoga Springs (Belden 1957b). An excellent description of travel along this short route to the borax mines and the upper Amargosa River Valley is contained in T.W. Brook (1971) and in Spears (1892:132-149). This road became an important desert route but in the early 20th century a shorter route was built which caused the Cave Springs route to fall into disuse (Belden 1960b).

Traffic through the southerly portion of the study area moved along the old Mojave Indian Trail, later the "Government Road." A very complete picture of the activities along this route is available in Casebier (1975). While only occasionally traveled in the 1850's, certainly an important share of the freighting traffic moved from Cajon Pass along this trail to the 1860's, after the establishment of Fort Mojave with its need for provisioning. Simultaneously, gold mining was developed in Nevada's El Dorado Canyon along the Colorado River, and use of wagons to serve that camp was also an important activity. Freighter Phineas Banning's men dug the first well at what was later called "Government Holes" during this period (Casebier 1975:119). In 1861, a ferry opened at Fort Mojave, with regular freight service to Arizona, further stimulating wagon traffic along the Mojave Road. Hardyville, Arizona, founded in 1864, with its ferry, also competed as a supply center for some years (Bard 1973:50).

Chapter III: Nineteenth Century Settlements

A. Mining

1. Salt Springs

Settlements in the Amargosa-Mojave Basin area of the Mojave Desert were slow to be established. The region is so desolate, so difficult to traverse, and offers so little in the way of agricultural potential, that for many years it was merely a corridor between more desirable localities. Mining activities stimulated the first settlements, most of which were very ephemeral. The earliest Anglo settlement was a small gold mining camp at the mouth of Salt Creek on the Amargosa River. The gold was discovered in December 1849 by Addison Pratt and others, members of the 1849 Jefferson Hunt wagon train to California (Pratt diary in Hafen and Hafen 1954:95-6). In late 1850, work was being conducted by a company from San Jose, California (Cheesman in Foy 1930:296). A sheriff of San Jose and a Mr. Yount were part of the group (Foy 1930:296). Andrew Sublette, brother of the famous mountain man, Ben Sublette, was reported to have been connected with this company between 1850-52 (Belden 1960c) and a nephew of Aaron Burr, also named Aaron Burr, was likewise interested in the Salt Springs mine. Captain W. B. Sanford, brother-in-law of freighter Phineas Banning of San Bernardino area, held still another interest in the mine (Beattie and Beattie 1939:331). A small mill was brought to the site in 1851, but following an Indian attack the place was abandoned (Heap 1957). Shortly thereafter, the mill was dismantled and taken to Holcomb Valley where it was used to power a sawmill (Beattie and Beattie 1939:198). The remains of this camp were noted by later travelers (Heap 1957; Mowry in Bailey 1965).

In 1863 the Amargoza /sic/ Mining Company was organized to mine in the Salt Spring District for gold and silver (Daily Alta California 17 Feb. 1863, in Casebier, June 3, 1974). This operation was still briefer (Rousseau 1958). However the mine was operated sporadically until the 1930's (Belden 1958, 1960b; Paher 1973:20). Mendenhall's description of the camp includes the physical layout, the condition of the water supplies, and the ruined state of a 20 stamp mill (1909:48-9). There were no people at the site. Belden reported that the bodies of "unidentified miners massacred by Indians" are buried at the site. This should be field checked. The remains allegedly lie near a cabin, still standing in 1960. The area later was generally termed the Resting Springs District (cf. Daily Morning Argus 1877, various).

While this camp was occupied only intermittently, it nonetheless holds the rank of first in the Mojave, and therefore is deserving of special merit. Other equally ephemeral mining camps will be dealt with below, in discussion of mining in the northeastern Mojave.

2. Soda Springs

Another important early settlement in the Amargosa-Mojave Basin planning unit region was at Soda Springs. The springs have a long history of use as an important watering hole on the old Mojave Trail (Brooks 1977; Casebier, source materials on Soda Springs, July 2, 1974). In May of 1860, Lt. Milton T. Carr established an adobe redoubt at the site (Casebier 1972:20). Named for Captain Winfield Scott Hancock, quartermaster in Los Angeles (Casebier 1972:32) the redoubt served military needs on the desert for a few important years when there was constant threat from menacing Indian assaults to traffic along the newly established trail. Emigrants along the trail were able to use the facility as well. The structure may have been demolished by April of 1867, when an army inspector visited the springs and reported "there was no house or even hut there" (Rusling 1877:418-19, in Casebier 1974b).

In August and September of 1867, military troops erected a small stone shanty (Major Henry M. Robert in Casebier, 1974b). The troops also erected a stone wall around the grave of Dr. Merril E. Shaw of Buffalo, New York, who had died from an arrow wound on October 16, 1867 and was buried at Soda Springs. The Arizona Overland Mail Company maintained a relay station there during part of 1867 (Casebier 1974b). A corral was noted on March 27, 1868 (Whittier in Casebier, 1974b).

In 1871, Soda Lake was operated as a stage relay station by Mssrs. Ward and Co. A "nice bathing place" had been built for public use. In the early 1880's (probably 1882), Fenton Gass, then ten-year-old son of Octavius D. Gass, former proprietor of the Las Vegas Rancho in southern Nevada, passed through Soda Springs while moving to Redlands. He recollected (Interview, 1967, in Casebier, 1974b) eight or ten low buildings there, near the lake. Water from the Soda Spring flowed through a wooden trough into the lake at the time.

A minor water stop was made at the site by the Tonopah and Tidewater Railroad after construction on the line reached the spot in 1906. Nearby Rasor was the more important water supply point, and there was no regular use of Soda Spring (Bard 1973; Myrick 1963).

Mendenhall described the station as in ruins but with a well which was "a pool lined with stone, about five by eight feet in dimensions and three feet deep, and located about 150 feet southeast of the largest stone building" (1909:62).

Waring did not include Soda Spring in his 1915 publication on Springs of California. Thompson (1929) reported on the condition of Soda Lake settlement. Thompson mentioned a religious colony had recently been occupying the buildings, but the place was abandoned when he passed through. Jaeger (1958:26) similarly noted that "about the time of the first world war (Belden says 1914; 1953b:16; Casebier 1974b) a religious colony occupied the area near Soda Springs."

The founder, Pastor Charles T. Russell, invited into the colony German aliens who eventually brought about its downfall. There must have been some confrontation between the local community and the Germans, but the difficulties are only hinted at. Russell, the Germans, and several other members of the colony were imprisoned. On October 30, 1916, Russell died and the Soda Springs settlement was abandoned. In 1919, Thompson reported the site was deserted and the water system had been dismantled (1921:205).

Russell's group had built five frame houses at Soda Springs and spent $50,000 in an effort to mine gold nearby. After the colony disbanded, the houses were torn down and used in building some early structures at Baker, a few miles to the north (Jaeger 1958). Russell's original vision that led him to Soda Springs included that in the hills nearby gold would be found which the community could mine to provide for its own support. This is probably the same gold development reported by Thompson (1929:556). Thompson also mentions in the same publication a salt evaporation plant with large vats in ruins. Belden states (1953b:16) they had been associated with the production of soda and salt prior to World War I.

Until 1944, the site lay virtually unused. The Tonopah and Tidewater discontinued services in 1937 and physically abandoned the right of way in 1943. In 1944, Curtis Howe Springer took over the site and began erecting the buildings of his health resort, Zzyzx (Bureau of Land Management n.d., p. 7). Springer remained on the site for 30 years until the Bureau of Land Management finally ousted him in 1974. The site is now utilized as a desert study retreat and managed by a consortium of California colleges.

3. Ivanpah

The most important pre-20th century settlement in the study area, however, was undoubtedly Ivanpah. This was the first settlement to develop the semblance of a true town, with a variety of services primarily established to serve the mining camp but which also were drawn upon by the residents of areas nearby. In the days of early desert settlement, "nearby" could mean a distance of as much as 80 miles. Late 19th century ranchers in Las Vegas and Pahrump Valleys, over 50 miles from Ivanpah by the road, provisioned the town with meat, vegetables, fruit, hay and grain and were able to obtain at Ivanpah goods shipped to Fenner by rail and transported by wagon to Ivanpah (Williams 1935; Dellenbaugh 1876).

Ivanpah was primarily a silver camp with gold and copper of lesser values. Zinc proved to be one of the longest-lived products, providing employment well into the 20th century (Westfall 1974). The beginnings of the camp are somewhat obscure. Prospector Matt Palen is sometimes credited with making the first strike in 1867 (Westfall 1974; Paher 1973), while others credit the well known John Moss and Joseph Good in 1869 (Hewitt 1956; Hartill et al. 1979:n. 286). Moss and Good were among the pioneer organizers of the Clark Mining District in July of 1865. Mines included in the original district were the Colosseum, Copper World and Mohawk. In 1868, Moss discovered one of the silver mines of Ivanpah (Hewitt 1956). Palen and others are reported to have arrived in the district in 1867, locating silver claims on "Alaska Mountain." Their group of mines was called the "Stonewall Jackson," later known as the Stonewall Mine (Westfall 1974:5). J.A. Bidwell went into the Clark District in 1866 and developed the Lizzie Bulloch mine and mill. The McFarland (sometimes McFarlane) Brothers owned the Ivanpah Consolidated Mill and Mining Company, which operated the Beatrice Mine, another important silver property.

The Piute Mining Company prospectus described a grand scheme for development that never materialized. The prospectus was published in 1869. Ivanpah never attracted large eastern investment, possibly because of demonetization of silver in 1873. See Hewett 1956 for mines presently included in the district.

The population of the town has reflected the fortunes of the mining industry. About 1875, according to local report (Hewitt 1956:7) there were about 500 persons in and near old Ivanpah. Most of these had left by 1885, and by 1926, a few low adobe walls were all that remained of the town. When Dellenbaugh visited the site in March of 1876, he found a community which included one stamp mill operating, one stamp mill under construction, two stores and several houses. The size of the camp does not reflect the population, however, as it was customary for miners to live at their claims (Williams 1935). Williams arrived in the district in 1892, and his unpublished manuscript autobiography and histories of Mesquite Valley are packed with many details about life in the mining camps of Ivanpah, Goodsprings, Sandy, Vanderbilt and others.

While the original camp declined and was abandoned, the name lives on. In 1902, the California and Eastern Railway completed a line extending from their old terminus at Barnwell (formerly Manvel) to a new station in Ivanpah Valley, aptly named Ivanpah for the old, then nearly deserted mining camp. The promising future of this line for transporting the borax ores of the Death Valley region was destroyed first by the failure of Borax Smith's traction line by which he attempted to haul the ores to Ivanpah, and second by the completion of the Salt Lake Railroad in 1905, which destroyed not only Ivanpah as an important shipping point, but broke the California Eastern's monopoly on traffic in the eastern Mojave (Myrick: 845-8). The crossing of the California Eastern and the San Pedro, Los Angeles and Salt Lake line was at a station first called Leastalk. The name was subsequently changed to South

Ivanpah, which it retained until 1918 when the California Eastern railhead at Ivanpah II was discontinued. Thereafter the historic name was applied only to the lonely station on the Salt Lake Line.

The original Ivanpah townsite appears to have been occupied for some years beyond its peak. Westfall (who makes an inflated claim for a population of 3000 people in the area in 1875) moved into the district in 1909 and reported a population in Ivanpah of about six people, including himself, his mother and grandmother. The total population of the geological district, which extended down into the New York and Providence Mountains east to include Goodsprings in the Yellow Pine Mining District of Nevada, and Sloan, along the Salt Lake Line south of Las Vegas, numbered only 500 between 1924-26 (Hewitt 1956:8). Ivanpah boasted ten people and Mesquite Valley had ten, Clark Mountain mines listed eight, while there were six at Valley Wells where a smelter was available, Shadow Mountain claimed two, and the Kingston Range was occupied by a grand population of one. Old Ivanpah today has no permanent residents but is much visited by pothunting and treasure hunting "recreationists." Ivanpah II has blended back into the desert and fortunately cannot be located by most people, and Ivanpah III remains as a name at a little place where a gravel road crosses the Union Pacific Railroad tracks. The property is owned by a private party but is not occupied.

4. Tecopa

The Resting Springs Mining District, successor to the "Washington District" of M.H. Farley, included the famous Gunsight and Noonday mines in the northeastern Mojave. The first mining camp of any consequence established in the district was Tecopa. According to Benjamin Hayes, the camp was begun in 1875 "after the exodus from Panamint City" by a "gang originating in Pioche, Nevada: Silas Pearson, John Taylor, and John Mowbray." They located at Quail Springs and renamed it Tecopa. Others followed, including J.B. Osborne, who came in 1876. Osborne filed a "squatters claim" on 160 acres at Resting Springs in 1866. Osborne filed a map of the claim at the County Recorder's Office in San Bernardino but it has apparently since disappeared (Keeling 1976:88). It is not clear if Osborne gave the name to the district at this time (Gudde 1969:332).

According to the Hayes account (Keeling 1976) Tecopa in the late 1870's had "two stores, three saloons (including 'one that would not disgrace any town in the State'), one blacksmith shop, three stables, two restaurants, several dwellings and seven white ladies fullgrown." The Indians, especially the female portion of them were "very friendly." The town was situated along Willow Creek, an affluent of the Amargosa River, about eight miles southeast of the present town of Tecopa (Noble et al. 1922:59). There had been other prospects located during the first wave of surveying that began in 1860, when Darwin French, S.G. George, W.T. Henderson and others began to explore the Death Valley region. The object of their searches was the "Lost Gunsight" ledge (Lee 1963:60-82; Chalfant 1933:119-128, 129-138, 303-306). Mormons opened up the Confidence Mine nearby as early as the late 1860's (Glasscock 1940:251; Noble et al. 1922:39). Glasscock may also be referring to the activities at Salt Springs, also sometimes called the "Mormon Diggings" during the 1850's (Casebier mss. on Salt Springs 1974; Hartill, Vredenburgh and Shumway 1979, Baker Area and Vicinity, and Tecopa discussions). Myrick claims a date of 1865 for the Gunsight Mine in the Resting Springs district (Myrick 1963:593).

Ores from the mines were processed at Ivanpah in 1876 (Hartill, Vredenburgh and Shumway 1979, Ivanpah discussion). However, Vredenburgh's comment that mining at Tecopa only continued until 1880 appears to be in error. It was not until around 1880 that Osborne installed substantial developments at the site: three water jacket furnaces and a ten stamp mill (Myrick 1963), although a smelter was put in operation in late 1875 (Keeling 1976:21). Prior to that time, there was apparently some sort of furnace established at Resting Springs (Daily Morning Argus, September 14, 1877). The furnace was fired up "night and day," the "result of which being 120 bars of bullion per day." A load of 10,500 pounds of bullion headed to San Bernardino from the Resting Springs District in September, 1877, according to the same report. In June of 1877, the Resting Springs Express and Stage Line from San Bernardino to Resting Springs carried passengers for $20, freight seven cents per pound (Daily Morning Argus, June 5, 1977, advertisement).

Little is known of production in the District until the early 20th century. Apparently the boom subsided sometime after 1882 (Myrick 1963).

In 1908 the camp was reactivated. At the time of Mendenhall's visit that year, the place was called "Tecopa Well," perhaps because the new Tecopa station on the Tonopah and Tidewater had already usurped the name. A lead smelter and many adobe houses were at the site, located "at the head of Willow Creek, on the north side of the Kingston Mountains." The camp was supplied with a well which "stands by the roadside about 100 yards east of the old smelter." The water was described as excellent and about seven or eight feet deep. Tecopa was located about seven miles east of China Ranch, on the main road from the ranch to Manse, Nevada /Pahrump Valley/. It was "easily found" by following the road up Willow Creek from China Ranch to the smelter" (Mendenhall 1909:41-2).

The Gunsight and Noonday mines were owned by the Tecopa Consolidated Mining Company at the time. Prospects were very good, with ore valued at $38-40 per ton for lead, silver and gold (Myrick 1963). Philadelphia financier John Brock, Tonopah capitalist, bought into the mines in 1907. In May 1909, the Tecopa Railroad Company was incorporated to construct a spur from the Tonopah and Tidewater to the mines via Tecopa Pass. Between 1913 and 1918, one to two cars of ore per day were turned out and sent to a concentration mill at the Tecopa Tonopah and Tidewater station, unless the ore was of such high value that it could be shipped directly to the mills at Murray, Utah (Myrick 1963:596).

After 1918, the mine's production dwindled. During the Great Depression, the mine and railroad were purchased by Dr. L. D. Godshall, who had worked the mines for the Tecopa Consolidated Company between 1913 and 1918. He paid $10,000 for the lot. Sometime after 1938, the railroad lines were abandoned and the mine sold still later to the Anaconda Copper Mining Company (Myrick 1963:597). The tracks and smelter were removed in 1942, when the desert was scoured for iron scrap to use in the war effort (Myrick 1963; Belden 1957c:46).

Talc had also been taken from the area in the early 20th century (McKinney 1971:13; Ver Planck 1961; Vincent 1973:5; Hartill et al. 1979, Tecopa section). Western Talc, owned by the Vanderbilt family, loaded ore at the Acme (former Morrison) siding of the Tonopah and Tidewater (Vincent 1973:4). These operations were bought by the Pacific Coast Borax; in 1907 they were inactive (Yales 1908:634).

In 1906, when the Tonopah and Tidewater Railroad was being built through the region, a spot along the line near some warm springs was selected for a watering stop. This new site was given the name Tecopa, replacing the earlier camp located farther south in Amargosa Canyon (cf. Myrick 1963; Noble et al. 1922:60). The location of these then unnamed warm springs was "on the eastern edge of Resting Springs Dry Lake, about three miles southeast of Zabriskie" (Mendenhall 1909:39). The springs yielded then about 200 gallons of water per minute. The water contained sulphates of soda and magnesia, some borax and some niter. There was an old tent at the site in the fall of 1908, and Mendenhall indicated the springs were then occasionally used for bathing purposes. The water temperature was 107° F. This use of the springs was popular quite early. O.J. Fisk, pioneer of the eastern Mojave Desert who resided in Vanderbilt in the early 1890's, made a 75 mile trip from Vanderbilt to Tecopa hot springs to bathe (Myrick 1963:843). In 1908, a ditch and pipe led part of the water to a watering tank beside the track of the Tonopah and Tidewater Railroad (Mendenhall 1909:39). Mendenhall's description does not exactly match Waring's, who conducted his field work in 1908 for the 1915 publication. Waring described two springs, rising in "pits that have been dug about ten yards apart." Their combined flow was about 225 gallons per minute. Waring also indicated that the water "had been used to some extent for bathing at a pool near the springs" (Waring 1915:137).

Thompson's field reconnaissance in 1917-18 for the 1921 publication, Routes to Some Desert Watering Places, listed only the Tonopah and Tidewater station under the name "Tecopa," and described the ranch complex at the China Ranch (1921:226, 252). Noble *et al.* (1922) indicated that by 1921, the watering spot used for the railroad had usurped the name Tecopa and the old camp had been forgotten. Thompson's 1929 study on the Mojave Desert Region also does not include discussion of the old mining camp, but on Plate 11 the Tecopa smelter (abandoned) is located east of China Ranch along Willow Creek. The site is known today as Tecopa Pass, and is easily reached by a paved road from Tecopa.

At the new Tecopa the use of the springs as a spa eventually caused the local residents to construct some buildings at the site. The site itself was not filed upon and remained open to the general public. In the 1950's, this use had become so constant that the area was being degraded. Belden described the town as "having the appearance of a trailer convention all year"(1957a:20). Sanitary facilities were lacking, and there was concern on the part of the federal government about health hazards (Deke Lowe, personal communication 1978). The County of Inyo Parks and Recreation Department took over the maintenance and care of the hot spring facilities in 1969. Today this area is still popular, growing in use, and is an important winter stopping place for "snow birds" from northern states. Local and regional use has increased as well, and it is frequently used by people from Las Vegas, Nevada.

Tecopa was named for a local Paiute "chief" who befriended early day settlers. Tecopa was quite a well known local character whose most distinguishing feature was his costume. On formal occasions he would dress up in a stove pipe hat and morning coat with tails--certainly an odd form of dress in the far reaches of the Mojave Desert! Tecopa supposedly was given this garb by Jim Slauson of Resting Springs because Tecopa wanted $200 for the use of his name for the old mining camp (Gudde 1969:332). Tecopa died in 1904, before his name could be appropriated once again, this time to identify the little railroad watering stop on the Tidewater and Tonopah.

5. Borax Camps: Eagle, Harmony, Amargosa

Borax mining activity in the northeast Mojave Desert was concentrated first in the Death Valley area in the late 19th century. The first discovery was made by Aaron and Rose Winters in 1880. The claim was sold to entrepreneur William T. Coleman of San Francisco for $20,000 and developed into the Harmony Borax Works which shipped its first ore to Daggett in 1882. This historical event was eclipsed by a shipment from a competitive operation in the southern end of Death Valley, at a site located by Isidore Daunet, M.M. McDonald, M. Harmon and C.C. Blanch (Spears 1892:52; Glasscock 1940:125-6). The Eagle Borax Works, as it was known, located near Bennett's Well in Death Valley, ceased to function in 1884 when Daunet commited suicide because of the failure of his marriage. The property eventually became part of the Coleman holdings in Death Valley and the works never operated again.

Shortly after acquiring the primary holding in Death Valley, Coleman also bought the claims of Winters, Parks and Ellis in the Amargosa Valley, which would be designated the Amargosa Borax Works. This plant operated during the hottest part of the year when operations had to suspend at Harmony because the borax would not crystallize in the extreme heat (130°). The Amargosa temperature would be a comparatively cool 110° during the summer months, allowing operations to proceed. Finally, Coleman also acquired from discoverers Philander Lee, Harry Spiller, and Billy Yount (Spears 1892:62; Glasscock 1940:144) the Monte Blanco deposit, and later the site of the famous Lila C. mine, named for his daughter (Glasscock 1940:145). This mine was the first opened which tapped the newly discovered form of borax named colemanite in honor of the distinguished William T. Coleman. While operations continued at the Harmony/Amargosa Works for a number of years following the discovery of the Monte Blanco deposits, development of further borax activities in Death Valley soon was suspended in favor of the Calico District Borax Mines.

Coleman had made some dealings with Francis Marion Smith during the time they both operated at the Columbus Marsh in Nevada. Smith provided the wood to fuel the furnaces for Coleman's borax works there. Smith purchased part of Coleman's holdings after the Teel's Marsh borax gave out. He continued to do well at his chosen goal of becoming borax king, while Coleman spread his investments thinly over a wide variety of enterprises. In 1886, Coleman was forced into bankruptcy because of reversals in some of his far-flung businesses. In the liquidation of the Coleman company assets, F.M. Smith was able to acquire the borax properties. The Death Valley deposits were neglected in favor of the Calico works, located much closer to transportation and water (Glasscock 1940: Ch. IX). Calico furnished most of the borax mined in San Bernardino County, the nation's major supplier between 1888 and 1893 (Brown and Boyd 1922:104). Harmony and Amargosa works were abandoned and did not operate again. The famous 20-mule team wagon trains which carried ores from Harmony to Mojave station on the Southern Pacific Railroad, and earlier from Eagle Works to Daggett on the Santa Fe line, no longer plodded the desert wastes carrying borax made from "cotton balls." By 1889, traffic of this type had been suspended. The old lead, silver and gold camps at Ibex, Confidence and Tecopa maintained a trickle of traffic into the area (Glasscock 1940:146), but the volume of operations was small. Death Valley would "simmer on the back of the stove" (Glasscock 1940:146) for some 15 years before attention would be turned once again to the rich colemanite deposits at Monte Blanco.

6. Turquoise Camps: Toltec, Himalaya

Turquoise was discovered in 1897 in the area east of Baker and Silver Lake, causing an initial stir of excitement which would soon be pushed off from the front pages of the newspapers by the Spanish-American War. The mines, located by a T.C. Bassett, had obviously been worked prehistorically, which occasioned much interest and resulted in the organization of a scientific party headed by Gustav Eisen, one of the foremost scientists of the period. The party traveled to the mines from San Francisco, and Eisen's report was published in succeeding issues of the sponsoring San Francisco Call (Roske's report on Eisen in Warren and Roske 1978). The mines were considered to have been worked out by 1903 (Pemberton 1964:10), but considerable amounts of gem quality stones can still be found at the localities (Nazelrod 1977), and the mines are being actively worked today.

7. Mesquite Valley: Salt Works

Around 1881, an "Old Country Spaniard, Miguel Nevarus (sic)" built a crude salt works in the extreme south end of Mesquite Valley. He put the salt water from a well into shallow galvanized iron tanks and evaporated the water by heating with a brushfire. He sold the salt to the two large mining companies in Ivanpah, who used it in milling the rich silver ores. The remains of this salt works were still visible in the valley as late as 1935 (Williams 1935 :3).

However, just what these remains were is difficult to assess. Waring visited old salt workings in 1916, reported that the brine was obtained from shallow pits, and that the salt was produced in Mesquite Lake around 1900 (1915:57). These may be the same operations or the works may be older than Waring credited them. Williams arrived in the area in 1892 as a young man of 18, and would be more familiar with the details of the region's history. However, Williams did not write down his account until 1935, and it is thus difficult to have credibility in his dates. A Miguel Nevares does appear on a list of delinquent tax assessments in San Bernardino County in 1876 which would appear to support Williams' dates (San Bernardino Weekly Times, Supplement; Delinquent Tax List, County Board of Supervisors 1876). There also may have been two separate salt operations at the site, since the descriptions of operations are so different and the dates are so far apart.

B. Agricultural Settlements: Ranches and Farms

Agricultural developments to sustain mining operations on this remote frontier were possible only where there was permanent water for irrigation. The few sites in the northeastern Mojave which were suitable were put to use in very early days. Ranches or farms were found at Mesquite Valley, Amargosa Canyon, Amargosa Valley and Death Valley. Ranches in nearby Nevada also provided supplies for the mining camps.

Use of this portion of the Mojave Desert for irrigated farmlands was minimal at best. Most efforts of this type were made in the 20th century, and most failed after only a short time. Sufficient water was hard to locate and expensive to pump. Frequently, where the water was shallow enough to reach with a drilled well, the soil is too clayey to permit agriculture (Thompson 1929:609-10). Where the soil would support some farming, water was at too great a depth to lift efficiently. The area's few irrigated ranches of the 19th century were located at sites with flowing springs.

Sheep Ranching

Sheep raising has always been limited in the area and no permanent camps were ever established. Williams indicated (1935b: 8) that no sheep ever were recorded in Mesquite Valley. Some informants indicate that Clark Mountain was used early for sheep (Ernst 1978), but details are lacking. In the early 20th century, the Kaiser Land and Livestock Company of Elko, Nevada attempted to set up sheep operations in the Spring Mountains in southern Nevada, just across the state border from the study area. The company filed on a number of springs and apparently maintained some large flocks. However, the Mojave Desert's thorny plants defeated the experiment, and the wool was literally torn off the backs of the sheep (Correspondence, Willard George to State of Nevada Water Resources Division, September 16, 1955). By 1911, they had withdrawn from the region and sold their water rights to cattle outfits which were able to use the browse provided by the low desert plant communities. Possibly this sheep outfit was the one which Ernst reported used Clark Mountain since they pastured their sheep in the Spring Mountain Range just to the north.

The main use of the northeastern Mojave for sheep appears to have been simply as a corridor to pass between California and Utah, Arizona or New Mexico. The earliest record of sheep passing through the area is with the Workman-Rowland expedition of 1841 (Hafen and Hafen 1954:212; Bard 1973:43). These animals were brought along to use for food and may not actually have survived far into the desert. The Workman-Rowland party traveled by way of the Old Spanish Trail and passed through the study area along the Needles route (Brown and Boyd 1922: 679).

In 1850-51, Dr. Thomas Flint, his brother and a brother-in-law named Bixby brought several thousand sheep across the Fremont version of the Spanish Trail, from Council Bluffs, Iowa to Los Angeles (Westergaard 1923). They started their journey with 5600 sheep but only 2800 survived the trip (Rittenhouse n.d.). Flint and Bixby later became very prominent California sheep men, importing Merino sheep from Vermont to improve the California strains. Flint's party crossed the Kingston cut-off only ten days ahead of the Cheeseman party (Westergaard 1923; Foy 1930). Flint's diary of the trip is excellent reading and contains many details of the strenuous effort this undertaking required.

In 1853, Kit Carson and Lucien Maxwell trailed over 13,000 head of sheep to California via the Mojave Trail. Between 1852 and 1860, 5,551,000 sheep trailed to California from

New Mexico (Douglass and Bilbao 1975:219).

The drought of 1862 marked a major shift from cattle to sheep on the southern California ranges. Sheep withstand drought better than cattle and their flocking instinct allows them to be herded more easily away from flash floods (Douglass and Bilbao 1975:221). It is not clear just what impact this situation had on the northeastern Mojave area. There were some instances reported of cattle being driven from the San Bernardino Mountains down along the Mojave River (Keeling 1976:19, 36). The localities used for grazing are not clearly delineated in the literature, but it would be most likely that grazing along the Mojave River and its naturally watered meadows would be the most likely spots. Cronise Lakes and the sink of the Mojave might have been used for cattle grazing at this time.

During the severe drought of 1877, the overstocked sheep ranges of Southern California suffered tremendously. Two million five hundred thousand sheep are estimated to have been lost. "Stock fled in every direction, to Arizona, to New Mexico and to the Sierra Nevada" (Douglass and Bilbao 1975:239). Some of these may have gone east through the study area but no details are available.

1. Amargosa Valley: Ash Meadows

Ash Meadows is located along the upper reaches of the Amargosa River, on the California-Nevada border east of today's Death Valley Junction. It was the site of historic Indian rancherias when the first explorers and prospectors filtered into the region. Aaron Winters and his wife Rosie are probably the best-known early residents of the valley, which they occupied prior to the 1880 discovery of borax in Death Valley. Little is known of the earliest farming operations in this relatively well-watered northeastern Mojave area. Winters' cabin has been described in the literature (Spears 1892:56-7). It may be his cabin that appears on an early map (1871) of Ash Meadows, filed in early Lincoln County, Nevada records (Surveys Book B:82). The map was drawn for the purpose of filing on water rights in the names of Charles King and Grant Foreman.

It is not clear just who King and Foreman were and how much they developed the valley. A Charles King was a member of the Wheeler expedition of 1871 that passed through Ash Meadows (Cragen 1975:107). Wheeler's camp site is marked on the map, although he spent but a short time there. The map depicts a long ditch planned to carry water from the springs at the northern to the southern end of the valley, a distance of some ten to eleven miles. There is a house drawn on the map which matches in most respects the location of Winters' cabin as described by Mr. Plumb (Spears 1892). This would place a non-Indian residence in the valley by 1871, and the presumed raising of crops or alfalfa as well. Winters moved his spread after the shower of wealth occasioned by the borax strike and sale to Coleman. He purchased the even better-developed Pahrump Ranch in Southern Nevada (Glasscock 1940:113, 118).

In 1904, R.J. "Dad" Fairbanks established the first tent city at Ash Meadows, then an important passenger stopover on the Las Vegas-Beatty run of the Las Vegas and Tonopah Railroad (Myrick 1963:588). Tents were used for the hotel, for residences, a restaurant, and another for a saloon. The saloon was best remembered by the Fairbanks children for its colorful visit by Tiger (or Diamond Tooth) Lil and her retinue of "sportin' girls" (Myrick 1963; Lowe 1974:3-5). Mendenhall (1909:90) listed Ash Meadows under the name "Fairbanks Ranch, Nye County." He noted that it was a "well-known ranch and stopping place for travelers on the roads leading from Barnwell to Ivanpah, California, and from Roach and Jean, Nevada northward by way of Manse." It is possible for it to have been on the road north from Roach and Jean via Manse (Nevada), but not between Barnwell and Ivanpah, which are both located south of Ash Meadows. Grains and provisions were obtainable at the ranch, irrigated by abundant water from springs.

Another ranch in the valley in the early 20th century was Longstreet's, about 1 1/2 miles east of Fairbanks' place (Myrick 1963:602). It is not clear from the record whether or not Fairbanks took up the land that Winters had left, nor what specific developments he made and/or found at the site. The area should be more completely researched to clear up the picture of land use in the 19th and early 20th century. The most important development in the mid 20th century was the Ash Meadows Ranch, an attempt to cultivate good grass for cattle. The extensive development was stopped because of conflicts over water. The National Park Service was granted enough water to provide the Devil's Hole pupfish a breeding environment, and the ranch development was then not feasible.

2. Amargosa Valley: Resting Spring, Yeoman Hot Spring

Resting Spring, south of Ash Meadows at the southern tip of the Resting Spring Range, east of the Amargosa River, was the site selected by Philander (Phi) Lee and his Paiute wife for the ranch he began to develop in 1882 (Waring 1915:319). Phi Lee was one of a near-legendary group of brothers who were actively ranching and mining on the northeastern Mojave beginning in the early 1870's (cf. Glasscock 1946:112; Lee 1963:123). While Mendenhall in 1909 gave a date of 30 years for the Lee Ranch at Resting Spring, Mendenhall was using data and descriptions provided by other sources. It is likely that he rounded out the date to thirty years. It is not clear whether Lee took over the ranch from Osborne, who had filed there in 1876. Lee apparently began to develop his ranch with the money realized from the sale of the Monte Blanco borax to Coleman in 1880-81.

There is considerable discrepancy in the description of the size of the irrigated ranch in the period 1909-10. Mendenhall described a ranch of 200 acres and did not specify the amount that was irrigated. Waring (1915:319) mentioned only about 25 acres of alfalfa, corn and garden vegetables. Chalfant has interpreted this to mean a 200 acre irrigated ranch (1933:119), but the Waring description is probably more accurate. Thompson did not visit the Resting Springs Ranch, but cited an account given to him by L. R. Mansfield, United States Geological Survey (Thompson 1921:264, n. 34). The ranch today is owned by descendants of the original founders.

Thompson (1929:574-5) mentioned a Yeoman Hot Springs and an Alec C. Yeoman ranch, five miles southeast of Shoshone. It is not certain at this time just when this ranch developed.

3. China Ranch

China Ranch is another early ranch located just a few miles from Resting Springs, in Willow Creek above the confluence with the Amargosa River. The ranch has also been known as the Morrison Ranch and the Willow Creek Ranch (Mendenhall 1909:40). This site was apparently heavily used by prehistoric peoples, and was visited by Fremont in 1844 (cf. McKinney 1971:14; Waring 1915:343; Mendenhall 1909:41). The ranch is located on an old road leading from Manse in Pahrump Valley, Nevada to Death Valley (Waring 1915:343; Mendenhall 1909:42).

The creek and springs furnished sufficient water to irrigate about 100 acres, according to Mendenhall (1921:41). Again Waring's descriptions indicate that only a few acres were irrigated of a spread that would be considerably larger in size. This is most likely the truer picture. In 1929, the ranch comprised over 214 acres. Mendenhall noted that "Good hay can be obtained here, the first to be had after leaving Daggett, 110 miles south" /on the Daggett-Death Valley route of 1909/. Further, only at the China Ranch, at Coleman /Furnace Creek Ranch/ and Resting Spring was hay available in the Death Valley region in 1909 (Mendenhall 1909:39). This would indicate that ranching activities at Ash Meadows were not successful in supplying other than a subsistence level for owners, or that their surplus was sold entirely to one buyer. Hay was available at that date, however, across the state boundary in Nevada, at the Manse and Pahrump Ranches.

China Ranch has an interesting history which remains to be documented for the early period. Early agricultural development of the site may have begun with the first activities at Tecopa in the 1870's. J.B. Osborne, the region's most prominent mining entrepreneur of the late 19th century, had been involved in Tecopa's development since 1876 (Keeling:1976:88) and at the Amargosa Mine at Salt Springs (Belden 1958, 1960b). Osborne is also credited with having settled his former cook, Quon Sing, on the ranch at or just prior to the 20th century (Vincent 1973:4; McKinney 1971:6). According to the McKinney account, there was then no development at the site, and Quon Sing had only raw land to work. Given that the camp at Tecopa had been active since the 1870's, it is likely, however, that some small farming operation was conducted at this site, where water was sufficient to raise some crops which would be welcomed in the mining camp upstream.

Belden (1957:46) names the ranch's Chinese founder as Ah Foo, a Tibetan. He omits any mention of Osborne's rôle, and places Ah Foo on the ranch in the mid 1880's. Ah Foo supposedly raised vegetables for the "borax crews" of the area, and later he planted fig trees. Belden says that Ah Foo returned to Tibet to visit relatives and never was able to return despite the assistance given to him by residents of Tecopa and Pahrump. This may be a variant account of the Quon Sing story. Quon Sing was Chinese and had come to the Death Valley area to work as a cook for the Harmony Borax Works and later for the Gunsight mine. Still later he went to work as personal cook for Osborne, and Quon Sing retired to the farm after many years of service to Osborne.

Quon Sing disappeared one day (no date is given in the local accounts) and was never seen again. A man named Morrison took over (some stories are that he chased away Quon Sing /Ah Foo?/ who either had no legal rights to the land or else did not know how to fight for them). Morrison's name appeared on the records at the time of the construction of the Tonopah and Tidewater Railroad. His name was used at a siding of the railroad; the siding was later renamed Acme.

The ranch was purchased in 1955 by Mr. and Mrs. Ben Robinson who permitted the Pacific Coast Archaeological Society to excavate prehistoric sites on the ranch. This group has made the most systematic surveys and study of the area to date and has noted down part of the brief history that appears here. In 1964 the ranch was sold and the new owners did not permit any digging on the property. In 1967, the Robinsons repossessed the ranch, and in 1969 sold it to Bernice Brown Sorrells and her brother Charles Brown, children of the late Charles Brown, famed state senator from the region, and grandchildren of R.J. "Dad" Fairbanks, pioneer of the Ash Meadows area of Shoshone and of Baker. The ranch is still in their hands, and again available to the Pacific Coast Archaeological Society.

4. Saratoga Springs

Saratoga Springs would have been a large enough water supply to provide considerable irrigation potential. However, the site was not developed as a ranch; there was some construction during mining activities nearby in 1908 (Mendenhall 1909:47; Waring 1915:137). The soils may not have been sufficiently developed and widespread to tempt even the rugged pioneer Mojave Desert farmer.

5. Mesquite or Sandy Valley: Mesquite Well

Mesquite Valley, now locally known as Sandy Valley but still shown with its original name on most maps, was another locus of agricultural activities in the study area during the 19th century. Mesquite Valley was filed upon prior to 1880 for its agricultural values (Coombs et al. 1978:27). The actual "home ranch" was apparently located on the Nevada side of the border, but the ranching activities extended into the planning units discussed here. There was apparently a spring located some two miles northwest of the playa, but it was early developed into a well. The spring was once known as "Cub Lee Spring" (Waring 1915:70; Thompson 1921:260). After the well was drilled the name was changed to Mesquite Well.

Leonidas or Leander "Cub" Lee kept a herd of cattle in the valley, and later John Yount ranged cattle there (Williams 1935b:7). Lee was probably in the area prior to 1876, while John Yount only settled in the valley after 1880. Cub Lee is a shadowy figure, hard to pin down in the literature. He ran some cattle at "Bellerin' Teck's or Tex'" Greenland Ranch for one season after Teck left in 1872 (Glasscock 1940:112). Cub and Phi Lee discovered the Lila C. mine deposits which they sold to William Coleman in the early 1880's (Glasscock 1940: 145). Lee seems to have been a rancher for the most part, but his headquarters were the Pahrump Valley area and hence his home ranch does not play an important part in the area covered by the Amargosa-Mojave Basin planning units, except that the region was used by his cattle. The Lees all married local Shoshone/Paiute women, and their children and descendants are carried on tribal rolls today.

Mendenhall (1909:93) described the Mesquite well water supply as located about three miles south of Sandy post office, on the stage road from Ivanpah to Manse. In 1909, the wells were protected by curbing and the water was easily drawn up in a bucket.

6. Mesquite Valley: Rose's Well

Rose's Well, located close by (Waring 1915:78), may have been used during the early historic period by Oliver Rose, recorded in the valley as early as 1880 (U.S. Census of 1880, Nevada, Pahrump section). Rose, a French Canadian, operated a small spread and stage stop in Mesquite Valley on the road between Ivanpah and Manse, Potosi and Goodsprings. The road to Manse was broken through via Stump Springs following the establishment of the Manse Ranch by the Yount family in 1876 (Williams 1935b:3). Rose brought a large flock of goats into the Mesquite Valley in 1889 (Williams 1935b:4). Most died, and the survivors were hunted down by Indians in the nearby mountains. Rose and his family established their home at "a water hole southeast of what is now /1935/ Mr. Farner's homestead." Rose sold liquor, groceries and horse feed, and had a wagon freight business. In 1899, Rose deserted the family and returned to Canada. The fate of the family is unclear (Williams 1935b). /In 1902, a man named Walker undertook to pump water from Oliver Rose's old place for irrigation, but he soon gave it up

(Williams 1935b:8)/7.

In 1886, Utah mining millionnaire A.G. Campbell located in the Yellow Pine Mining District, which included the Mesquite Valley region. Campbell established the "first really permanent community in this section"/Goodsprings, Nevada/. Part of the time, Oliver Rose's place was their headquarters. Campbell became a vital force in the development of mines in the Yellow Pine and New York Mountains districts. Ore from the nearby Golden Chariot and Barefoot mines near Keystone (all in Nevada) were worked in arrastras at Oliver Rose's place (Williams 1935b: 7).

7. Mesquite Valley: Sandy Townsite

Mesquite Valley's name change came about after 1894, when the town of Sandy was established some three miles from Mesquite Springs. The name gradually began to be applied to the whole valley and continued in general use until the townsite was abandoned in 1910. By 1935, the original name was again used (Williams 1935b:5), but in the 1960's, with a new boom in population, the valley once more was called "Sandy." During the short life of Sandy townsite, there was a store, saloons, and post office. "Occasionally, the Pahrump and Manse ranch sold fruit and vegetables at the Sandy store" according to Williams (1935b:7).

The mill at Sandy placed great pressure on the plant resources of Mesquite Valley. The boiler for the ten stamp mill required vast amounts of wood for fuel. Indians were employed to cut mesquite for this purpose. "All over this valley, one can see decaying stumps amid the mesquite growth of today /1935/ where the original trees were cut by Indians for this mill (Williams 1935b:5). In 1932 the "ill-fated" Green Gold Milling plant was erected at the south end of Mesquite Valley (Williams 1935b: 3).

8. Mesquite Valley: Hidden Hills Ranch

Yount became established permanently in the valley, some miles north of the Mesquite Spring site at a place now known as Roland Wylie's Hidden Hills Ranch. Homesteaders arrived in the area after the turn of the century and made cattle raising unprofitable, according to Williams, "on account of the close herding that the California state law requires" (1935b:7-8). The reference to close herding is the restriction that cattle on open land not be permitted to graze within a certain distance of farmlands, townsites and water sources. Glancy noted (1968:6) that cattle grazing was unprofitable because the sparse plant cover provided little forage.

9. Yates Ranch

Other late 19th century ranches active in the study area include the Yates ranch based at Rosalie (now Valley Wells) and the Rock Spring Cattle Company based at Kelso and earlier at Barnwell (Bard 1973:75; Peirson 1970:176). These and other smaller spreads such as Kessler's and Gibson's at Cima, the Domingo Ranch near Providence (Bard 1973:75), the Blackburn Ranch in the New York Mountains (Williams 1935a:8) provided subsistence for the ranch operators and in a few instances (Yates and Rock Spring ranches) became major cattle outfits. While their headquarters were located outside the study area, their wide-ranging cattle impacted the area throughout the late 19th and early 20th centuries. According to Ernst (1978) overgrazing in the early 20th century caused a decline in the range quality and a consequent decrease in the number of cattle on the land.

10. Rock Spring Land and Cattle

The most important cattle operation in the northeastern Mojave was the Rock Spring Land and Cattle Company. Its thousands of head of cattle ranged public lands from California into Southern Nevada, accounting for the registration of two of their brands in Pioche, Nevada, county seat for Lincoln County, where the public lands used were partly situated (Casebier 1976:319). The company was organized in 1894 and by 1910 had ten times as many cattle on the range as Yates (Peirson 1970:176).

By the end of the 19th century, several major economic bases of the northeastern Mojave had been tapped. Developments in the 20th century would in some instances focus on the earlier activities of mining, transportation and ranching. More emphasis would be given to recreational use, scientific inventorying and analysis, and health resorts. Military use of the desert would become a permanent aspect of California Desert Conservation Area history.

Chapter IV: Twentieth Century

A. Transportation: Railroads

By the opening months of the 20th century, rail transportation through the study area was nearing reality. Although the Atlantic and Pacific Line (Santa Fe Railroad) had been open since 1883, another 18 years passed before train traffic could pass through the northeast Mojave rather than along its southern boundary. Completion of the west-east San Pedro, Los Angeles and Salt Lake line in 1905 finally ended the area's extreme isolation.

Within two years, a second rail line bisected the region, this time from north to south. The Tonopah and Tidewater, constructed between Ludlow on the Santa Fe Railroad and extending northward through the Death Valley-Amargosa region into Southern Nevada, stimulated new mining developments. The Tonopah and Tidewater also provided, incidentally, a stimulus to tourist traffic into Death Valley, presaging the phenomenal mid-century popularity of this forbidding territory.

1. San Pedro, Los Angeles and Salt Lake Line

The San Pedro, Los Angeles and Salt Lake Railroad, usually shortened to the "Salt Lake Line," was conceived at the turn of the century by Senator William A. Clark of Montana and merchants from the Los Angeles basin (Gibbon n.d.). Although construction on the line was begun in 1901, because of behind-the-scenes maneuvering by Clark and E.H. Harriman of the rival Union Pacific Railroad it was not until May, 1905 that the line was completed and open for traffic.

The best single source of information is David Myrick's _Railroads of Nevada and Eastern California_, Vol. 2 (1963). George Kirk wrote a history of the San Pedro, Los Angeles and Salt Lake Railroad in 1934 which is very general but contains a useful bibliography. The Railroad itself produced several small publications of value for their photographs (primarily of sites in Southern Nevada), and as examples of land promotion and advertising of the period. _The Story of a Trail_ (White 1905), _Legends of the Arrowhead_ (San Pedro, Los Angeles and Salt Lake Railroad n.d., ca. 1910) and _Hints to the Husbandman along the Lines of the San Pedro, Los Angeles and Salt Lake Railroad_ (San Pedro, Los Angeles and Salt Lake Railroad n.d., ca. 1915) are included in this category. A summary of the line's history is contained in Allan Krieg's unpublished manuscript "The Story of Union Pacific Railroad's South-Central District" (n.d., ca. 1977).

Clark was able to negotiate an agreement with the Santa Fe line to use its tracks into the Los Angeles Basin, and therefore did not have to begin separate track construction until Barstow. The Salt Lake line joined the Santa Fe there, and moved northeasterly down the Mohave River Valley. Small stations were established at Dunn, Afton, Scott, King, Crucero, Epson and Balch in the Mojave Basin. Many other small facilities were constructed along the line, but all are outside the study area. Most of these were uninhabited watering places for the steam engines used on the line. With the switch to diesel fuel, fewer stops were needed and many places were subsequently stricken from the list. Crucero became a little better known than the rest because the Tonopah and Tidewater Railroad, finished in 1907, crossed the Salt Lake line at this point.

Norris and Carrico (1978:63) have claimed that this railroad had "little effect on mining or other local activities" and that the construction of the line was "set against the prevailing pattern of short-line railroads and mines developing in concert." This evaluation is greatly at odds with my own interpretation of the impact of the Salt Lake line on the region. Myrick (1963:845, 848) has pointed out the negative effect the Salt Lake Line had on the development of the California Eastern Railway because it siphoned off the traffic from the north. Secondly, the Salt Lake Line's Las Vegas stop was originally intended by F.M. "Borax" Smith to be the jumping off point for his railroad to the Lila C. Mine. Such a connection with the Salt Lake Line would have permitted Smith to build his Tonopah and Tidewater Railroad from Southern Nevada to Death Valley and on to Bullfrog-Rhyolite. Because Clark reneged on the deal, Smith moved his line to the Santa Fe Railroad at Ludlow, and changed the face of the Mohave Desert thereby. Simultaneously, Clark built his own Las Vegas and Tonopah railroad to the same gold mines at Bullfrog, rivaling the Tonopah and Tidewater.

Ver Planck (1961:5-6) has recognized the significance of railroads in the area upon the development of mines previously too low grade to be profitable at high freight rates charged for wagon shipments.

Finally, Clark's line was not intended to serve local desert mining community needs so much as to provide Los Angeles interests with a means of tapping the lucrative midwestern markets without being subjected to the exhorbitant prices and trade practices of the Santa Fe and Union Pacific Lines (Gibbon 1898; Myrick 1963). Traffic with mining areas was simply a gratuitous boon. Its conception was therefore quite different from, for example, that of the Ludlow and Southern Railway Company or the Amboy-Saltus line (Myrick 1963). It is also worth noting that the Mojave Desert does not end at the Nevada border, but continues for miles easterly and northerly. The Salt Lake Line's impact on this portion of the desert was also very great and indeed permanent. While Las Vegas, Nevada might be the most important city developed along the line, other communities which were opened up in the Mojave Desert of Southern Nevada include Jean, Sloan, and Arden. These communities served mining areas which were located some distance from the railroad, and which have continued to operate despite the decline of the mines. Jean was once the terminus of the Yellow Pine Railroad, a short line which connected the rich mining properties near Goodsprings with the main line. There was a line at one time connecting the mines east of the Blue Diamond Hill in Las Vegas Valley with the main line at Arden, and there is still a line from the old Blue Diamond gypsum mine (now the Flintkote Mine) to the main line at Arden. While all these are outside the confines of the study area, their development certainly is due to the Salt Lake Line construction, and the railroad thus did have enormous impact, both negatively and positively, on the development of Mojave Desert industry.

2. Tonopah and Tidewater Railroad

The Tonopah and Tidewater Railroad far more greatly impacted the study area, although it was dismantled in the early 1940's and lay idle for several years prior to that. This line, the realization of F.M. "Borax" Smith's dream of tapping his Death Valley borax properties, also opened up many lesser areas. The presence of the railroad made feasible mining of lower grade ores and of products which had previously been too far from markets and/or processing, such as talc and clay.

Myrick (1963) is also the best published source of information on the Tonopah and Tidewater. Belden has published many articles focusing on the "tired and tardy" line (e.g., 1953b, 1960b). A graduate student at the University of Nevada, Las Vegas, Art Rader, has researched the history of this railroad and has included many details of construction that have not been published previously. His thesis should prove useful to resource management planning. Rader has also collected over 150 historic photographs and has made several hundred photographs of the Tonopah and Tidewater in its present condition.

Borax Smith first tried to move ores from his newly opened Lila C. mine near Death Valley to the California Eastern railhead at Ivanpah II via a rock base wagon road he constructed (Myrick 1963:545; Belden 1953a). In April of 1904, a traction engine left Ivanpah on the inaugural trip but completed only 14 miles before it bogged down completely. Smith then decided on the more practical railroad. The old traction road, never used for its intended purpose except for the 14 mile maiden run, is still visible on maps of the area (cf. Shenandoah Peak, Clark Mountain, Mescal Range, and Ivanpah Quadrangles). It is used by jeeps and pickups today.

The traction road was built east from the mines at Old Ryan via Eagle Mountain, Pahrump Valley, Mesquite Valley and Stateline Pass to Ivanpah II. The road should be examined along its entire length for any well preserved segments which can be identified and placed on the National Register. A traction engine is located at Pop's Oasis in Jean, Nevada; inquiry should be made to determine if this machine was a Smith property.

After Smith moved his line from the Salt Lake railroad tracks to the Santa Fe line at Ludlow, strong rivalry understandably developed between Smith and Clark. The new Tonopah and Tidewater tracks crossed the just opened Salt Lake line at a spot designated as Crucero (Spanish for crossing). Both lines maintained limited station facilities at this point, but trains were not scheduled to meet at this remote desert crossroad (Myrick 1963:548).

Northward, the Tonopah and Tidewater built watering stops at Rasor, Soda Lake, Baker, Riggs, Valjean, Dumont, Sperry, Morrison (Acme), Tecopa, Zabriskie, Shoshone, and Death Valley Junction. By the time the line was completed to Gold Center, Nevada in 1907, the towns of Rhyolite and Bullfrog were already declining. Even Tonopah and Goldfield had already peaked, with the consequence that the line was never extended to its original terminus at Tonopah. Instead arrangements were made for the Tonopah and Tidewater traffic to connect with the Bullfrog and Goldfield Railroad. Eventually all traffic on the line would be considered Tonopah and Tidewater traffic, although the Bullfrog and Goldfield remained a separate financial entity.

Branch lines were contemplated from time to time at various places along the Tonopah and Tidewater close to what seemed significant mining camps. One was surveyed but never built to Crackerjack, west of the line near Silver Lake and across the Avawatz Mountains (Myrick 1963:548). The Tecopa Railroad, over the Kingston Mountains via Tecopa Pass and Horsethief Springs, was built in 1910 to carry ores from the Noonday and Gunsight mines to a concentrator at Tecopa (Myrick 1963:559). A branch to Greenwater was considered but never materialized (Myrick 1963:555).

The Lila C. Railroad from Death Valley Junction to the Lila C. Mine at (Old) Ryan was finally completed in August 1907 (Myrick 1963:555). Prior to that time, the ores from the Lila C. were freighted north to Zabriskie on the main Tonopah and Tidewater line. In the spring of 1908, the new roaster at the Lila C. was opened, and Pacific Coast Borax began moving its Borate (Calico) operation to (Old) Ryan (Myrick 1963:557).

In 1914, major changes occurred for the Tonopah and Tidewater. The Lila C. ores had been exhausted and the seven mile Lila C. Railroad had become a "useless appendage" (Myrick 1963:585). The Pacific Coast Borax Company now opened the Biddy McCarty mine at the very edge of Death Valley proper and built a narrow gauge railroad to it which it called the Death Valley Railroad (Myrick 1963:586). Pacific Coast Borax continued minor operations at Old Ryan, enough to enable the company to keep its claims. The ore was stockpiled on the ground, since the tracks to the mine had been torn up. In 1920, the Lila C. Branch was briefly rejuvenated to haul out the stockpiled ores (Myrick 1963:587).

A short (1.3) mile spur was constructed in 1914 from Morrison up Willow Creek to a gypsum deposit at Acme. Morrison siding later was renamed Acme. Despite floods of 1910 and 1916 that caused extensive damage to the line, operations were continued until 1919, when the mine owner's two sons were killed in a cave-in. The tracks stayed intact until 1927 when they were removed and used to build the Carrara spur in Nevada (Myrick 1963:587).

Another narrow gauge spur was built in 1921 north of Shoshone to a new borax deposit. Gerstley siding was built four miles north of Shoshone at the terminus of this three mile long spur. The line was abandoned in 1926, but the tracks were not pulled up for some years thereafter (Myrick 1963:587).

As Pacific Coast Borax began to develop its borax deposits at Boron, California in the 1920's, older, depleted mines were scavenged for equipment. The Death Valley Railraod, built to serve the mines at (New) Ryan, became a surplus road with the closure of the mine in 1927. Despite efforts to create winter tourist activity (Myrick 1963:591), little use was made of the line and it was closed down in 1931.

The Tonopah and Tidewater fell on still harder times during the Great Depression. In 1933, in an economy move, the tracks between Ludlow and Crucero were abandoned, although the tracks themselves remained in place "to meet mortgage requirements" (Myrick 1963:591). The shops at Ludlow were picked up and moved to Death Valley Junction. In 1938, flood again damaged the line severely and forced a decision to cease operations. The mortgage requirements were met by leaving the tracks in place. After several delays in the effective date of suspension, all traffic over the Tonopah and Tidewater ceased on June 14, 1940.

Within two years, the Second World War caused the War Department to requisition the line. The tracks were torn up between July 18, 1942 and July 25, 1943. Legal abandonment was authorized only after the war on December 3, 1946, despite the fact that no tracks had existed for three and a half years!

During its 31 years of effective life, the Tonopah and Tidewater was plagued by flash floods and slides that caused the tracks to be moved and stations relocated. Notable floods occurred in 1910, 1916, and 1938. The town of Silver Lake was a community greatly affected by the flood waters. Silver Lake was located along a section of the tracks that was built directly across a dry lake bed that was the end of the Mojave River drainage. During the flood years, when the usually intermittent river flowed throughout its length, water would flow from Soda Lake northward into Silver Lake. In 1910, the townsite and tracks were flooded for so long that the tracks had to be elevated six inches above the lake bed. In January, 1916, more severe floods caused the Tonopah and Tidewater to completely suspend operations, and eventually the tracks and siding were relocated on higher ground east of the dry lake.

In Amargosa Canyon, a difficult 12 mile section which delayed completion of the original construction project for one year, a slide occurred at Red Cut. The Tonopah and Tidewater had to install a drainage tunnel 300 feet back of the hill (Myrick 1963:567).

A list of the stops along the Tonopah and Tidewater in 1939, at the end of its career, includes: Ludlow, Broadwell, Mesquite, Crucero, Rasor, Soda, Baker, Silver Lake, Riggs, Valjean, Dumont, Sperry, Acme, Tecopa, Zabriskie, Shoshone, Gerstley, Evelyn, Death Valley Junction, Bradford, Scranton, Jenifer, Leeland, Ashton, Carrara, and Beatty (Myrick 1963:589). Scranton was the last stop in California. The more important stops on the line were Ludlow, Silver Lake, Tecopa, Shoshone and Death Valley Junction. Most are well documented by Myrick (1963). A few places have survived the demise of the line itself because they came to serve diverse local or regional needs.

a. Baker

An unimportant watering stop in the beginning, Baker gained prominence not because of the railroad but because a new national highway (U.S. 91) was built one-half mile south of the train stop. The town moved down to the new crossroads and has become an important rest-refreshment stop on the new I-15 which replaced old U.S. 91. Keeling (1976) and Peirson (1970) include Baker in fair detail; Myrick (1963) barely mentions the town. R.J. "Dad" Fairbanks opened the first service station at the site in 1926, thereby continuing a chain of pioneering ventures in the area that began at Ash Meadows, continued in Greenwater and Shoshone (Myrick 1963:588; C. Lowe 1974:4) and ended in Baker (Keeling 1976:27-31).

b. Silver Lake

Silver Lake, though important because of mining and freighting activity in 1900, before the railroad was built, has nearly completely disappeared. Perkins (1922) has some amusing descriptions and a photograph of the site in 1920. O.J. Fisk, owner of the large store and freighting business at the locality in the early 20th century (Myrick 1963:548), had been engaged in business in the area since at least 1891 (Myrick 1963: 883). According to a long-time Nevadan (Fayle 1978) Fisk was quite a photographer and was never without a camera. His collection has been donated to the San Bernardino County Museum.

c. Tecopa

Tecopa has survived the demise of the railroad and has lived through several modern mining booms (talc, iron from Standard Slag operations). The enduring attraction at the locality has proven to be the hot springs, which continue to lure bathers in increasing numbers.

d. Shoshone

Shoshone, originally a stopover to serve railroad travelers, now hosts automobile tourists as well as local mining operations. For many years, its school welcomed students from Pahrump Valley, Nevada. A well paved road named after Shoshone's famous citizen, Charles Brown, connects Shoshone with the Pahrump townsite. Tourist traffic into Death Valley has been an important source of revenue for the local area.

e. Death Valley Junction

Death Valley Junction, ironically, lost its railroad connection to Death Valley in 1931, two years before the federal government established a national monument and began to encourage recreational visitors through its network of parks and monuments that comprise the National Park Service. Tourists today assume the town's name refers to the junction of California 127 and 190, which branches into Death Valley at that point. Death Valley Junction today is owned by Peter Simon of Jean, Nevada and is for sale. The Amargosa Inn, built in 1923, has been partially restored. The Opera House, also built in 1923 by Ryan to serve the Pacific Coast Borax community, has been purchased by Tom Williams and Marta Beckett, who have become famous in the desert annals for their cultural productions on the very edge of Death Valley (Cuppett 1979). The continued survival of these towns is probably assured because of the proximity of Death Valley, a major national monument, and the mining activities which continue to function both in and around the monument.

3. Short Line Railroads

At the southernmost edge of the Amargosa-Mojave Basin planning units, there were two short line railroads constructed to serve mining developments. The Ludlow and Southern Railway Company was built in 1903 to take ores from the rich Bagdad-Chase mining district (also known as Rochester or Stagg) to the Santa Fe line for transmittal to the mills owned by the same company in Barstow. The line, only eight miles long, operated as a common carrier until 1916 (Myrick 1963:835), when mining ceased. In 1932 most of the buildings remaining at the site and the equipment were burned. In 1937, the locomotives were cut up for junk while the tracks had been sold off two years prior to a San Francisco outfit (Myrick 1963:835). The mines operated throughout World War II because of the valuable ores, but closed down again in 1954.

The Amboy-Saltus Railroad, east of Ludlow along the main line of the Santa Fe, was actually two small roads constructed to take gypsum and salt from open pit mines at Bristol Dry Lake to processing plants built along the lake's margins. The gypsum railroad first went into operation about 1904 (Myrick 1963:837), and continued with some changes until 1924, when the U.S. Gypsum Company closed the Amboy operations and moved to Midland in Riverside County, California, along the Colorado River (Myrick 1963:840).

The other important product of the Bristol Dry Lake has been salt. Salt has been quarried at this site for over 90 years and extraction is continuing today. Myrick (1963:840-1) has a good summary of both the mining operations and the fortunes of the small rail line connected with them.

B. Transportation: Automobile Roads

Development of auto routes, barely begun in the first 25 years of the 20th century, took on great importance in the next 25. The cross-desert travel by auto stimulated by road construction soon caused a significant decline in passenger traffic on the railroads. The Automobile Club of Southern California (ACSC) began publishing road maps as early as 1909 and lesser known auto maps were available as early as 1903 (Rueger; ACSC). These and other printed sources lured America's vacationers and recreationists to the remotest desert regions. Particularly after the publication of the ACSC maps with their picture of well-graded and well-marked roads, reliable watering spots and decent traveler accommodations available on the way to some of America's most spectacular scenery, desert travel proved enticing. The motoring public's fascination with Death Valley, once regarded as a place of hideous aspect and unlivable climate, caused the ACSC to lobby Congress to create a National Monument. Many others joined in these efforts (Norris and Carrico 1978: 88-9) and in 1933 their efforts were rewarded when President Roosevelt signed the papers dedicating the Death Valley National Monument. Despite the interest shown by the public in this new park, the Pacific Coast Borax Company's Death Valley Railroad did not deliver enough patrons to its facility at Furnace Creek, and the rail line was discontinued in 1931 (Myrick 1963: 611).

1. National Old Trails Road

Automobile travel through the planning units was poorly served during the first quarter of the 20th century. Following completion of the Atlantic and Pacific Railroad, later the Santa Fe, a road was constructed in 1914 parallel to the tracks which crossed the Mojave Desert between San Bernardino and Needles. The precursor of the famous U.S. 66, now I-40, this "Ocean to Ocean Highway" or "National Old Trails Road" was promoted by California and especially San Bernardino County officials as an easily traveled, good roadway. However, it was some years before the road was well signed (Norris and Carrico 1978:72) and safe to use. By 1929, however, Thompson reported the road "so well marked that the traveler cannot lose his way. It /was/ traveled by a number of machines each day--in certain seasons more than 100 daily" (Thompson 1929:133). In respect to the planning units under discussion here, the National Old Trails Road only skirted the region and did not penetrate it. The Eastern Mojave remained relatively remote and travel difficult.

2. Arrowhead Trail

The Arrowhead Trail, marked from San Bernardino to Salt Lake City during the period 1914-16, originally followed the National Old Trails Road to a point west of Needles variously called Bannock, Ibis, Arrowhead Junction, and Searchlight Junction (Thompson 1929:143; Bard 1973; ACSC maps). It is located near Goffs on the Santa Fe Railroad. Here the Arrowhead Trail branched off to Las Vegas, Nevada, via Searchlight. This road was well marked and favored by early auto travelers (Ford 1956:20). Mining activities in the Northeast Mojave continued to use the old wagon routes through this nearly unpopulated area, traveling by way of Daggett down the Mojave River to the vicinity of Old Camp Cady, striking northeast to Cave Springs or the Silver Lake, or sometimes continuing down to the Mojave sink at Soda Lake and then north. Consequently, an alternate Arrowhead Trail was marked, but poorly maintained, between Barstow and Las Vegas via Silver Lake and Goodsprings, Nevada (Ford 1956; Squires 1920:18). This Silver Lake cutoff was 65 miles shorter (Ford 1956; Squires says 92 miles) than the Searchlight route, but was not as well used. It was therefore more risky to travel it.

The need for guidebooks to this remote desert region was recognized early with resultant response by the U.S. government as well as private organizations and individuals. Invaluable early references include Mendenhall (1909), Waring (1915), Thompson (1921, 1929), and early ACSC maps. Another fine source is Thurston's Auto-highway, Mountain and Desert Map (1919). Comparison of earlier maps with the 1920 maps clearly delineates the growth of auto traffic reflected in the growth of knowledge about the desert and roads which penetrated it (compare Rueger 1903 with Thurston 1919 and various ACSC maps of 1917, 1923, 1927).

In 1925, with pressure from the ACSC and the citizens of the northeast Mojave, the California Highway Department commenced a new alignment of the Arrowhead Trail. The new road, U.S. 91, (now I-15) was closer to the Silver Lake cutoff than the National Old Trails Road. The new Arrowhead Trail opened up relatively new territory to safe travel by America's increasing auto traffic. From Barstow the road paralleled the National Old Trails Road to Daggett, then followed the Union Pacific railroad (formerly the San Pedro, Los Angeles and Salt Lake line) to Manix Station. Thence it passed northeast across east Cronise Valley to Berry Station on the Tonopah and Tidewater. U.S. 91 then headed by way of Halloran Springs and Valley wells across Clark Mountains into Ivanpah Valley. The road once more met the Union Pacific near Roach, and paralleled the railroad into Las Vegas (Thompson 1929:143). The old Arrowhead Trail north from Bannock retained the name on many old highway maps, but the shorter route was quickly favored by travelers whose destination was the eastern Mojave, Las Vegas, Zion Park or Salt Lake City (<u>cf</u>. ACSC Maps 1923, 1927).

This new highway had enormous impact on the region covered by the planning units (Keeling 1976:28). Prospectors, surveyors and ranchers had learned their way around the northeastern desert, but the greenhorn traveler was at great peril in the area. A.O. Egbert, a resident at Avawatz Mountain's Cave Springs had provided help for the unwary as early as 1895 (Belden 1957b:12) but this remote desert area was not traversed early by great numbers of vacationers and auto buffs. The Perkins account of her attempt to reach Death Valley by auto in 1919 is a fine account of the ordeal characterized by such travel. Perkins in fact could not reach Death Valley by auto and came in the following year by mule, horse and foot via Beatty (Perkins 1922). The new Arrowhead Trail with its clearly marked routes and convenient water and service stops encouraged new incursions into the desert heartland. Death Valley became much easier to reach from the highway at Baker. A new road, California 127, was built north to Death Valley via the Tonopah and Tidewater's stations at Shoshone and Death Valley Junction. This road stimulated auto traffic in greater numbers into the valley, and successfully competed with the Tonopah and Tidewater and Death Valley Railroads in bringing tourists into Death Valley (Keeling 1976:28; Norris and Carrico 1978:89).

Baker, a few miles south of Silver Lake, rapidly eclipsed that old community which had been functioning since the late 1800's. Silver Lake hung on during the construction of the transmission lines between Boulder Dam and Southern California, but by 1940, the small town was dead and today only ruins remain (Keeling 1976:31). Pioneer businessman R.J. "Dad" Fairbanks, then 70 years old, moved to Baker in 1926 and opened up the "Big Blue," Baker's first service station (Keeling 1976:28). By 1933, Silver Lake had declined to the point that the post office was moved to Baker (Keeling 1976:31). Farther west along the new highway, Midway opened up to provide services to automobile traffic (Keeling 1976; Norris and Carrico 1978:81).

Traffic between San Bernardino and Salt Lake City via Las Vegas increased so much in the next few decades that in the mid-1960's an interstate highway (I-15) was constructed parallel to old U.S. 91. As Norris and Carrico point out, many of the small service stations opened along the 1926 highway were completely by-passed by the new interstate, and the economic impact has been quite strong (1978:123). In the southern portion of the Amargosa-Mojave Basin planning units, I-40 has similarly replaced old U.S. 66 of song and legend, and with similar results.

The growth of California highways, 1895-1945, and their economic impact is examined in a book now in press by Dr. Gerhard A. Fenzke (in press). This volume should prove useful in providing detailed accounts of the impact of the various highways on the California desert growth and use patterns.

C. Military Activity

In the 20th century, military activity of a relatively permanent nature became an important influence in the Mojave Desert. The desert was no longer the province of army surveyors pushing out the boundaries of knowledge or defending overland travel routes, as in the 19th century, but rather a desirable location for weapons testing, storage, personnel training and battle strategy development. In the Mojave, large tracts of land were set apart as military reservations. The Mojave Army Antiaircraft Range, later Camp and then Fort Irwin, was established northeast of Barstow in 1940. Norris and Carrico (1978: Ch. 11) have a good summary of the desert facilities established during the early '40's, although only Camp Irwin was of importance for the northeast Mojave.

Camp Irwin was abandoned after World War II, but reactivated for the Korean Conflict. Goldstone Tracking Station was carved out of Camp Irwin in 1958 (Keeling 1976:78), but the entire base remained in military hands. In 1970 (Norris and Carrico 1978:126) Fort Irwin was deactivated by the U.S. military but has been turned over to the California National Guard. The continued use of this portion of the desert by the military has resulted in closing off of early wagon trails, roads and mining camps between Barstow and Silver Lake via the Avawatz Mountains, and has isolated the Owlshead area by nearly surrounding it with military reservations or park lands.

The former army supply centers at Nebo, near Yermo, now Marine Supply Depots, are important facilities just west of the planning unit boundaries (Keeling 1976:73; Norris and Carrico 1978: 110). The Marine Corps training center north of Joshua Tree National Monument borders the southern boundary of this study area. Patton's Desert Training Center was located east and south of these planning units, and had only indirect impact on this area.

D. Mining

Mining of precious metals continued to provide significant revenues during the early years of the 20th century. However, salt, gypsum, clay, iron and rare earths gradually gained importance and today provide most of the mining opportunities in the Amargosa-Mojave Basin planning units (Ver Planck 1961: 1). Feverish, sporadic activity spurred short-lived growth at Ludlow for the Bagdad-Chase area on the Santa Fe line. Ludlow station also was the important staging area for supplies to Borax Smith's mines in the Death Valley region far to the north, as well as for the Baghdad-Chase area to the south (Norris and Carrico 1978:61; Myrick 1963:827). The Orange Blossom Mine in the Old Woman Mountains also provided a brief but rich flurry of activity between 1907 and 1910 (Norris and Carrico 1978:70; Myrick 1963:787; Hartill et al. 1979). Mining activities at Dale also supplied important revenues from previous metals and extended railroad supply services as well.

Lead and silver ores were anticipated in important quantities from the Avawatz Crown Mine (Mining and Oil Bulletin 1919:451). However, the leads proved to be insignificant. Manganese was recovered in short-lived operations near Owlshead Spring (Thompson 1921:203). Mendenhall (1909:45) noted the presence of a monument mineral claim marker, but did not mention mining operations. Williams (1935 :6) reported that a George Rose of Utah, first foreman of the Keystone Mine in Nevada, in 1935 was operating a gold property near "Leache's Point,in California." Nothing more is known of this operation. Mendenhall (1909:45) noted the ruins of two corrals along an old pipe line at Leach's Spring which he attributed to the 20-mule team borax developments.

In the northeastern Mojave, new gold and copper strikes at Greenwater, Crackerjack, and Schwab were served by the Tonopah and Tidewater Railroad. The Keane Wonder Mine north of Furnace Creek and the Lila C. became active in the second decade of the 20th century, and old mines such as the Gunsight and Noonday were reactivated (Norris and Carrico 1978:69, 71).

The Pacific Coast Borax Company opened the Biddy McCarty borax mine north of the Lila C. and moved its base of operations to the new location. The new camp was called "New Ryan" (Hartill et al. 1979; Myrick 1963:586).

Important mines were opened for non-precious metals--especially talc, iron and borax. The Shadow Mountain area was especially productive (Myrick 1963:587; Wright 1954, 1968) and the Acme mine in Amargosa Canyon shipped out so many tons of borax that the old Morrison siding at China Ranch was renamed Acme by the Tonopah and Tidewater. In 1928, however, the Pacific Coast Borax Company moved its facilities from New Ryan to Kramer, near the Kern-San Bernardino County line (Norris and Carrico 1978:83). The removal of these activities signaled a significant decline in the population of the region that was accelerated during the Great Depression of the 1930's. The Tonopah and Tidewater discontinued operations during this period, and the isolated railroad communities of the Northeast Mojave lost their residents. Death Valley Junction became a ghost town, Tecopa and Shoshone dwindled to a few families each. Only Baker held on, important to motoring cross desert and because it is the southern portal to Death Valley.

Death Valley Junction lay abandoned for many years, until the arrival in 1959 of Tom Williams and Marta Beckett. Beckett is a mime and dancer. The town itself is now owned by Peter Simon, owner of Jean, Nevada, and some further work has been put into restoring the interior of the old Amargosa Inn. However, Simon now has the property on the sale block again. Simon reportedly has agreed to a restrictive clause in the sale that would preserve the new murals painted in the Inn by Marta Beckett. Tom Williams reports that he has been given the entire wing of the old structure that houses the Opera house which he and Beckett already own. He hopes to establish a research facility there (Kepper, personal communication, 1979).

Another old mine that got a new lease on life in the 20th century is the Copper World, located to the east of the planning unit boundaries. The revival was stimulated by an extension of the California Eastern Railway in 1899 to Ivanpah II (Norris and Carrico 1978:60; Ver Planck 1961:5, 6). This resurgence of activity also resulted in the erection of a smelter at Rosalie, once headquarters of the old Yates ranch and located just north of today's I-15 near Valley Wells (Hartill et al. 1979; Ver Planck 1961:6). The Copper World declined for some years following this early resurgence, and then revived briefly in World War II (Norris and Carrico 1978:76).

For a brief period around the turn of the century nitrates were thought to exist in commercial quantities in the Amargosa region. Intensive investigation was made and the results were conclusive that this was not the case. While the lack of nitrates was a major disappointment to the U.S. government, which sought American deposits, much good historical information can be found in the reports. A summary of all the activity is contained in Noble et al. (1922).

Since the 1920's, talc, gypsum and iron have been worked successfully in northeastern San Bernardino County (Ver Planck 1961:1, 7). With increasing emphasis on environmental protection, and with high labor and transportation costs, however, many mines are now closed. In Death Valley, no new mines are permitted to open as pressure has been put on Congress to protect the scenic values of the Monument.

Rare earths have become extremely important in modern manufacturing processes. The Mountain Pass Mine managed by the Molybdenum Corporation of America mines bastnaesite with lesser quantities of other rare earths also found. The ore was first recognized in 1949 (Ver Planck 1961:8) although the area had been extensively worked for gold and silver since the 1860's. In 1939 a gold mining venture opened at the site, but was unsuccessful. The buildings constructed for the gold operation now house the plant for processing the rare earth ore (Anonymous n.d., n.p., ca. 1970, Las Vegas, Nevada; Ver Planck 1961:8).

The Standard Slag iron mine in Tecopa opened up first in the late 1960's, but was developed on an old claim called the Beck Mine, apparently a gold property. Standard Slag mined ore at this small vein deposit, trucked the ores to Cima where they were sent by rail to San Pedro and transshipped to Japan by freighter for processing. This complicated picture emerged because the owner of the mine, connected with Youngstown Steel, had won a huge court battle against U.S. Steel in connection with patents on rolling mills, and no U.S. company would process the ores. The mine last worked in 1978; the company, based in Reno, Nevada, still operates in Nevada at Atlanta, north of Pioche in Lincoln County (Rawlinson, personal communication 1979).

E. Agriculture: Homesteading-Farming-Ranching

Spurred by the Panic of 1907, which dispossessed many people of land and livelihood in more rewarding areas, homesteaders began to trickle out in to the farther reaches of the Mojave Desert.

Cronise Valley

In the Amargosa-Mojave Basin planning units, Cronise Valley was a virtually untapped area that provided some agricultural opportunities. Generally, however, the soils were too thin and water too scarce to ensure successful operations. Cronise Lake is an overflow basin for the Mojave River. Flooding is also a problem in this valley and a hazard for any settlement. Some subsistence farms were established (Thompson 1929; Bard 1973; Norris and Carrico 1978), but proved short lived. Today the Cronise Valley is traversed in minutes by speeding autos on I-15, and looks as if no plow had ever touched the soil. Only an occasional fence post still stands to reveal that farmers once thought to make the place into an agricultural region.

Mesquite Valley

The first homesteaders arrived in Mesquite Valley in 1908, locating on the California side (Williams 1935). They lasted two years. Not until 1922 did interest revive, when Kingston townsite was developed by E.M. Funk (Williams 1935 ; Norris and Carrico 1978:78). In 1934, the town was comprised of a store run by E.M. Funk, a community hall, and a branch of the San Bernardino County Library. The community hall was used for occasional church services. However, the land was unproductive, lacking in sufficient water for profitable farming operations. The mines supported the town until their demise. Kingston has now vanished, with only a few rotting boards and one lone grave in a nearby cemetery to mark the spot.

Cattle ranching declined throughout the years. In 1929 Thompson estimated only 5000 cattle on the range in the entire desert region (1929:40). The Taylor Grazing Act of 1934 brought the vast desert acreage under meaningful federal management (Bard 1973:111; Clawson 1971). Control passed to the Bureau of Land Management in 1946 (Norris and Carrico 1978:110), and the record of grazing allotments has been kept since that time. Small numbers of cattle are still run along the northeast border, some on Nevada and some on California allotments. One of the largest spreads in the area was the Spring Mountain Ranch allotment (the old Wilson Ranch). This ranch is now a Nevada State Park, and the grazing lands have not been leased since 1974. The waters have been filed upon for recreational/

wildlife use, and it is unclear what will be the fate of the unused grazing allotment. Unless the lessor is prepared to drill wells, and unless the states of Nevada and California grant permits for such wells, there would be no further use of these lands for cattle. There is not enough natural rainfall to serve domestic animals.

F. Recreation

Recognition of the recreational and park values of the California desert was made early by such organizations as the Automobile Club of Southern California and by the International Desert Protective Association (Norris and Carrico 1978:88). The Automobile Club, in particular, by encouraging its members to tour the desert, and by assisting them to do so with maps and sign programs, as well as lobbying for better roads, has been a twin-edged sword in so far as the desert is concerned. The desert, ecologically fragile while magnificent, and seemingly strong and unchangeable, came to be loved by a large cadre of Californians. In the process, this love affair has grown to such proportions that the very existence of the loved one is threatened in modern times. A direct response to the problem has been the formation of an association to promote a "Mojave National Park." The western portion of this proposed development incorporates part of the Mojave Basin and Kingston planning units (Citizens for a Mojave National Park 1977:15).

Mining was expressly permitted in the boundaries of Death Valley National Monument until pressure in the late 1970's has caused Congress to forbid the opening of new claims, although the claims themselves might be quite old. While park visitation was low in the 1930's through mid 1940's (Norris and Carrico 1978:90, Fig. 4), much of this can be attributed to the Great Depression and to World War II following immediately on its heels. Wartime gasoline rationing curbed auto travel and the depression earlier resulted in lack of money to finance autos, gasoline and trips of any kind except for the super rich or Dust Bowl refugees (Bard 1973:101). Postwar interest in the desert has grown steadily and shows no signs of diminishing. Perhaps the major decision faced by the Bureau of Land Management in these next few decades is the growing and complex problem of reconciling conflicting demands placed on the land.

As the economic studies of Stanford University have shown for the Bureau of Land Management, this problem will be more difficult to resolve later in the century, as more and more population centers build up in the growth of the "Sun Belt," and more pressure is put on the lands from all sides, rather than primarily from the California coastal area and the Colorado River developments (Ryan et al. 1978).

Chapter V: Research and Management Recommendations

A. Research

Virtually all of this portion of the Mojave Desert is in need of professional research attention from historians. On the basis of this Overview, certain sites can be identified that are of significance in discussing the history of the entire region. These sites should be considered as components of a larger research project and systematic efforts made to research their individual histories. At some point in the future, then, the story of the development of the region could be synthesized. At this time, no site is adequately known and placing of historic values on individual sites is therefore somewhat haphazard and even presumptuous.

The BLM should attempt to collect certain resources identified in this report which could be used in the research needed to document the history of the region. Specific recommendations include:

1. Tonopah and Tidewater Railroad. Acquire Art Rader's collection of photographs of the length of the T & T line. These photographs and his comments on the changes documented in them could be acquired by contract with Rader.
2. O.J. Fiske collection, San Bernardino County Museum, should be studied for relevant photographs and copies made for BLM archives.
3. Frank Williams' manuscripts should be acquired from Special Collections Department, Dickinson Library, University of Nevada, Las Vegas. These would be available upon request from BLM. Manuscripts of interest are the Williams autobiography, and his histories of Mesquite Valley, Potosi, and Goodsprings. All of these items contain information of interest concerning the California Desert.

B. Management Recommendations

Management of historic sites and trails should be based on a conservative philosophy; that is, every effort should be made to ensure that the resource is not destroyed by efforts to publicize or exploit them for the "public good." It is most emphatically not in the best interests of the resource to be "loved to death." In line with this thinking, interpretive programs in particular should be very conservatively approached at this time. If and when the BLM achieves a satisfactory level of staffing, programs could be increased in number, scale and frequency. Adequate staffing means on-site supervision by trained rangers of a site that has been signed, cited on maps, or listed in guidebooks.

Specific recommendations include:

1. Trails, Wagon Roads, and Railroad Beds

a. Spanish Trail: Virtually impossible to identify with precision on the ground due to over 100 years of use since its decline. Historic markers could be placed along major highways that intersect the old trail routes so that the public could discover its existence and appreciate the difficulty of trans-desert travel 150 years ago.

b. Mormon Road: Good traces of this route still exist and historic marking would be appropriate for back country users. Where possible, indicate as well the Fremont path, which is the same route in many instances. Prior to signing the route, all archaeological and historical sites along it should be identified and properly protected. Portions of the route would be suitable for hikers and horseback riders. Appropriate maps could be printed and distributed to these users. Some provision should be made for patrolling the route so that any user who encounters difficulty could receive help.

c. Arrowhead Trail: Readily identifiable along portions of the route, where it was not obliterated by construction of the newer U.S. 91 project. The same recommendations as for the Mormon Road apply here. This trail will not be suitable for ordinary passenger vehicles now because the roadbed has not been maintained. It should be treated as a wagon road, despite its paved condition when it was abandoned.

d. Mohave Trail-Old Government Road: Very rugged in some spots, the road is identifiable in many instances. In certain portions, the roadbed could easily be converted to use as a hiking/horseback trail. Precautions should be taken in respect to historical and archaeological sites, and there should be regular patrol of the road to protect its users. Between Soda Springs and Fort Piute, the trail could be managed quite well for hikers and horseback riders. In this instance, Fort Piute should be considered the eastern portal of the trail, and Soda/Zzyzx the western. Rangers (not caretakers, who have no police authority) should be stationed at each end to provide constant control over the trail.

e. Tonopah and Tidewater Railroad bed: This nearly level roadbed is ideal for a biking trail, providing an extraordinary opportunity for this type of recreational use of the desert. Bikes could be accommodated with a minimum of maintenance even though the roadbed is not paved. Such use of the trail should be patrolled so that anyone in trouble is given assistance within a reasonable time period. Water should be made available at the 20 mile intervals once utilized by the railroad itself. The roadbed might also accommodate horseback riders, trail bike users, and all-terrain vehicle drivers. However, the use of the roadbed by all these types of recreationists has some inherent dangers. Attention to conflicting uses would have to be carefully considered (motorized vehicles and animals don't mix well). Motor bike users and 4-wheel drive people could cause too much deterioration of the roadbed and damage to other portions of the environment. Unfortunately, people who drive vehicles with powerful engines tend to try them out on precipitous terrain regardless of the effect on the topography. In other words, it would be hard to interest these users in staying on the relatively level roadbed when they want to test their vehicles on the rugged terrain so temptingly close around them.

f. Smith's Traction Road: This road should be field surveyed its entire length. Where possible, it should be marked so that back country users will know they are on a historic road and what it was. Prior to opening the road in this manner, all archaeological and historical sites should be identified and protected.

2. Historic Settlements and Ranches

Settlements are very vulnerable sites. Most of them have been abandoned and many have been heavily impacted by pothunting. Others have been obscured by modern developments. However, such sites as Ivanpah I, the Mesquite Salt Works, and Silver Lake have all but vanished from the public awareness. It is recommended that these sites be recorded for future interpretive development by the BLM but that no effort be made to include them in publicity concerning the desert until and unless there is a considerable measure of protection afforded them by the BLM. The potential for vandalism and looting is too high.

Sites which have been identified as now being impacted by the public, such as Salt Spring, should be fully surveyed and recorded. At Salt Spring, efforts should be made to discover the location of the historic burials, and a thorough analysis of the prehistoric record should be conducted. A campground of some type should be placed there, with ranger patrol as a minimum level of supervision. This site is being used indiscriminately now, and without proper attention the site will be totally destroyed within a few more years. The site should be signed and interpreted for its important historic value as the first gold mine on the Mojave Desert, and it should be placed on the National Register of Historic Places for that and for its role as an early emigrant camp site.

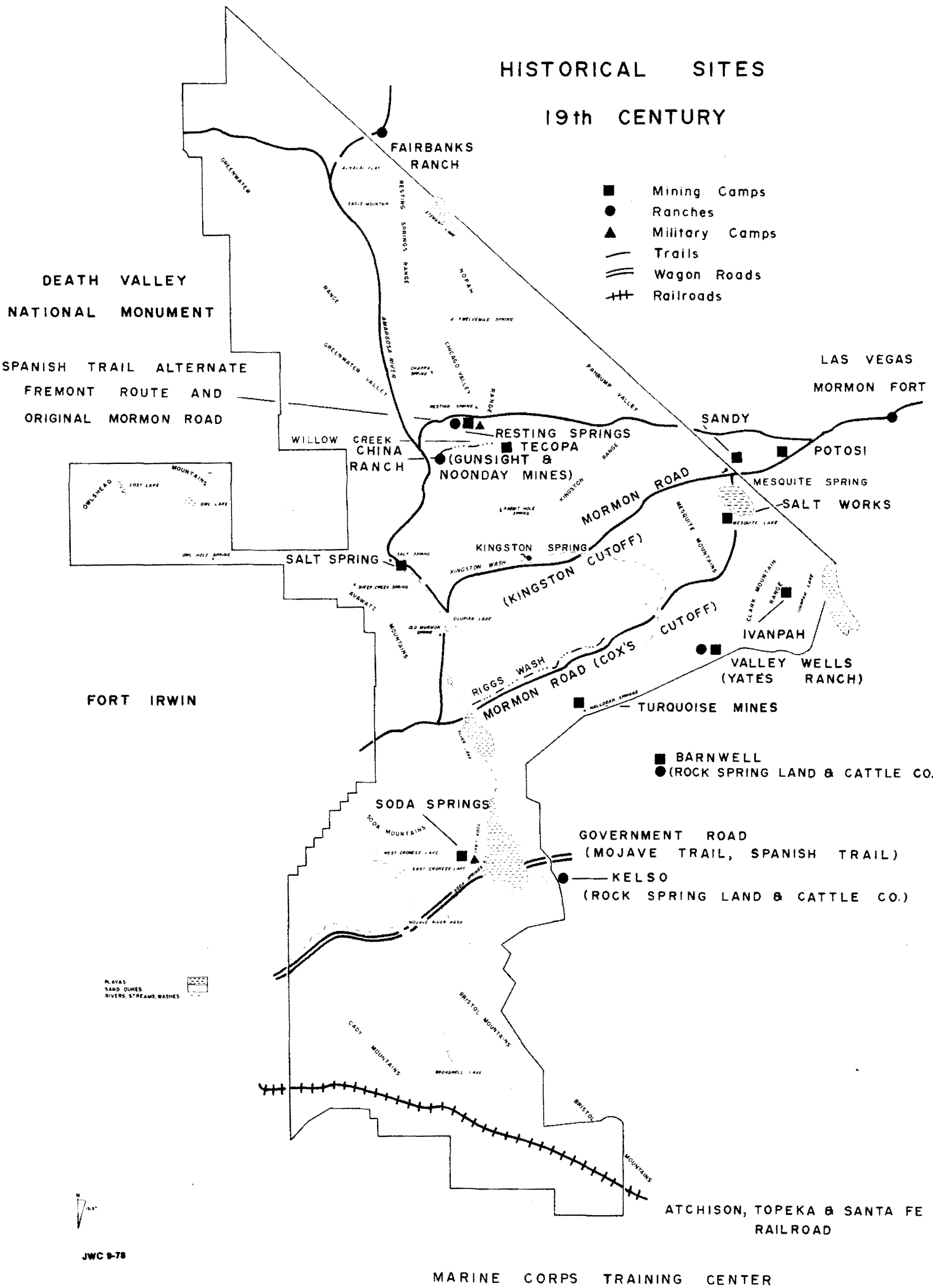
Soda Springs, now being managed as a scientific research station, should be managed as much for its historic values as for science. The role of Zzyzx and Dr. Springer should be restored to importance in the interpretive programs developed here, as they are more unique than the military importance underscored in the naming of the "Fort Soda ACEC" in the draft preview of the Preliminary Desert Plan. As Zzyzx, the site attained widespread publicity and deeply affected the lives of many health seekers. National public awareness of the value of the desert in restoring health was certainly achieved in great part because of Dr. Springer and his health resort.

Tecopa Pass should be identified as the site of the historic Tecopa of the 1870's, and a survey should be done of the grounds to attempt to identify the remains of the early camp. Tecopa Pass might also be considered as a portal to Amargosa Canyon via China Ranch and Willow Creek, with suitable arrangements made with owners of China Ranch. It would be a fine natural and historic trail, offering many enjoyable and educational experiences, suitable for hikers and riders.

PACHALKA SPRING PETROGLYPH (NO SCALE)

Map 1

HISTORICAL SITES OF THE 19th CENTURY

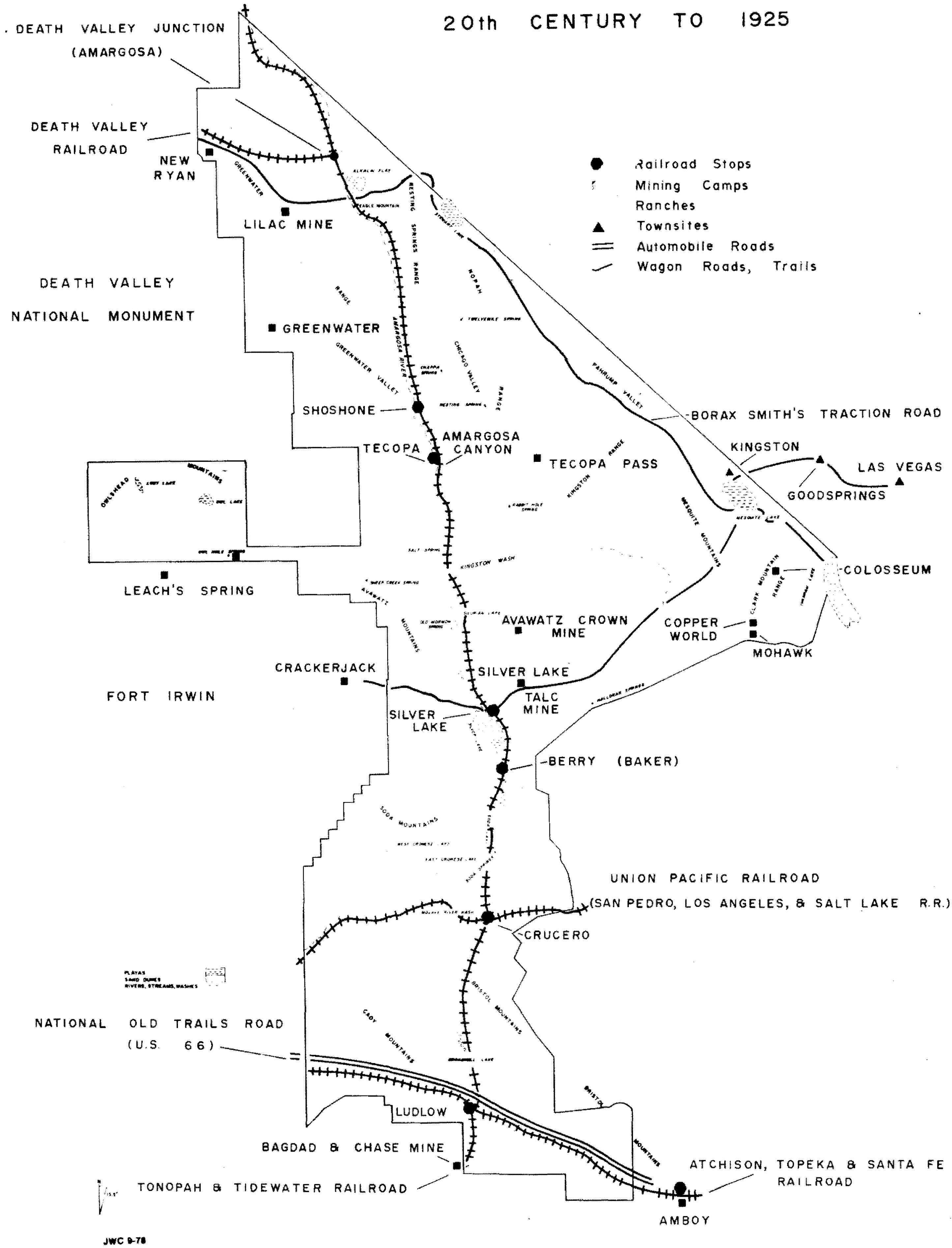

HISTORICAL SITES
19th CENTURY
Mining Camps
Ranches
Military Camps
Trails
Wagon Roads
Railroads
FAIRBANKS RANCH
DEATH VALLEY NATIONAL MONUMENT
SPANISH TRAIL ALTERNATE FREMONT ROUTE AND ORIGINAL MORMON ROAD
LAS VEGAS MORMON FORT
SANDY
POTOSI
RESTING SPRINGS
TECOPA
(GUNSIGHT & NOONDAY MINES)
WILLOW CREEK
CHINA RANCH
MESQUITE SPRING
SALT WORKS
MORMON ROAD
KINGSTON SPRING
SALT SPRING
(KINGSTON CUTOFF)
IVANPAH
(COX'S CUTOFF)
VALLEY WELLS (YATES RANCH)
RIGGS WASH
MORMON ROAD
TURQUOISE MINES
FORT IRWIN
BARNWELL
(ROCK SPRING LAND & CATTLE CO.)
SODA SPRINGS
GOVERNMENT ROAD (MOJAVE TRAIL, SPANISH TRAIL)
KELSO
(ROCK SPRING LAND & CATTLE CO.)
AMARGOSA RIVER
RESTING SPRINGS RANGE
NOPAH RANGE
GREENWATER VALLEY
CHICAGO VALLEY
PAHRUMP VALLEY
KINGSTON RANGE
MESQUITE MOUNTAINS
CLARK MOUNTAIN RANGE
AVAWATZ MOUNTAINS
SODA MOUNTAINS
BRISTOL MOUNTAINS
CADY MOUNTAINS
PLAYAS
SAND DUNES
RIVERS, STREAMS, WASHES
ATCHISON, TOPEKA & SANTA FE RAILROAD
JWC 9-78
MARINE CORPS TRAINING CENTER

Map 2

HISTORICAL SITES OF THE 20th CENTURY TO 1925

HISTORICAL SITES

20th CENTURY TO 1925



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