PREHISTORIC LITHIC
PROCUREMENT AND LAND USE ON
THE PEBBLE TERRACES
OF THE MULE MOUNTAINS
NEAR PALO VERDE,
RIVERSIDE COUNTY, CALIFORNIA

Mooney-Lettieri & Associates, Incorporated

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aerial photos
Sun Desert reports.

PREHISTORIC LITHIC PROCUREMENT AND LAND USE ON THE PEBBLE TERRACES OF THE MULE MOUNTAINS NEAR PALO VERDE, RIVERSIDE COUNTY, CALIFORNIA

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TABLE OF CONTENTS

APPENDICES

TABLES

I. INTRODUCTION

Coon Hollow is on the West side of the Mtns.

The Coon Hollow region on the east side of the Mule Mountains, only 19 kilometers (12 miles) west of the Colorado River, is a land of barren desert pavements and sparsely vegetated washes. The dry desiccated hills stand in stark contrast to the green Palo Verde Valley that is today irrigated, but in antiquity probably appeared as an overgrown flood plain of the Colorado River. Yet despite the inhospitable terrain there is evidence everywhere of prehistoric human activity. For the Pebble Terrace Project area, named after the abundant naturally formed desert pavements of rounded Colorado River pebbles, was a source of raw lithic material as well other basic resources that attracted prehistoric hunters and gatherers, probably for the last 10 millennia.

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The same fine grained (?) chalcedony pebbles and cobbles that brought the ancient tool maker have also brought the modern rock collector who may cause substantial impacts to archaeological sites. Commercial collectors have been illegally scraping up whole areas of desert pavement with heavy equipment for sale to landscape companies. In addition, some of the more select material has been hand picked by both commercial collectors and amateur rock hounds. Additional impacts have also resulted from off-road vehicular activity that disturbs the spatial association of artifacts and obliterates sensitive surface features such as trails and cleared circles.

General impacts to archaeological sites on desert pavements in the Colorado Desert have been recognized by the Bureau of Land Management for quite some time (Weide 1976). The problem has become acute enough in the Pebble Terrace area that they have contracted with Mooney-Lettieri to collect data with which to assess the significance of these cultural resources.

Purposes of project, etc. Some explanation.

1. Conduct an inventory of approximately 1000 acres of desert pavement covered terraces within the project area. This area was defined as Sections 29,30,31, and 32 of Township 8 South, Range 21 East on the Palo Verde Mountains 15 Minute U.S.G.S. Quadrangle. These four sections are just north of the Riverside County, Imperial County line.

2. Record all materials on site forms and produce maps of selected cultural resources in the inventory area.

3. Analyze the lithic material using a non-collective field recording strategy to ~~access~~ assess the age, cultural affiliation, and lithic technology of the artifacts in the recorded sites. This task also includes an assessment of the significance of lithic exploitation and reduction in the project area within a general hunter-gatherer settlement subsistence system.

4. Evaluate the cultural resources for potential eligibility to the National Register of Historic Places.

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5. Collect and analyze any unusual or unique artifacts that might be collected during the survey.

This report details the accomplishment of these tasks. A section on the environment is first presented that outlines the environmental variables that are important for understanding the cultural history of the area and the ecological aspects of prehistoric human resource extraction. The geomorphology of the project area is also summarized, with criteria given for dating three major surface types and six chronological phases of alluvial terrace formation. Data and arguments are provided for the establishment of desert conditions by the end of the Pleistocene Period and the beginning of firm evidence for human occupation of the area. The next section outlines the culture history of the area as it is currently understood. Problems of dating sites on desert pavements are discussed with reference to desert pavements, desert varnish, and lithic taxonomy. A brief discussion of previous research connected with the Sun Desert Nuclear Plant Site is also presented.

I hate this word.

The methodology section discusses survey and data recording techniques. Each of the six survey units and seven lithic data recording units are described with reference to localized geomorphology and archaeological finds. This is followed by the detailed presentation of results, beginning with a description of the two large sites defined for the project area. The lithic data is then analyzed with accompanying tabular presentations. General patterns of lithic distribution are used to access the density and range of variability of archaeological remains on different geomorphic surfaces. Attributes that are traditionally associated with dating, namely varnish, patina, and relation to desert pavments, are found to be associated with specific geomorphic surfaces and may provide some of the first quantitative evidence to support these long held assertions. Aspects of the prehistoric lithic reduction technology are also outlined from the qualitative and quantitative analysis of flakes and cores. Several collected artifacts are also described in detail, including an unusual imported obsidian scraper.

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The final section on National Register assessment considers the scientific significance of the two defined sites and provides an evaluation of eligibility, drawing on the data presented in the results section.

II. ENVIRONMENT

The environmental variables that most directly ~~e~~affected prehistoric lifeways are described below. Ecological relationships between natural environment and cultural systems appear to be most direct among hunter-gatherers. Compared to farmers and herders, hunter-gatherers cause the least change on their environment and rely on the least complex technology (Bettinger 1980). It is therefore essential to understand the environmental constraints and opportunities that shaped hunter-gatherer adaptations in the Pebble Terrace area as reflected by the archaeological record. Within a hunter-gatherer ecosystem, environmental change will be expected to have the greatest effect on human behavior. Evidence will be reviewed for changes in climate, hydrology, and vegetation within the Colorado Desert and the extent to which present environmental conditions can be projected into the past. Relevant environmental overviews have also been prepared by D. Weide (1976), McCarty (1981), and McGuire (1982). Col. Des. overview

The Pebble Terrace study area is on the far eastern edge of the Salton Trough geographical province. At an elevation of 400 to 500 feet above mean sea level (amsl) the region supports a typical Lower Sonoran habitat (Sharp 1972:34-41). Few areas of North America are hotter or dryer than this. The only permanent water source is the Colorado River, 19 kilometers to the east. As a result, vegetation is sparse and widely distributed. Today, as in the past, the area ~~was~~ is marginal for any human occupation because of environmental conditions.

Current climatic conditions provide for dry, mild winters and dry, hot summers. Yuma weather records indicate mean winter lows of 44° F (6.7° C) and a mean summer high of 104° F (40.0° C), with record highs of 120° F (48.9° C). Precipitation in the region is insignificant. There are an average of seven thunderstorms in the summer resulting from the desert Southwest monsoon pattern but they only produce an average of 0.83 inches (2.1 cm) rainfall. The winter mean is only 1.30 inches (3.3 cm). When rain does fall, it often occurs as violent localized storms that produce extensive runoff but little useful water.

The limited precipitation has produced a sparse creosote-bursage scrub vegetative community (Collins 1976, Jaeger and Smith 1966, McCarty 1981). The desert pavement covered terraces are almost totally denuded of vegetation while the sandy washes retain enough water to sustain the only plants. The most commonly occurring species include *Larrea tridentata* (creosote), *Ambrosia dumosa* (bursage or burrobush), *Fouguieria splendens* (ocotillo), *Encilia farinosa* (brittle bush), and *Opuntia basilaris* (beavertail cactus). Larger washes also contain some additional species representing the woodland-wash vegetative community. Woodland associations include *Olneya tesota* (ironwood), *Cercidium floridum* (palo verde), *Parosila spinosa* (smoketree), *Acacia greggii* (catclaw), and rarely *Prosopis julifera* (honey mesquite). A more comprehensive list of both indiginous and introduced desert species that can be found in the general area appears in von Werlhof and von Werlhof (1976:134-136). Seasonal grasses and various Atriplex (saltbush) species may also be found in the project area.

While several of the species listed above have known aboriginal uses (Bean and Saubel 1972, Forde 1931, Castetter and Bell 1951, Pendleton 1984:65-76), none occur in sufficient variety or density to make the area an attractive food collecting zone. Only the beans of the mesquite were a preferred wild food source, while the beans of ironwood, screwbean and other related species were considered quite inferior "famine foods". The oasis-like conditions of the Colorado River flood plain certainly provided wild plant resources in greater abundance and with greater reliability than the desert areas (Griffin 1931).

Evidence of earlier environmental conditions ~~are~~ is very limited. Pollen bearing stratified deposits from caves or lake beds are not common in the Colorado Desert as they are in the Great Basin (where most of the climatic reconstructions are based.) Very recent data, however, indicate that the area was already approaching modern desertic conditions by the beginning of the Holocene Period and the advent of the earliest well-documented cultural remains (Thompson 1984).

Ernest Antevs first developed a tripartite model of environmental change in western North America (1948, 1952). This model was widely accepted by archaeologists, although there were a few objections (Jennings 1957). The past two decades of research in palynology and sedimentology, with chronological control provided by radiocarbon dating, have substantially modified Antevs' original formulation. Time depth has been expanded and Antevs's middle Holocene climatic period, the Altithermal, has been re-evaluated. This very dry/hot interval between 7,000 and 4,000 before present (BP)/ may only be applicable to the Northern Mojave and Great Basin, and not to the Southwest deserts where the summer monsoon patterns produced a less severe climatic regime (Aikens 1979, Mehringer 1977, Van Devender and Spaulding 1979). There is also greater awareness of that minor fluctuations may have effected prehistoric populations, although these short-term shifts are difficult to document.

Based on current information the climatic history of the area may be summarized as follows (Van Devender and Spaulding 1979):

Late Pleistocene (22,000 to 11,000 BP): cooler and wetter conditions supporting Pinyon-Juniper Woodlands, expansive deep lakes, and savannah grasslands at low elevations.

Early Holocene (10,000 to 8,000 BP): gradual warming and drying conditions resulting in the shrinking of lakes and replacement of woodlands by creosote-bursage scrub communities at lower elevations.

Middle to Late Holocene (8,000 BP to present): warm and dry conditions continue, dominated by summer monsoons in the desert southwest and winter storms along the Pacific Coast. Lakes in low lying basins completely dry up or become only short-term shallow bodies. Locally specific fluctuations in temperature and aridity produced ecological variations of no greater magnitude than known from historic records.

The most recent pollen and macrofloral studies near the project area strengthen this model of climatic change, although they indicate that arid climatic conditions and Lower Sonoran vegetation had already been established by the very beginning of the Holocene. Packrat (*Neotoma* spp.) middens from Picacho Peak in the southern Chocolate Mountains (Thompson 1984) and from low elevation sites in the Wellton Hills area near Yuma (Mead et al. 1983, Van Devender 1973) have been radiocarbon dated between 10,500 and 8,000 BP. They have been found to contain the full compliment of cresote-bursage scrub species. The Picacho Peak middens also produced desert mouse bones (*Perognathus baileyi*) which also indicates warm/dry conditions in the early Holocene. These data are additionally supported by a recent examination of Quarternary geomorphic surface in the Picacho Basin, California, just south of the project area (Waters 1984). Changing vegetation patterns due to climatic shifts can be indirectly traced by observing changes in the mode of sedimentation and stream channel action. These erosional processes are indicated by soil characteristics, surface morphology, and particle size. From such observations, Waters reconstructed a semi-arid climatic and vegetative pattern in the Late Pleistocene and earliest Holocene, followed by arid conditions throughout the Holocene.

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Pollen records from upland areas of Arizona do indicate climatic shifts at 11,000 BP and 8,000 BP resulting in the ascension of pinyon-juniper and oak woodlands to higher elevations. Desert vegetative communities had already established themselves in the lowlands, however, and these changes had little effect on local human adaptations in the Colorado Desert . Even in the late Pleistocene, there is evidence to suggest that a refugium of desert species survived in the southern Sonoran Desert, including the Lower Colorado River Valley (Thompson 1984).

Pollen studies from the middle and late Holocene period are few, but several dispute Antevs's model of a warm/dry Altithermal, at least for the Sonoran Desert (Thompson 1984). In any case, it is clear that the prehistoric occupants of the Colorado Desert were confronted with very similar climatic and vegetative conditions as presently found. What cannot as yet be determined is the presence, or effect, of minor periodic climatic fluctuations of micro-environmental variability in the prehistoric period. White, (1974) however, has assembled documentation of periodic droughts along the Colorado River in ethnohistoric times and its effect on tribal warfare and territoriality.

The most important environmental change in the Late Holocene period of the Colorado Desert was the formation of ancient Lake Cahuilla. Approximately 950 years ago the Colorado River, in flood, broke through its natural deltaic cone at the Gulf of

California and turned north into the Salton Trough. For the next 450 years, the river periodically poured into what is now Imperial and Coachella Valleys to produce a 96 meter (315 foot) deep lake. An oasis-like lacustrine environment then developed around the shoreline, at about 12 meters (40 feet) above mean sea level. A string of shorelines, marshes, and embayments ringed the lake, supporting habitats for shellfish, fish, waterfowl, cattail reeds, and other economically important resources for the local inhabitants (Wilke 1976, 1978). The lake shore attracted people from the Colorado River, the Mojave Desert, and the Peninsular Range; and they all left their remains on the relic shoreline. There is some evidence for periodic fluctuations in the depth of Lake Cahuilla during the late prehistoric period but these are uncertain. Much deeper earlier lakes are also documented for the late Pleistocene period but none of those shorelines are directly associated with any cultural remains (Waters 1980). (In any case, the Colorado River finally returned to its original course after a drought reduced the velocity of flow about 500 years ago (A.D. 1450-1500). Evaporation caused the lake shoreline to gradually recede, drying up the littoral marshes and embayments. Eventually the water became too saline to support much wildlife, and most of the native population ceased to inhabit the area, returning to their home territories in the Peninsular Range and on the Colorado River.)

Opinions differ concerning the periodicity and longevity of Lake Cahuilla (Water 1980a, Waters et al. 1980:9-26, Weide 1976:9-20, Wilke 1978). Six stands of the Pleistocene period lake, known as Lake Leconte or the Blake Sea for that period, are documented for the time between 50,000 and 10,000 B.P. All of these Pleistocene shorelines are above 100 feet AMSL, with the youngest at 26,000 years B.P. None of these are associated with human occupations. At least four intervals occurred in the Late Holocene, leaving a string of archaeological sites. There is every probability of fluctuations in the shoreline level as well, although these are difficult to document. (In any case, the Colorado River finally returned to its original course after a drought reduced the velocity of flow about 500 years ago (A.D. 1450-1500). Evaporation caused the lake shoreline to gradually recede, drying up the littoral marshes and embayments. Eventually the water became too saline to support much wildlife, and most of the native population ceased to inhabit the area, returning to their home territories in the Peninsular Range, on the Colorado River,) or occupying more hospitable newly formed environments on the Alamo and New Rivers in the Imperial Valley.

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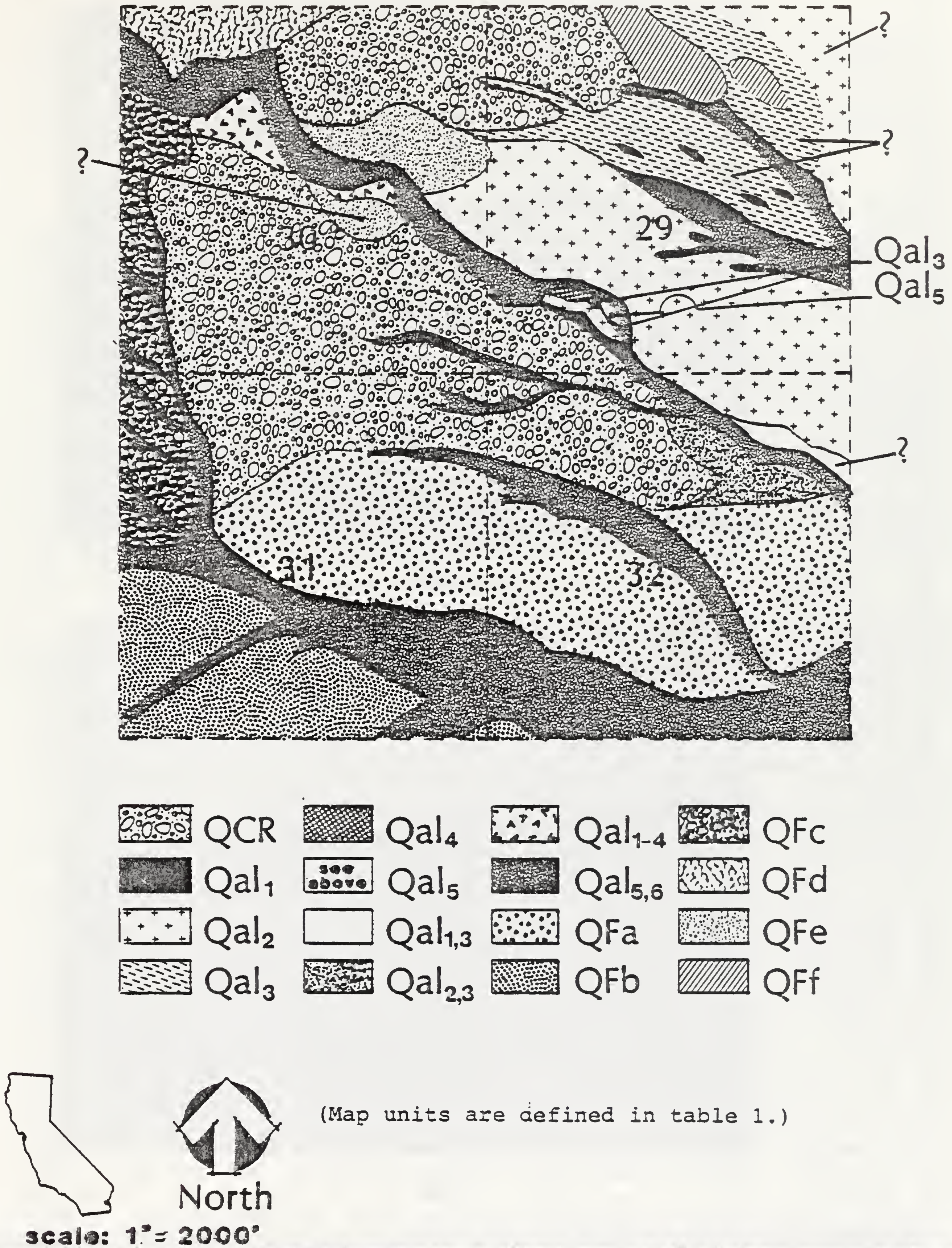
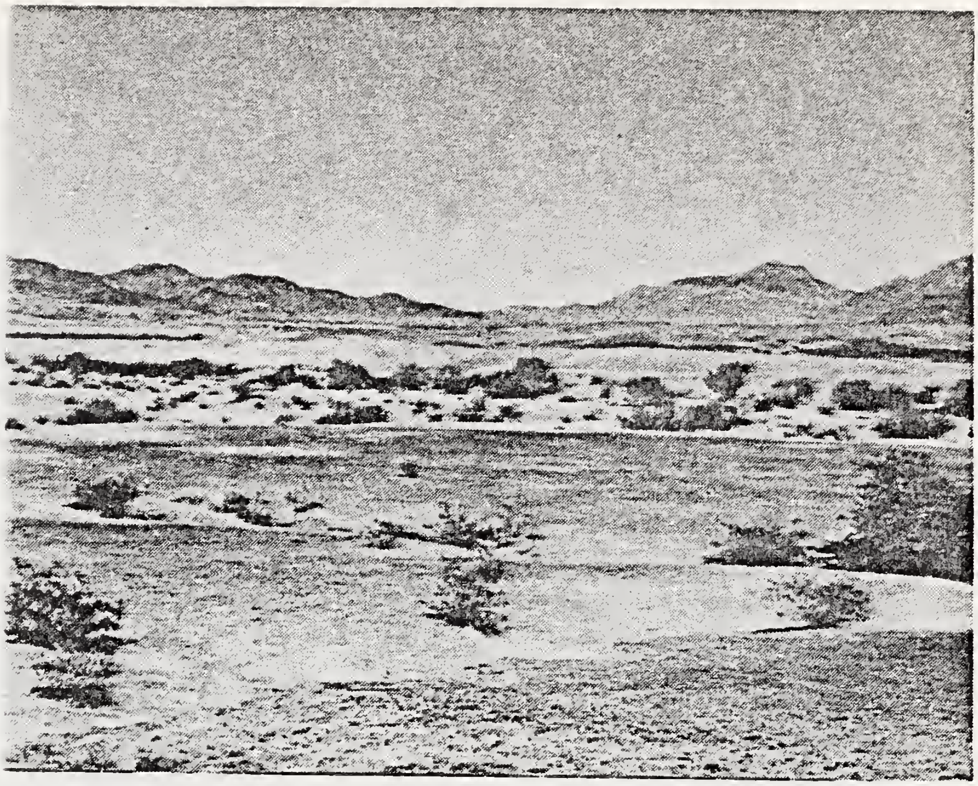
The surface geomorphology of the Pebble Terrace area is characterized by three types of soils and surfaces (Figure 1). (See Appendix A for a full discussion by Michael Waters) The oldest surfaces are former Colorado River terraces that contain dense deposits of rounded quartzite and chert pebbles derived from the Colorado River (Qcr)(Figure 2a). Two terraces can be defined, the older is at approximately 520 feet amsl and the younger is at approximately 440 feet amsl. Both date to the Pleistocene, greater than 100,000 years B.P. and therefore pre-



(Map units are defined in table 1.)

MOONEY LETTIERI AND ASSOCIATES	Generalized geologic map of the Pebble Terrace Study Area, California.	FIGURE 1



a

b

a) View of Qcr Surface at Sample Unit I from the southwest corner looking north
b) Overview of a Qal 4 surface looking east

FIGURE 2

date all evidence of human occupation in the area. Desert pavements on these surfaces are characteristically formed by densely packed, uniformly small rounded pebbles that form almost a mosaic effect. These materials also possess the darkest desert varnishes. Argillic (B2t) soil horizons can be found directly below the pavements with stage II-III calcium carbonate horizons below these.

Also of estimated Pleistocene date, but earlier than the Colorado River terraces are six episodes of alluvial fan building, originating from the Mule Mountains (QF). These fans contain both reworked Colorado River pebbles resulting from the destruction of earlier river terraces and source rock of igneous and metamorphic origin from the Mule Mountains. The latter include precambrian gneiss, schist, quartz, and quartzite, as well as tertiary ryolites, basalts, brechias, tuffs, and agglomerates. Six fans have been identified in the project area based on lithology and position. They include a fan containing many local basalt boulders (QFa), three fans containing local grussy rock and few Colorado River pebbles (QFb-d)(Figure 3b), and two fans containing local grussy rock but moderate amounts of Colorado River Pebbles (QFe-f). Desert pavements on alluvial fans are typically less compact than Colorado River terraces and composed of angular igneous and metamorphic pebbles and cobbles of varied sizes. Argillic and calcic horizons with stage II calcium carbonate development underlies all of these pavements.

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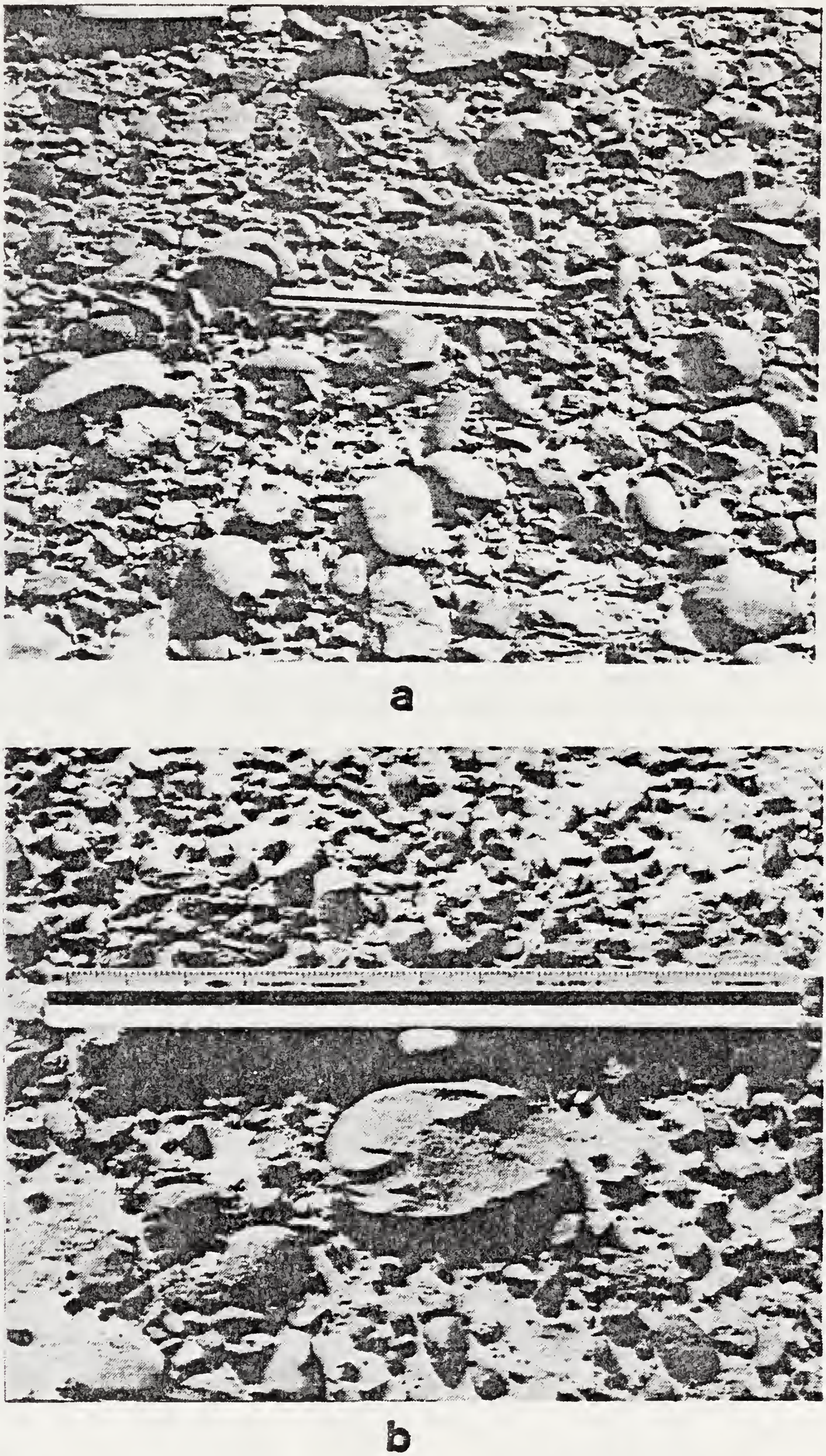
The third type of surface is a Holocene alluvium that were deposited in braided stream channels, ~~and~~ cross cutting Pleistocene alluvia and fans (Jenkins 1962, Morton 1977, Waters 1984). They are characterized by having bar-and-swale surface topography, no argillic horizons, and calcic horizons of only stage I and II development. Except for the most recent, modern washes, all are represented as terraces above the modern channels. Six chronologically successive Holocene surfaces have been identified by Waters. The oldest surface (Qal1) actually dates to the late Pleistocene and is characterized by subdued bar-and swale topography and planar varnished desert pavement, 1-2 millimeter calcium carbonate coatings on the underside of pebbles in the calcic horizon at a depth of 10 centimeters or more, and elevation of surfaces as a terrace above the modern wash channel (Figure 3c). A surface of early Holocene date, no older than 8,000 years B.P., (Qal2) is recognizable for the bar-and-swale topography where the bars are varnished but the swales are unvarnished. Calcium carbonate coatings on pebbles in the calcic horizon are also thinner (less than 1 millimeter). The third terrace (Qal3) is middle Holocene, dating to less than 4,000 years B.P. There is no varnish on the desert pavements of the bar-and-swale topography and just a thin calcium carbonate coating on pebbles in the calcic horizon (stage I) at a depth of 5-7 centimeters below the surface (Figure 4a,b). Of late Holocene date, no older than 1,000 years B.P., is a Qal4 terrace with bar-and-swale topography but no desert varnish at all and a discontinuous light dusting of calcium carbonate on pebbles in the calcic horizon, less than 5 centimeters below the surface (Figure



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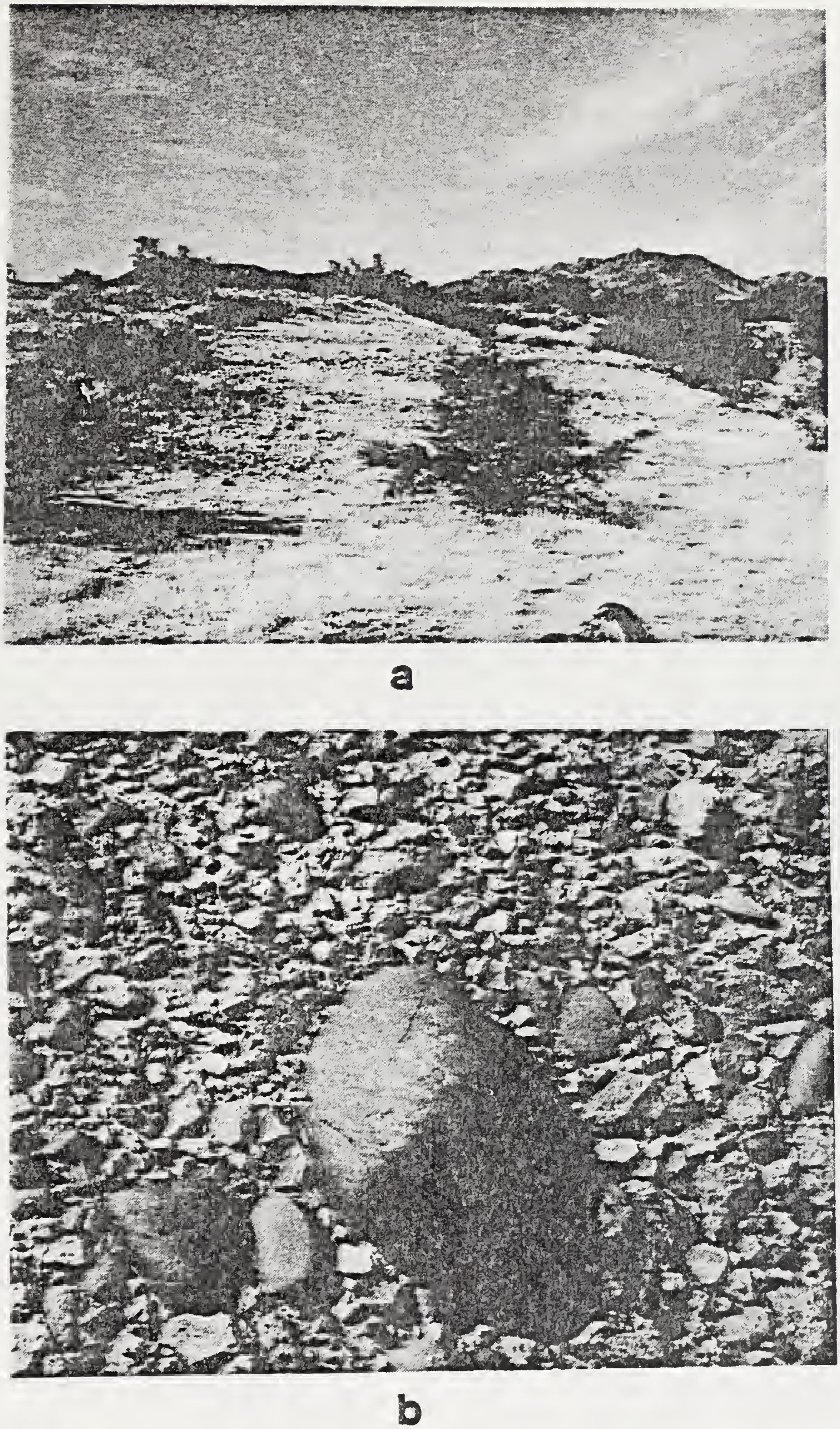
a) Closeup of Qal 1 surface showing more developed but lightly varnish pebble pavement.
b) Quartzite biface roughout on a surface in Sample Unit 1.

FIGURE 3



MOONEY LETTIERI AND ASSOCIATES

a) Overview of a Qal 3 surface and Data Recording Unit 6, looking up towards the Qal 2 surface
b) Anvil and Hammerstone on a typical gruss surface

FIGURE 4

2b). Immediately adjacent to and above the active flood channel is an inactive flood plain area of sandy alluvium that may represent part of the 100 year flood plain and is no older than 500 years B.P. (Qal5). Finally the modern active wash represents the last stage of Holocene alluvial activity, leaving the current pattern of braided stream channels (Qal6).

The Holocene terraces provide the best source of independent data for the relative dating of archaeological remains. In sequence they provide a *terminus post quem* for remains found on each succeeding terrace. Of particular note is the well preserved remnant of successive terraces that was found along the south side of the modern wash in the southwest quadrant of Section 29. Here, all six terraces can be found ascending down in a series of steps from the Pleistocene Colorado River terrace to the modern wash channel. Unfortunately only a small segment of the entire series is preserved in one spot, but other portions of Qal1-6 terraces can also be found to the northwest, southeast, and northeast. The sample size of artifacts from these terraces is too low for a statistically valid comparison of assemblages. The recognition of temporally sensitive occupational surfaces does provide the basis for larger regional studies in which the dates of terrace formations may be used as an independent variable to guide sampling procedures and problem oriented research questions regarding chronology.

can this be said in English for those who do not know what the Latin means?

III. CULTURAL ASSOCIATIONS

Archaeological sites in the Colorado Desert are notoriously poor in datable remains with firm cultural associations. Several major problems confront the researcher. Stratified sites are lacking, most remains being deflated surface scatters of artifacts on desert pavements. Organic or carbonzied remains that are amenable to radiocarbon dating are usually lacking because of the surficial character of sites. Diagnostic tools and other artifact types are generally few in number or more often entirely lacking from many Colorado Desert sites. In this regard, many marginal desert sites are particularly difficult to date because they represent the discarded debitage of the knapper, while the finished tool was carried off to be used elsewhere.

The archaeologist is therefore required to employ innovative, and often controversial dating methods to place sites in a chronological and cultural context. Observations that have been made to access relative dates of archaeological remains include degree of desert varnish, relationship of objects relative to desert pavement surfaces, and evidence of lithic technology. Each will be discussed below as they relate to the dating of remains on Pebble Terrace. Most often employed is the observation of desert varnish as an indicator of relative age. Malcolm Rogers first used the technique in the Colorado Desert, but cautioned against reliance on the technique because of the subjective nature of these observations and the uncertainty about the rate of desert varnish accumulation (Rogers 1966).

The terraces are covered by a distinctive desert pavement composed of well rounded pebbles and cobbles. Wind and water have eroded away the fine silts and sands that originally formed the suspending matrix of these pebbles, leaving a compact mosaic of stones on the surface, called a desert pavement. It is estimated that up to 46 centimeters of sediment may be deflated before a desert pavement is completely formed (Hayden 1976:275-279, Rogers 1966: 43). Once formed, the pavement reaches an equilibrium precluding further erosion unless the surface is broken (Wilshire and Nakata 1976).

Desert pavements and many of the stone artifacts found in association are frequently covered with a red, brown or black reflective coating. It has been long known that this varnish is made up of clay minerals, iron oxides, and manganese oxides originating from airborne desert dust (Engel and Sharp 1958, Potter and Rossman 1977, Péwé 1978). Even though the process of desert varnish formation has been much disputed, archaeologists have used observations of "thickness" and color to estimate the relative age of artifacts (Hester and Heizer 1973:39-40, McGuire and Schiffer 1982:15, Rogers 1966:35). Most archaeologists realize, however, that the technique is far from reliable but it may be all they have to use for any age determinations, given the surficial nature and lack of diagnostics on desert pavement archaeological sites. Recent studies by Dorn and Oberlander (1981) strongly indicate that varnishes are laid down by microbial

or mircrobic

organisms and that the rate of incipient varnish formation may be very short. Previous studies by Elvidge (1979) suggest inorganic origins and lapses of over 3,000 years for the development of incipient varnishes, with over 10,000 years needed to form a heavy deposit (McGuire and Schiffer 1982). The varnish rate actually appears to be quite variable as observations by Waters suggest (1984:4). To further fuel the controversy, Pendleton (1984:180) recovered two bifaces from the Picacho Basin that were very heavily varnished but would have to be classified as "late" based on morphology.

Eff~~orts are c~~urrently being made to use varnish for absolute dating Dorn (1982). A cation rationing technique is being investigated ~~by measur~~ing the replacement rate of potassium and sodium by metallic ions such as titanium. What are needed, however, are diagnostic tools or artifacts with other clear-cut associations that establish their date independently from the varnish, thereby allowing for the calibration of the cation rationing.

A generally accepted outline of Colorado Desert culture history has been recognized by the archaeological community, but not without the realization that it is at best a superficial construct whose details are not well understood. This culture history is based on the pioneering work of Malcomb Rogers in many parts of the Colorado and Sonoran deserts (Rogers 1939, 1945, 1966). Since then several overviews and re-synthes~~i~~es have been prepared, with each succeeding effort drawing on the previous studies and adding new data and interpretations (M.Weide 1976, Crabtree, 1981, Schaefer 1984). Most culture history reconstructions derive from survey data and surface collected artifacts with extremely uncertain chronological controls. The only major data recovery project on desert pavements, the Picacho Basin Project (Pendleton 1984), as well as smaller testing and excavation projects (eg. Carrico, Quillen, and Gallegos 1980), confirm doubts that many of the cultural resources in the Colorado desert can be dated. Phases of cultural development~~s~~ or establishment of cultural affiliation of contemporary sites will probably remain an impossible task. Only at late prehistoric ceramic bearing sites will more precise cultural reconstructions be possible (eg. Wilke 1976).

Here we go again.

Six successive cultural patterns may be defined for the Colorado Desert, extending back in time over a period of at least twelve thousand years. They are: 1. Malpais (Early Man), 2. San Dieguito, 3. Pinto, 4. Amargosa, 5. Patayan (Prehistoric Yuman), 6. Historic Yuman, 7. Historic Euro-American.

Malpais (Early Man) Pattern

The Malpais pattern is represented by a complex of archaeological material hypothesized to date from 12,000 to 50,000 years BP (Begole 1973, 1976; Davis, Brown, and Nichols 1980, Hayden 1976, von Werlhof et al. 1977). The term was originally used by Malcolm Rogers (1939, 1966) for ancient looking cleared circles, tools, and rock alignments that he later classified as San

Dieguito I. The term continued to be applied to heavily varnished choppers and scrapers found on desert pavements of the Colorado, Mojave, and Sonoran deserts that were thought to predate the San Dieguito Culture and Paleo-Indian tradition of projectile point makers. Although few would refute that most of the artifacts are culturally derived, dating methods remain extremely subjective and have been assailed on numerous grounds (Taylor and Payen 1979, Mcguire 1982:160-164). Arguments for Early Man in the Colorado desert are further eroded by the predating of the "Yuha Man". Originally dated to over 20,000 years BP based on radiocarbon analysis of caliche deposits and amino acid racimization, more reliable dates based on C-14 accelerated mass spectrometry of actual bone fragments now place the burial at about 1,650 to 3,350 years BP. Almost all of the other southgern California burials that were assigned to the Pleistocene period have also been redated to the Holocene period as well (Taylor et al. 1985).

San Dieguito Pattern

Most of the aceramic lithic assemblages, rock features, and cleared circles in the Pebble Terrace area have been assigned to the San Dieguito Complex, Phase III (von Werlhof 1984). Indeed, most of the sites in the entire Colorado Desert are assumed to be San Dieguito, dating between 7,000 and 12,000 years BP. Malcolm Rogers first defined the San Dieguito complex based on surface surveys in the Colorado and Sonoran Deserts, but later refined his constructs with excavated material from the C.W.Harris Site, a few kilometers from the Pacific coast up the San Dieguito River (Rogers 1929, 1938, 1939, 1966). Rogers saw three phases of the San Dieguito Complex in the Central Aspect, that is the area of the Colorado and Mojave deserts, and the western Great Basin. Each phase is characterized by the accretion of new, more sophisticated tool types on the already existing tool kit.

San Dieguito Complex lithic technology is based on primary and secondary percussion flaking of cores and flakes. San Dieguito I and II phase tools include bifacial and unifacially reduced choppers and chopping tools, concave-edged scrapers (spokeshaves), bilateral-notched pebbles, and scraper planes. Appearing in the San Dieguito II phase are finely-made blades, smaller bifacial points, and a larger variety of scraper and chopper types. The San Dieguito III phase tool kit is appreciably more diverse with the introduction of fine pressure flaking. Tools include pressure-flaked blades, leaf-shaped projectile points, scraper planes, plano-convex scrapers, crescentics (amulets) and elongated bifacial knives (Rogers 1939, 1958, 1966, Warren and True 1961, Warren 1967). Various attempts have also been made to seriate cleared circles into phases but no convincing chronological scheme has yet to emerge.

Because of the surficial nature of desert sites and the lack of chronological indicators, no one has substantiated the validity of Rogers's phase designations as chronologically successive changes in the tool kit of a long-lived culture. Subsequent excavations at Rogers' C.W. Harris Site also failed to confirm his original observation of a stratigraphic separation of Phase II and Phase III assemblages (Warren 1967:171-172). Indeed, Phase distinctions may as likely be due to economic specialization at specific site loci or even to sampling error whereby later phase diagnostic artifact types are not represented in a specific archaeological collection. Rogers (1966:39) also identified different settlement patterns for each Phase but as Vaughan (1982:6-11) has argued, these distinctions are poorly defined and inconsistently applied.

No phase distinctions will be made for the San Dieguito in future discussions. It will be considered, rather, as a single archaeological and cultural entity with considerable time depth. Any consideration of inter-assemblage variability will be the subject of empirical study, but no de-facto assumptions of temporal phases will, or should be made here.

The San Dieguito Culture, as defined by the known complex and site associations, is a hunter-gatherer adaptation based on small mobile bands exploiting small and large game and collecting seasonally available wild plants. The absence of ground stone from the complex has been seen as reflecting a lack of hard nuts and seeds in the diet, and as a cultural marker separating the San Dieguito Culture from the later Desert Culture (Rogers 1966, Warren 1967, Moratto 1984). Portable manos and metates are now being increasingly recognized at coastal sites radiocarbon dated in excess of 8,000 BP and in association with late San Dieguito complex assemblages (Kaldenberg 1976, Bull 1984). While grinding technology is becoming increasingly accepted as part of the late San Dieguito (III) adaptation, arguments are also being made for the presence of a developed grinding tool assemblage in earlier periods, based on finds from the Trans-Pecos area of Texas (Ezell, 1984). In regards to the Colorado Desert, Pendleton (1984:68-74) also remarks that most enthnographically documented pounding equipment for processing hard seeds and wild mesquite and screw beans were made out of wood and do not preserve in the archaeological record.

Settlement patterns also indicate some basic elements of the San Dieguito Culture. Sites are characteristically located on any flat area but the largest aggregations occur on mesas and terraces overlooking the larger washes. Where lakes were present, sites are located around the edges. These are areas were a variety of plant and animal resources could be located and where water would at least be seasonally available. It may be assumed that at the beginning of the Holocene period, these areas were somewhat more suitable for habitation, although the climatic evidence reviewed above suggest that the early San Dieguito inhabitants already had to adapt to arid conditions.

Pendleton (1984) has made a strong case, based on ethnographic analogy from Colorado River based tribes, that the San Dieguito occupation in the eastern Colorado Desert was focused on the river flood plain. Surrounding desert areas were used only to a limited degree for special resource utilization within a foraging radius of logistically organized collecting groups. She tested her model with the large array of sites and data sets in the Picacho Basin, 67 kilometers to the southeast of the Pebble Terrace area.

Pinto and Amargosa Patterns

The Pinto Complex, dating between 7,000 and 4,000 BP, and the Amargosa Complex, dating between 4,000 and 1,000 BP, were regional manifestations of the Desert Culture that enveloped the Great Basin and California Deserts. They represent regional specializations of a diversified hunting and gathering tradition. Most of the tool types are similar to the San Dieguito, but there are the added notched and large-stemmed projectile points and more frequently occurring manos and metates that identify these later sites. These complexes are not well represented in the Colorado Desert. There may just be too few diagnostics with which to distinguish these sites from earlier and later patterns, or as suggested, periodic droughts interspersed by brief flooding of the Salton Trough may have discouraged any long term use of the area (Crabtree 1981:40-41, Weide 1976:85-87). In any case, it appears that the Desert Culture provided the technological basis and subsistence practices that later developed into the Patayan Pattern.

Patayan Pattern

The Patayan cultural pattern is marked by the introduction of pottery on the lower Colorado River approximately 1,200 years ago. A pre-ceramic phase can also be discerned by the introduction of new Desert Side-notched and Cottonwood type projectile points to the Amargosa Complex at about 1,500 years BP, but this transitional phase is difficult to identify in the desert (Moriarity 1966). Techniques of flood plain agriculture were also introduced to the Patayan at the same time as pottery. Burial practices also changed from extended inhumations to cremations in ceramic vessels. All of these new traits are typical of the Hohokam Culture and it is quite probable that they reached the Colorado River from southern Arizona via the inhabitants of the Gila River. From the Colorado River the cultural complex spread west to the Pacific Coast. Agriculture may not have been adopted beyond the eastern Peninsular Range until very late Prehistoric times or after European contact.

The Patayan Culture is typified by small mobile groups living in dispersed seasonal settlements along the Colorado River flood plain. They erected rock outlined jacale structures, semi-subterranean earth houses, simple ramadas, or brush huts, depending on the season and function of the settlement. Long range travel to special resource collecting zones, trading expeditions, and ? possibly some warfare are reflected by (the numerous trail systems throughout the Colorado Desert that are accumulated ceramic "pot-drops"), trail-side shrines, and other evidence of transitory activities. Many of the pictographs, petroglyphs and bedrock grinding surfaces in the Colorado Desert have also been associated with the Patayan Pattern, although direct dating and cultural affiliation of such features is difficult to determine.

Three other phases of the Patayan pattern can be identified in addition to the pre-ceramic phase. They are based on changes in pottery types and most importantly on the cultural and demographic effects of the infilling and subsequent desiccation of Lake Cahuilla. The Patayan I phase began about 1,200 years ago with the introduction of pottery. It appears to be confined to the Colorado River and the artifact complex in this phase bears the closest similarity to the Hohokam (Waters 1982). The Patayan II phase began 950 years ago and is contemporary with one infilling of Lake Cahuilla. Pottery producing people spread out from the Colorado River to periodically inhabit both the east and west shores of the new lacustrine habitat. New ceramic types appear, reflecting localized manufacture at Lake Cahuilla and technological changes in the Colorado River area. The final Phase, III, began with the final recession of Lake Cahuilla approximately 500 years ago. The phase continued into the ethnohistoric period, ending in the late nineteenth century when Euro-American incursions disrupted the traditional culture. During the last phase, a new pottery type, Colorado Buff, became the predominant ceramic along the Colorado Desert and Colorado River according to Waters (1982). Ceramic data recovery for the Picacho Basin project failed to identify any Colorado Buff Ware. Assuming that an adequate sample was collected, Townsend (1984) concluded that this ware is not common to the river area but is rather a western Lake Cahuilla regional type with one focus in the San Sebastian marsh area.

Ethnohistoric Yuman Pattern

The first historic accounts of the traditional inhabitants of the lower Colorado River were made by Spanish, and later, American explorers. The first professional anthropological account of the lower Colorado Yuman groups was prepared by Kroeber (1920). The closest group to the Pebble Terrace project area , the Quechan (pronounced Kwutsan), were documented by Forde (1931) in what remains the standard work. Ethnographies have also been prepared for many of the neighboring groups and a synthesis of these has been made by Pendleton (1984:38-54), focusing on the Mojave, Quechan, and Cocopah.

The Quechan are a Yuman-speaking group of the Hokan linguistic super-family. They are culturally and linguistically related to the Cochimi, Cocopah, Halyikwamai, Kohuana, Kamia and Diegueno (Kumeyaay), Kiliwa, Walapai, Havasupai, Yavapai, Halchidoma, Maricopa, and Mojave. They also shared many cultural and technological aspects with the Shoshonean-speaking Cahuilla and Chemehuevi to the north and west (Forde 1931:104-106).

The Quechan lived in dispersed winter settlements along the Colorado River flood plain, centering on what is now modern Yuma, but moved to mesa edges overlooking the river during the summer flood season. They relied on the riverine habitat for most of their necessities, both wild plants and animals and domesticated crops. Only ten percent of their diet coming from animal sources and only two percent derived from ~~the desert~~ habitat (Driver 1957). Desert areas such as the Pebble Terrace project area mainly served as routes for travel. Very long journeys are known for purposes of trade, social interaction, visits to religious sites, and warfare. While most travel was confined to the Colorado River Valley, longer trips to the Gulf of California, Northern Arizona, and the Pacific Coast were also undertaken (Forde 1931:105-106).

As with the prehistoric Patayan, the possibility exists that some of the cultural resources in the Pebble Terrace project area were produced by ethnohistoric Yumans. Their use of the area, however, would be expectantly low, as evidenced by the very few sherds recorded in the area, and the absence of datable remains will make it difficult or impossible to assign any dates to this cultural pattern.

Historic Euro-American Pattern

The project area remained peripheral to human activities after the first Spanish contact in AD 1540. Yuma was the center of most events during the three historic phases of Euro-American development: Spanish imperialism and missionization (1540-1821), Mexican and American frontier development (1821-1881), and post railroad modernization (1881-present).

PREVIOUS RESEARCH

The earliest study in the general area was begun in 1974 by von Werlhof and von Werlhof (1976). Most of the project area was considered in two phases of the Sun Desert Nuclear Plant Site cultural resources survey and evaluation. A total of 24 section quarters were investigated within an almost nine section project area. Subsequent to the initial study, six additional sections were added to the west and north of the original plant site. At that time Sections 29 and 32 of the Pebble Terrace project area were included within the southwestern portions of the Sun Desert Project. The results of this additional work were submitted as an addendum report (von Werlhof and von Werlhof (1978).

A total of 259 "sites" were originally documented in the 12 sections but these were later consolidated into nine large sites when official trinomials were finally assigned. The basis of these aggregations appears to derive in part from the von Werlhof's definitions of proposed National Register Districts within the Sun Desert Project area. The sites in Sections 29 and 32 were viewed as the eastern margins of a larger complex of San Dieguito cultural resources that extend to the west, toward Coon Hollow, and are situated between the 415 and 450 foot amsl contours (von Werlhof and von Werlhof 1978:6, Map No. 11). Most of these sites were defined as San Dieguito I-III temporary camps, lithic scatters, and chipping stations. They were interpreted to represent extensive lithic procurement and processing activities in association with a minimal level of other hunting and gathering activities. The few Patayan (Yuman) resources were small pottery scatters along trail systems. Dating of aceramic sites was based on patination observations, tool types, and other unspecified criteria that in this author's opinion, must be viewed as tentative at best. The additional resources that were located within the Pebble Terrace survey of Sections 29-32 were also aggregated and included within previously defined sites 4-Riv-668 and 4-Riv-1748.

Several aspects of the Sun Desert Project need further scrutiny and evaluation. These aspects concern dating, site definitions, and interpretation of spatial patterning. One of the major conclusions of the study was the recognition of distinct associations between elevation, as an independent variable, and the distribution, size, and cultural phase of sites as dependent variables. Ascending from the elevation of 470 feet to 390 feet amsl, sites were seen to decrease in number, size and to more frequently date to the later phases of the San Dieguito. These changes were interpreted to result from shifting environmental conditions at the end of the Pleistocene period, and continuing through the early and middle Holocene periods. Gradual drying trends were seen as causing a descent of subsistence-based resources to lower elevations and a general decrease in biomass with which to support a hunting and gathering population. This in turn caused a diminished use of upland resources and the establishment of smaller, more specialized sites at lower elevations. New technology was also introduced such as the projectile point and grinding stones (von Werlhof and von Werlhof 1978:9-13).

There are several issues that need to be resolved before these conclusions are accepted. First, there is insufficient evidence for distinguishing between San Dieguito I, II and III phases sites. Therefore, the association of elevation with numbers of sites per phase is dubious at best. While there is no doubt that ceramic bearing Patayan (Yuman) sites are at lower elevations, the San Dieguito sites cannot be so neatly differentiated. Second, more supporting evidence is needed to infer that a projected change in median elevation from 445 feet to 435 feet amsl represents a significant change in settlement pattern that would result from climatic change. It is difficult to imagine that such a minor difference in elevation would be the result of climatic shifts. There also does not appear to be a statistically significant difference in median elevations of sites divided by phase. An application of means and standard deviations bears this out. Third, recent paleo-environmental data strongly indicates that there has been little climatic or environmental changes since the end of the Pleistocene period, although a gradual decline in precipitation is suggested (see Environment section, this report). It might therefore be best to look at other environmental variables to explain site distributions in the Pebble Terrace area, such as long term patterns of land use and resource exploitation.

IV. METHODS EMPLOYED

Innovative methods were required to fulfill the goals of this project. Sufficient data had to be collected to define spatially expansive sites and to characterize the range of prehistoric activities and the nature of lithic reduction technology. Sample survey methods were developed to assess the patterns of artifact diversity, density, and distribution within the project area, but within the scheduling and budgetary constraints of the project. At the same time, more specific quantitative data was needed on chipping stations and lithic scatters. Controlled data recording were used whereby all of the lithics within a prescribed area were documented and the formal characteristics of the lithics were recorded in the field without the necessity for artifact recovery.

Prior to initiating fieldwork, Project Archaeologist John Cook and Consulting Quarternary Geologist Dr. Michael Waters conducted a field reconnaissance of the project area. Their purpose was to define the types of geomorphological features and determine their relative ages. Secondly, they wanted to use this information to see if there were associations between archaeological sites and specific geomorphic types. This information was used to formulate a sampling strategy and data recording approaches that would provide an understanding of site distributions and variability of artifact types.

Dr. Waters developed a map of geomorphic surfaces in the project~~s~~ area and established approximate dates of each surface type and of chronologically successive phases within each type (Figure 1). These results are summarized in Section II, Environmental Variables, and discussed in detail by Waters in Appendix A. The geomorphic data was then used to establish a judgmental sample survey of 37.5 percent of the entire project area. Six section quadrants were selected, each measuring one quarter of a square mile (160 ares or 65 hectares) and oriented to section boundaries (Figure 5). Each sample survey unit and the criteria used to select each are described below:

Sample Survey Units

Sample Unit I: The southwest 1/4 of Section 30 was chosen because of the high percentage of Pleistocene Colorado River terrace with the most heavily varnished desert pavement that is represented (Figure 2a).

Sample Unit II: The southwest 1/4 of Section 29 was chosen because it contains a well preserved and complete series of successive Holocene alluvial terraces that step up down from the old Colorado River terrace to the present drainage.

Sample Unit III: The northeast 1/4 of Section 31 was selected because the northern half contains Pleistocene Colorado River terrace and the south contains old alluvial fan deposits with distinctive basalt cobble desert pavement.

Sample Unit IV: The southwest 1/4 of Section 32 was selected because both Pleistocene Colorado River terrace and alluvial fan are present.

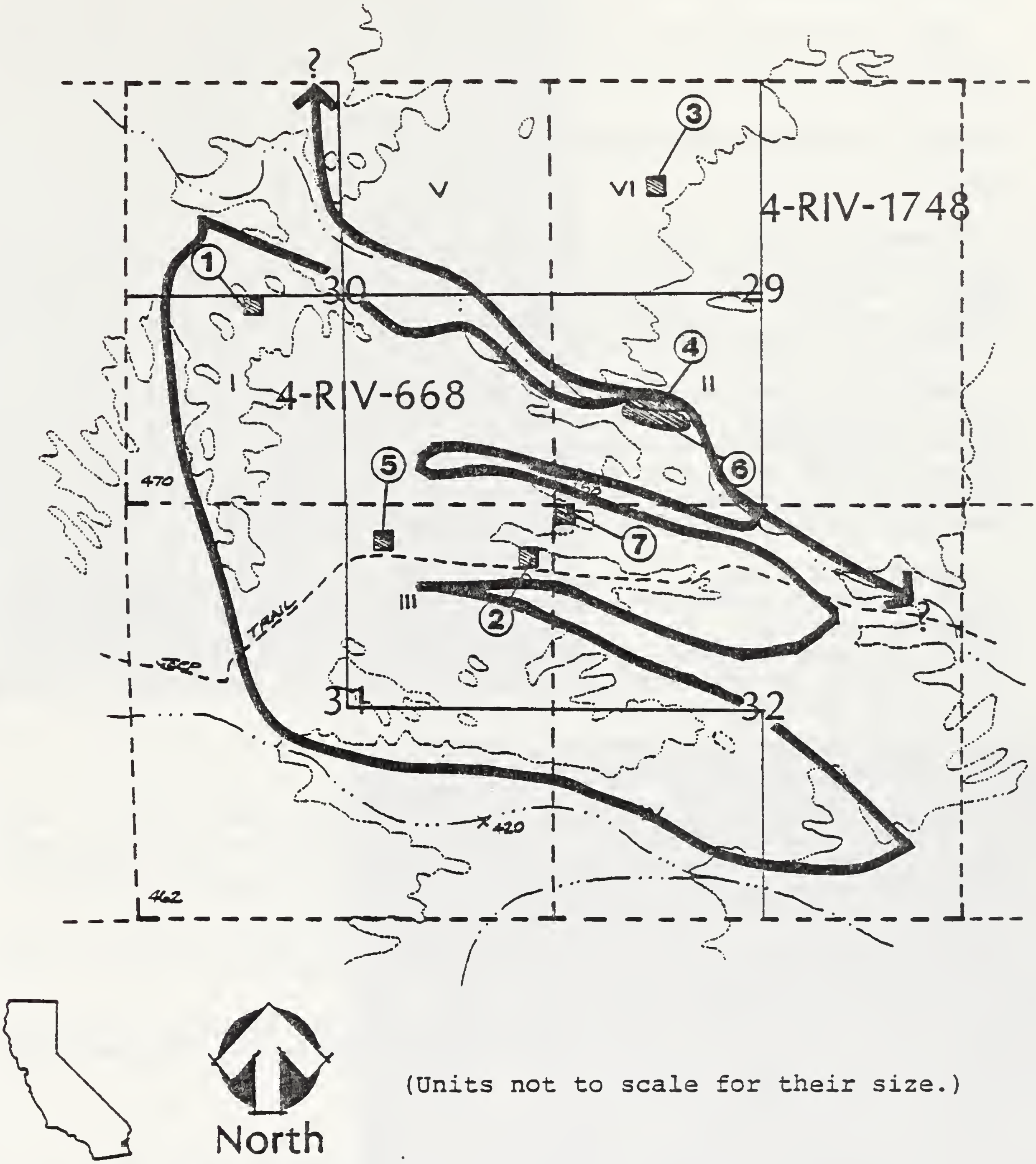
Sample Unit V: The northeast 1/4 of Section 30 was selected because Colorado River terrace and older Quarternary alluvial fans are present.

Sample Unit VI: The northeast 1/4 of Section 29 was selected because Colorado River terrace and old alluvial terrace and alluvial fans are all represented.

Prior to fieldwork, BLM personnel from the Indio Resource Area Office flagged all of the section and quarter-section markers to facilitate the accurate location of sample survey boundaries by the survey team. The survey team consisted of Project Archaeologist, John Cook, and crew members Tirzo Gonzalez, Dennis McFadden, and Chris Nordby. They walked four linear transects in each sample unit, maintaining a spacing of 40 meters between team members. East-to-west transects were used in units III and IV while north-to-south transects were employed in units I, II, V, and VI.

Each surveyor talleyed the number of artifacts observed on each transect. These talleys were then totalled for each geomorphic surface type within each study unit. Counts were made of isolated flakes, cores, and tools, and delineated localities that contain both flakes and cores, flakes and tools, and only flakes. Also recorded in each sample survey unit were the presence of any features, trails, vegetation, and qualitative observations of artifact density and distribution. These counts are by no means accurate enumerations of all the material in each sample unit, given the distant spacing between surveyors. Actual counts would be appreciably higher if a closer spacing were used and more intense surface observations methods were employed; such as slowing crawling along the surface and counting each object within a grid. These resulting data do, however, provide a good approximation of the relative density of artifacts on different geomorphic surfaces, and the patterned differential density of artifacts on the same type of surface.

A more detailed and quantitatively accurate data base was also assembled through the use of seven data recording units. These are grids with arbitrary dimensions within which all artifacts are recorded (Figure 5). The units were places within previously recorded areas of high artifact density, within most of the sample survey units. Data recording units were purposefully placed to sample all types of geomorphic surfaces and areas of different artifact densities. Areas with both low density lithic scatters and high artifact density chipping stations were included. Areas on Qcr terraces were more frequently chosen because the greatest frequency and density of artifacts were noted during the initial survey phase of research. Two Qal terraces were also examined to compare with Qcr surfaces in regards to dating and functional differences in activities. No Qfa surfaces were ex-



(Units not to scale for their size.)

scale 1": 2000'

MOONEY LETTIERI AND ASSOCIATES

Data Recordation Unit Locations

FIGURE 5

amined because of the low density of artifact occurrrences.

Each of the units is described below with a brief discussion of the local geomorphology, recording methods, and archaeological findings.

Lithic Data Recording Units

Unit 1

Geomorphology: Located in Sample Unit I, this is a Qcr desert pavement on a ridge eroding to the northwest and southeast. Small, medium, and large sized pebbles exhibit a medium to heavy desert varnish. Slightly less than ten percent of the pavement is made up of angular gruss.

Recording Methods: A 20 by 20 meter area was gridded into 16 five meter squares. It was set at 45 degrees from true north to better allign with the topography of the ridge. Two grids were selected from these for intensive artifact counts. No additional units could be examined because of the time needed to record the numerous lithics found in the first two grids.

Summary of Finds: This area was selected because of the high artifact density and the number of large pebbles that made a good knapping source. The ridge also appears to be a good strategic point for hunting game in the nearby washes. Close examination of recording grids revealed a large number of very small flakes that were not apparent on first scrutiny.

Unit 2

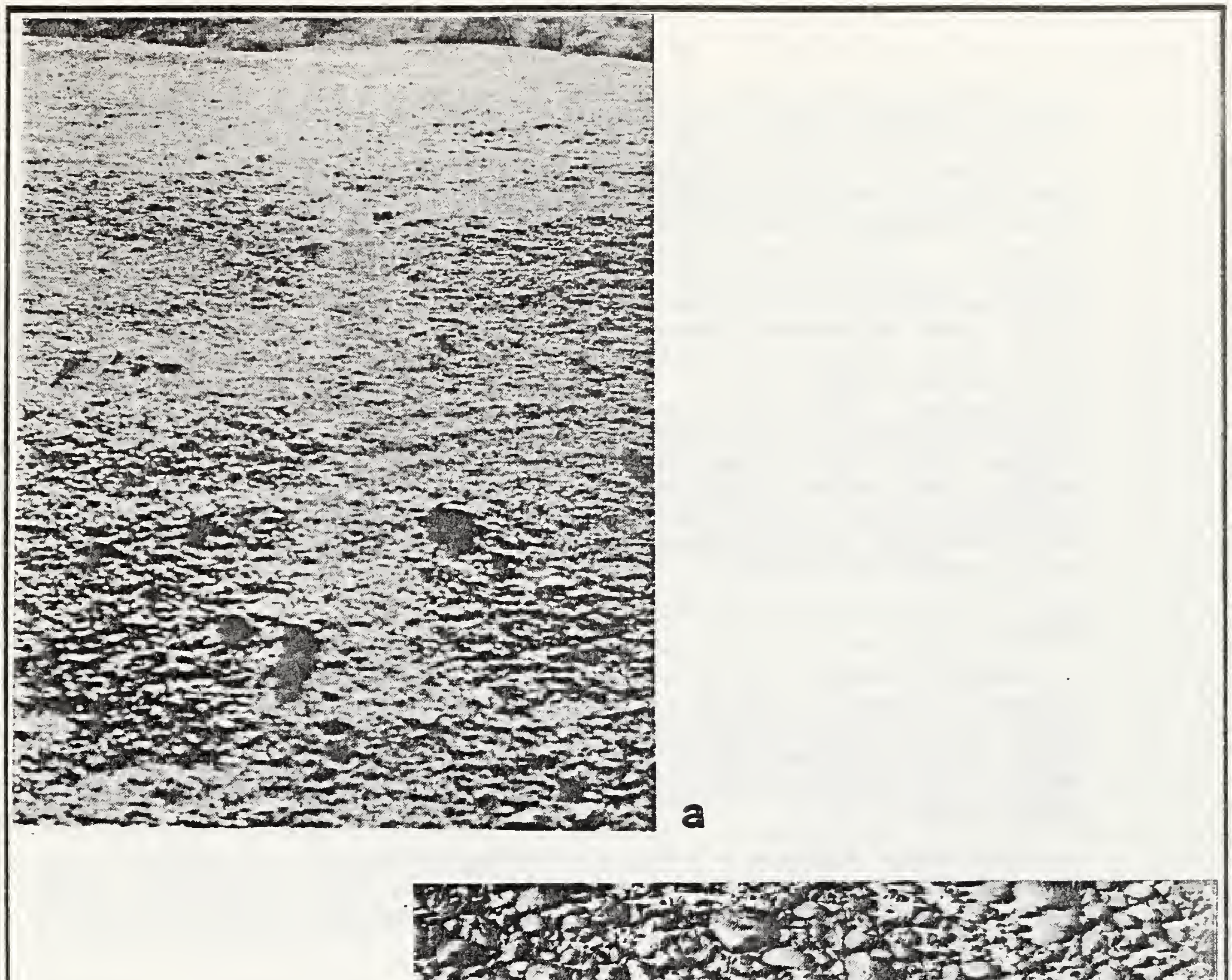
Geomorphology: This area of Qcr in Sample Unit III is comprised of a uniform desert pavement of heavily varnished small pebbles. It is located on the bottom edge of a low east-west oriented ridge, just above a minor wash (Figure 7b).

Recording Methods: Two contiguous five by five meter grid units was laid in an area of low artifact density.

Summary of Finds: Only 17 artifacts were recorded, with an absence of associated flakes and cores, suggesting limited knapping of these small pebbles.

Unit 3

Geomorphology: This area of Qcr in Sample Unit VI is an by "island" of larger pebbles that is dissected on all sides of small and medium sized washes. The elevated part of the "island" contains a mixture of different sized pebbles but the frequency of large pebbles is higher than surrounding areas. The lower portions of the "island" degrade into smaller and more loosely packed pebbles, with increasing amounts of gruss.



MOONEY LETTIERI AND ASSOCIATES

a) An aboriginal trail crosses a Qfa Surface in Sample Unit IV
b) A well developed Qcr pebble pavement in Data Recording Unit 2

FIGURE 7

Recording Methods: Two contiguous grid~~s~~ units measuring five by five meters were laid out (Figure 6a).

Summary of Finds: Seventy-five artifacts were recorded in the two units, with a higher percentage of heavily varnished pieces than recorded in other units. Ground patina was more developed as well. Cores and tools appear in higher frequency. One of the most interesting artifacts was a biface blank that was retrieved from an area just outside of the recording grid. It appears to have been abandoned because the knapper failed to remove a thinning flake across the central axis and thereby remove the remaining cortex (Figure 6b). Two other bifaces were recorded within the units. The first was a quartzite first stage roughout. Primary flakes were removed in an alternating bifacial pattern around the entire margin of the flattish pebble. The second biface was more finely worked, composed of a coarse~~d~~ grained chalcedony and was collected for further study. Revisitation of this locality is indicated by differential varnish of flake scars on the same artifacts.

Unit 4

Geomorphology: This area of Qal 4 in Study Unit II is the second to lowest terrace in a series of alluvial terraces descending to a large unnamed wash (Figure 4a). It contains a mixed light colored gruss and eroded, unvarnished pebbles from the Qcr above the terrace system. Bar and swale topography is evident throughout.

Recording Methods: The entire small terrace was defined as the sample unit because of the low density of artifacts. The field team systematically traversed the terrace, maintaining a very close spacing.

Summary of Finds: Artifacts of the terrace exhibit no varnish and only two had ground patina. Nineteen artifacts from a chipping station and 36 other artifacts and tools were recorded. Both bipolar and oblique free hand reduction techniques were evident from the debitage. The object of reduction process appears to have been simple flake tools or utilized flakes because cortex-backed interior flakes were the only objects that were missing from refitted cores. More refittable core-flake assemblages appear to be present than on the Qcr surfaces. There were also a number of quartzite cobbles with battering at both ends and bifacially removed flakes removed at oblique angles. These may be aborted attempts at bipolar flake reduction or food processing tools. Tools consisted of tan quartzite cobble choppers and hammerstone/abraders.

Unit 5

Geomorphology: This area of Qcr in Sample Unit III was selected because it represented a moderate mix of large, medium, and small sized pebbles relative to the many large pebbles in Unit 1 and many small pebbles in Unit 2.

Recording Methods: Two contiguous five by five meter units were intentionally placed over a small chipping station to highlight this aspect of archaeological context on Qcr type geomorphic surfaces. The general area contained scattered flake isolates, small well defined chipping stations with cores, and in least frequency, isolated cores.

Summary of Finds: All 74 artifacts from the chipping station were documented.

Unit 6

Geomorphology: This terrace of Qal 3 in Study Unit II is similar to the Qal 4 terrace located just below and to the north. It is covered with mixed pebbles of Qcr origin and gruss. There are a notably high number of small quartzite and basalt cobbles. The absence of varnish, infrequent patination and low density of artifacts is identical to that found on the Qal 4 terrace.

Recording Methods: The northwest quarter of the entire terrace was included as one unit because of the low density of spatially dispersed artifacts.

Summary of Finds: The terrace contained several isolated chipping stations, punctuated by isolated flakes, cores, and tools. Tools consist of quartzite choppers and hammerstones. Other finds include an anvil on which bipolar reduction for vegetal processing was performed (Figure 4b), a prepared core, and a trail segment. The occurrence of definite primary choppers suggests that this was the location of a temporary habitation or extractive camp focused on the resources of the woodland wash habitat located directly north.

Unit 7

Geomorphology: This area of Qcr in Study Unit VII was selected because it was intermediate between Data Recording Units 1 and 5. It represents the far eastern extension of the main Qcr terrace, atop a low east-west oriented ridge.

Recording Methods: The two contiguous five-meter square units were selected to determine if the Qcr surfaces with large flakable pebbles that are nearest to the river contain comparatively higher densities of lithics. This appeared to be the case with Data Recovery Unit 3.

Summary of Finds: A total of 44 artifacts were recorded. (A red quartzite cobble chopper that was also collected from a point 45 meters east of the Data Recording Unit.) It was also observed ~~that the elevated~~ ridges and knolls produced larger pebbles than the surrounding lower surfaces.

Recording Methods

A Phase II - Data Recording Form was filled out for each unit, with the following information supplied by the recorder: size, type of work performed, geomorphology, summary of archaeological finds and photographs. Whether the unit encompassed one or several grids, or encompassed an entire terrace (Unit 4), each artifact was described and recorded on code forms. The following variables and values were used:

PEBBLE TERRACE LITHIC ANALYSIS VARIABLE INDEX

A.Data Recording Unit Number
1-7

B.Grid Number
1-n

C.Artifact Number
1-n

D.Artifact Type
S. Shatter
F. Flake
C. Core
B. Blank
T. Tool

E.Material
1. Chalcedony
2. Chert(Combined with 1)
3. Quartzite
4. Quartz
5. Red Porphyry
6. Basalt
7. Silicate Mud/Chert
8. Porphyry

F.Ground Patina
T. Present
F. Absent

G.Varnish
H. High
I. Intermediate
A. Absent

H.Position in Pavement
A. Above
P. Partially embedded
I. Almost totally embedded

I.Cortex on Flake
1. 100 percent
2. 50-99 percent
3. 1-49 percent
4. none

J.Number of Dorsal Scars on Flake
1. 1
2. 2
3. 3-4
4. 5 or more
5. none

K.Position of Flake on Original Core
1. Hemispheric-longitudinal
2. Hemispheric-diagonal
3. Hemispheric-lateral
4. Internal with cortical plat.
5. Internal tertiary
6. Variation of type 4
7. Expanding flake
8. Quarter cobble
9. Variation of type 1

L.Cortex on Core
1. 75-100 percent
2. 50-74 percent
3. 0-49 percent

M.Number of Flakes Removed from Core
1-n

N.Direction of Flake Removal
1. To the inside
2. Bi-polar
3. Uni-directional
4. Lateral
5. To the outside
6. Multi-faceted
7. Downward
8. Multi-directional
9. Two directions

O.Tool Edge Angle
1. acute
2. intermediate
3. obtuse

P.Tool Edge Outline
1. convex
2. straight
3. concave
4. wavy

Comments

Comments concern wear damage on tools, tool types and functional descriptions, associations with other artifacts, and recording strategies.

The data was entered onto mini-floppy disks using a KAYPRO 4 Computer and the dBASE II assembly language relational database management system (Ratliff 1982). Statistical calculations were run through the NWA STATPAK Package that emulates many of the functions of SPSS but for small data bases and desk top computers (NWA 1982). The raw data, input files, and output files are available from Mooney-Lettieri for further analysis by interested researchers. Copies of output files os all recorded artifacts and all recorded tools and blanks appear in Appendices B and C of this report.

BLM
should be
notified prior to
any study of these.

V. RESULTS

SITE DESCRIPTIONS

Two sites have been defined in the project area. As is often the case in the Colorado Desert, site boundaries were difficult to establish and had to be based on either natural geomorphic boundaries or the arbitrary limits of the project area. Such low density lithic scatters, punctuated by chipping circles, cleared circles, rock rings, and other features, often continue for many kilometers, with the only apparent breaks being natural washes. A similar circumstance exists in the Picacho Basin, north and south boundaries of sites could often not be established and the limits of the transmission line corridor were used instead. In that case, sites were divided by north-south oriented washes and assessed for National Register eligibility as a discontinuous archaeological district (Schaefer 1983). Official site forms for each site appear in Appendix E.

4-RIV-663

This low density lithic scatter covers 840 acres of Quarternary alluvial terraces and fans. Site boundaries were established in four 1/4 section surface survey study units, one unit within each of the four sections of the study area. The remainder of the site boundaries were interpolated from the continuation of natural topography, using aerial photographs and contour maps. The site is bounded on the north and south by larger active washes, and on the east and west by the borders of the natural terraces and fans.

Relative artifact densities vary across the site, depending on the type of geomorphic surface and patterning of prehistoric activities that produced the lithic scatters. The highest densities are found on Quarternary Colorado River terraces where the abundance of chalcedony pebbles and cobbles attracted the prehistoric stone knapper (Figure 2a,6b). Much lower densities were found on Quarternary alluvial fans where quartzite, basalt, and other igneous and metamorphic sources dominate over silicates (Figure 3c). Non-silicates were also flaked but to a lesser degree. The highest concentrations of lithics within the four study units were in the central portion of Unit I, at the northwest end of the site, and in most of Study Unit III, in the center of the site. Other concentrations may also be present in areas not surveyed. So clearly, even within the Quarternary Colorado River Terrace there are areas of higher density scatters. Some of the lithics are embedded in the desert pavement to a depth of 5 centimeters, suggesting possible subsurface artifact occurrences due to erosion of buried material or subsequent sedimentation from recent alluvial processes.

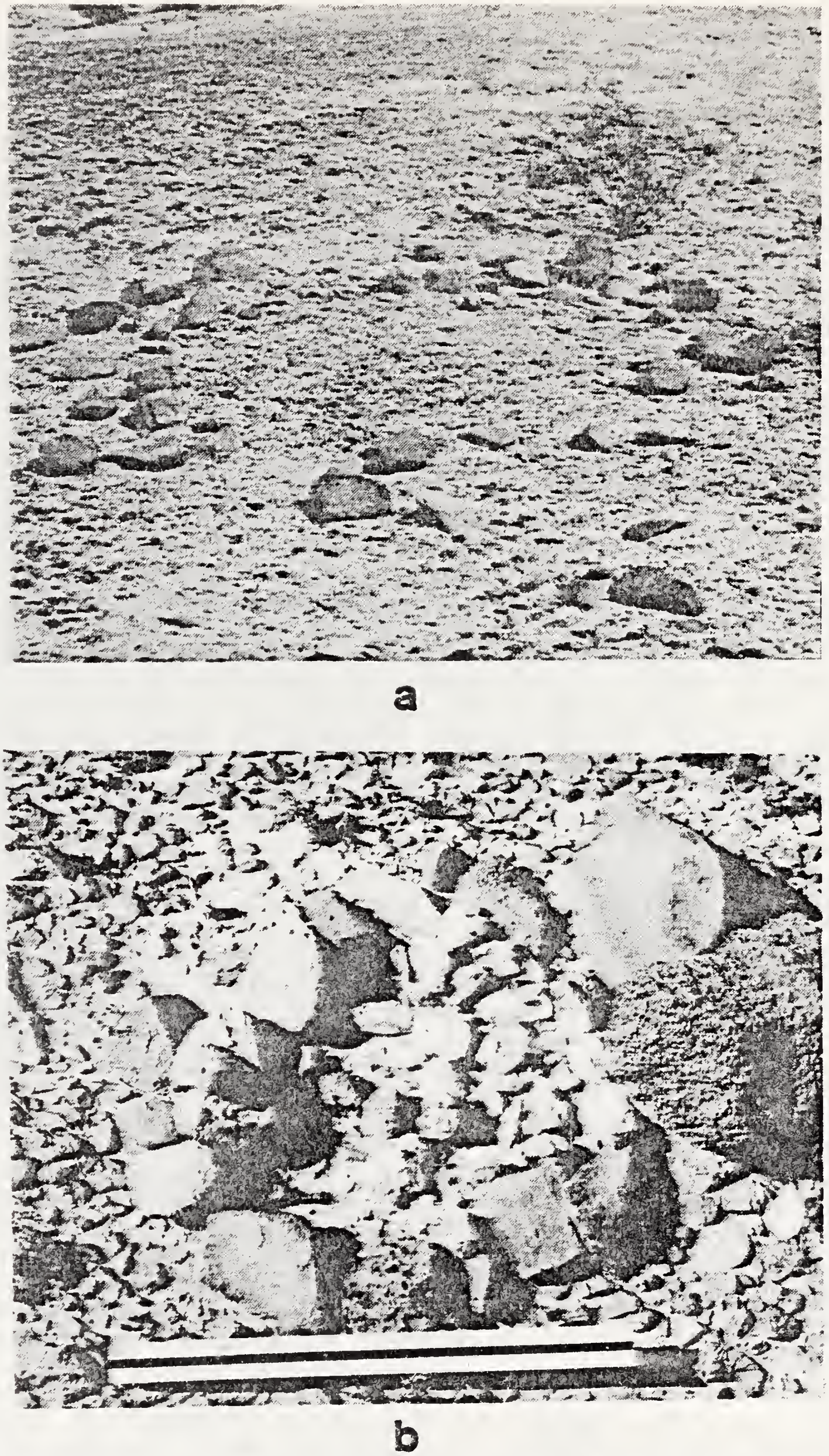
Within each low density lithic scatter, numerous "localities" were also counted. These are areas of higher concentrations of lithics. Some of these may indeed be chipping circles but time constraints did not allow for the close inspection of each one.

The vast majority were concentrations of flakes and cores, but flake concentrations were also recorded, some with associated tools. Two sherds were also documented in Study Unit IV, both of indeterminate type.

Several features were also recorded on the site, indicating the use of the area as a transportation corridor, ~~short term~~ occupations, and also of possible ritual activity. Two aboriginal trail segments indicate movement of people across the site in a northeast-southwest direction (Figure 7a). Approximately 250 meters south of the major trail segment in the center of the site, three cleared circles were recorded. A rock ring was also found on site (Figure 8a). Only 100 meters southeast of the same trail, an enigmatic rock ring was found, filled with chalcedony "flowers" (Figure 8b). These are small eroded pieces of chalcedony that resemble small rose blossoms. Measuring only 30-40 centimeters in diameter, many of the stones show calichification on their upper surfaces, indicating that the stones were dislodged from the desert pavement in comparatively recent times. Alternative hypotheses may be advanced to explain this feature. It may be a late prehistoric - ethnohistoric shrine, possibly associated with the trail. Larger examples of stone caches are known, particularly in the Indian Pass region (Rogers 1966:51-55). Small stone circles in the California Desert with central targets of one to five stones are interpreted by Davis (1980:284-296) to be associated with shamanism and ritual activity. Such stone circles often contain an array of materials that contrast with the surrounding dark desert pavement, such as quartz. This feature could be an example of such a type with a visually striking form of chalcedony as the central element. An alternative hypothesis that cannot be overlooked is that this feature was produced by recent rock hounds. Pot hunters and rock hounds are known to collect all material they might be interested in and then "cache" the finds until the end of the day. They will then select the best finds to take home and leave the rest of the cache. The rock ring does not conform to the usual collectors behavioral pattern, however, nor does the concentration of only one mineral type. Numerous caches of recent collectors were seen and in all of those cases, they were small piles of smooth round pebbles without rock rings.

Previous impacts to the site include numerous ORV tracks across desert pavements, and evidence of commercial rock collection. Several portions of the desert pavement have been graded of all the patinated pebble surface. Numerous piles of pebbles indicate where collection of pebbles by individuals had taken place. Recently fractured chalcedony pebbles are also common, where rock hounds were prospecting for collectible material. Several "glory holes" or miner's holes were also noted.

The most unexpected find in RIV-668 was a large obsidian flake found on the surface of the desert pavement on a Quarternary Colorado River terrace. It is described in detail at the end of this section and was analysed for source and hydration date in Appendix D.



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a) Rock ring in Sample Unit III
b) Small rock ring filled with chalcedony "flowers" in Sample Unit III

FIGU
8

4-RIV-1748

This low density lithic scatter continues over a 640 acre area in the northeast corner of the project area. It encompasses most of Section 29 and the northeast quadrant of Section 30 and 32. The southwest boundary of the site is defined by the large unnamed wash that separates the site from RIV-668. Only the portions of the site within Study Units II and V have been given securely defined boundaries. More of the site boundary has been interpolated within the project area , following the large wash. No east, west, or north boundaries could be determined so that arbitrary and artificial boundaries have been demarked at the border of the project area. In addition to Study Units II and V, a third unit, VI, was also surveyed in the northwest quadrant of Section 29.

Within the limits of RIV-1748 that occur within the project area, all three surface morphological types can be found. These include Pleistocene Colorado River terraces, Pleistocene alluvial fans, and Holocene alluvial terraces representing all but the most recent phases of wash activity. The greatest densities of artifacts occurred on Quarternary Colorado River terrace surfaces where chalcedony pebbles and cobbles are so abundant. Artifacts also occurred on the diverse mosaic of Quarternary and Holocene alluvial and fans of varying date, but they were generally infrequent compared to the Colorado River terraces. Artifact concentrations were by no means even across the surface of the site. The highest concentrations of lithics were to be found in the north west corner of Study Unit V (Section 30) and in small areas in the centers of Study Units II and VI (Section 29).

Artifacts consisted of primary, secondary, and tertiary flakes, cores, shatter, and hammerstones. As expected, chalcedony lithics predominate on Colorado River terraces while quartzite and basalt flakes predominate on alluvial fans. Only one feature was found within the site. That was an aboriginal trail segment that runs in an east-west direction within Section 30. The trail extends an additional 427 meters to the east in Section 29 and was previously recorded as 4-Riv-191 by von Werlhof and von Von Werlhof (1978: Photograph No. 10, Map No. 11). Only the portion of the trail in Study Unit Block V was mapped during this study.

DATING CRITERIA

Several variables were recorded that were used to test the validity of using established dating criteria on desert pavement surfaces. These included presence/absence of patina, amount of desert varnish, and position of artifacts relative to the desert pavement. Several contingency tables and tests of association were made to test the hypothesis that these variables are indeed indicative of age, and if such a relative dating system could be appropriately applied to the Pebble Terrace data base.

First, a cross tabulation was run between desert varnish and position in pavement. Given the assumption that more heavily varnished artifacts were older than lightly varnished or unvarnished artifacts, and that objects embedded in the pavement are older than those lying above the pavement, it was hypothesized that there should be a significant association between varnish and position in the pavement. A tabulation was made with 521 artifacts, those cases with missing data being deleted (Table 1). The majority of objects (67.8 percent) were located above the pavement, and were also not varnished (57.8 percent). This suggests, if the assumptions noted above are correct, that more than half of the artifacts are relatively recent. A Spearman's Rank Order Correlation Coefficient was run on this data, producing an index of only .5397 (with 1.00 indicating a complete positive correlation, -1.00 a complete negative correlation, and 0.00 indicating randomness). Thus a weak, but positive correlation is found between amount of varnish and pavement position.

The question of relative dating criteria was pursued further by looking for associations between different dated geomorphic surface and artifact attributes. Two basic surface types were investigated with data recording units. One was the Quarternary Colorado River terrace (Qcr) and the other was the Holocene alluvial terrace (Qal). The geomorphic analysis by Waters (Appendix A:6) indicated that artifacts on Qcr (Units 1,2,3,5, and 7) could have the longest possible range of artifact dates, extending back 10,000 years or more. Artifacts on investigated Qal surfaces cannot be older than 4,000 years (Unit 6) or 1,000 years (Qal 4). Thus given the assumptions of varnish and patination discussed above, it can be hypothesized that artifacts on Qcr surfaces should have a higher frequency of varnished and patinated artifacts as well as greater variability of degrees of varnish because these surfaces were extant for longer periods of potential human occupation. It was also hypothesized that the same differences should be expressed between the Qal3 and Qal4 surfaces given the 3,000 year difference in date.

To this authors very great surprise, there was indeed a positive correlation between age of geomorphic surface types and artifact attributes that are associated with relative age (Tables 2 to 6). With regard to varnish, over 97 percent of all artifacts on the Qal surfaces were unvarnished while frequencies of unvarnished artifacts on Qcr surfaces vary from only 11 to 78 percent (Table 2). Qcr related artifacts have much higher frequencies of intermediate (33 to 44 percent) and heavily varnished (5 to 24 percent) material. These frequencies were found at Units 1,2 and 3, while Unit 7 possessed the highest frequency of heavily varnished artifacts (60 percent). Only Qcr Unit 5 produced unusually high frequencies of unvarnished artifacts, but still considerably more intermediate varnished material than Qal surfaces.

I don't like these tables at all.

		POSITION IN PAVEMENT			
		ABOVE	PARTIALLY EMBEDDED	ALMOST TOTALLY EMBEDDED	*ROW TOTS*
VARNISH	ABSENT	69.4 209 59.2	19.3 58 61.7	11.3 34 45.9	100.0 301 57.8
	INTERMEDIATE	66.1 82 23.2	16.1 20 21.3	17.7 22 29.7	100.0 124 23.8
	HIGH	64.6 62 17.6	16.7 16 17.0	18.8 18 24.3	100.0 96 18.4
	COL TOTS	67.8 353 100.0	18.0 94 100.0	14.2 74 100.0	100.0 521 100.0

Table 1 Crosstabulation of varnish by position in desert pavement

VARNISH

DATA RECORDING UNIT	ABSENT	INTER-MEDIATE	HIGH	MISSING DATA	*ROW TOTS*
UNIT 1	39.9 83 27.3	33.7 70 52.6	24.5 51 53.1	1.9 4 80.0	100.0 208 38.7
UNIT 2	58.8 10 3.3	35.3 6 4.5	5.9 1 1.0	0.0 0 0.0	100.0 17 3.2
UNIT 3	33.8 25 8.2	44.6 33 24.8	21.6 16 16.7	0.0 0 0.0	100.0 74 13.8
UNIT 4	98.2 54 17.8	0.0 0 0.0	0.0 0 0.0	1.8 1 20.0	100.0 55 10.2
UNIT 5	78.9 45 14.8	17.5 10 7.5	3.5 2 2.1	0.0 0 0.0	100.0 57 10.6
UNIT 6	97.6 82 27.0	2.4 2 1.5	0.0 0 0.0	0.0 0 0.0	100.0 84 15.6
UNIT 7	11.6 5 1.6	27.9 12 9.0	60.5 26 27.1	0.0 0 0.0	100.0 43 8.0
COL TOTS	56.5 304 100.0	24.7 133 100.0	17.8 96 100.0	0.9 5 100.0	100.0 538 100.0

Table 2 Crosstabulation of data recording unit by varnish

	GROUND PATINA			
DATA RECORDING UNIT	PRESENT	ABSENT	MISSING DATA	*ROW TOTS*
UNIT 1	51.9 108 44.1	46.2 96 33.2	1.9 4 100.0	100.0 208 38.7
UNIT 2	70.6 12 4.9	29.4 5 1.7	0.0 0 0.0	100.0 17 3.2
UNIT 3	73.0 54 22.0	27.0 20 6.9	0.0 0 0.0	100.0 74 13.8
UNIT 4	9.1 5 2.0	90.9 50 17.3	0.0 0 0.0	100.0 55 10.2
UNIT 5	19.3 11 4.5	80.7 46 15.9	0.0 0 0.0	100.0 57 10.6
UNIT 6	27.4 23 9.4	72.6 61 21.1	0.0 0 0.0	100.0 84 15.6
UNIT 7	74.4 32 13.1	25.6 11 3.8	0.0 0 0.0	100.0 43 8.0
COL TOTS	45.5 245 100.0	53.7 289 100.0	0.7 4 100.0	100.0 538 100.0

Table 3 Crosstabulation of data recording unit by patina

DATA RECORDING UNIT	POSITION IN PAVEMENT				
	ABOVE	PARTIALLY EMBEDDED	ALMOST ALL EMBEDDED	MISSING DATA	*ROW TOTS*
UNIT 1	66.3 138 38.9	17.3 36 37.5	12.5 26 35.1	3.8 8 61.5	100.0 208 38.7
UNIT 2	58.8 10 2.8	35.3 6 6.3	5.9 1 1.4	0.0 0 0.0	100.0 17 3.2
UNIT 3	54.1 40 11.3	23.0 17 17.7	21.6 16 21.6	1.4 1 7.7	100.0 74 13.8
UNIT 4	69.1 38 10.7	23.6 13 13.5	5.5 3 4.1	1.8 1 7.7	100.0 55 10.2
UNIT 5	77.2 44 12.4	5.3 3 3.1	15.8 9 12.2	1.8 1 7.7	100.0 57 10.6
UNIT 6	82.1 69 19.4	15.5 13 13.5	2.4 2 2.7	0.0 0 0.0	100.0 84 15.6
UNIT 7	37.2 16 4.5	18.6 8 8.3	39.5 17 23.0	4.7 2 15.4	100.0 43 8.0
COL TOTS	66.0 355 100.0	17.8 96 100.0	13.8 74 100.0	2.4 13 100.0	100.0 538 100.0

Table 4 Crosstabulation of data recording unit by position in pavement

```
                                        VARNISH
                                 INTER-                MISSING
                     ABSENT      MEDIATE      HIGH      DATA      *ROW TOTS*
                   ==========  ==========  ==========  ==========  ==========

                        52.7 |       27.1 |       19.8 |        0.5 =     100.0
         CHALCEDONY   224    |    115     |     84     |      2     =    425
                     75.4    |  89.8      |  92.3      |  50.0      =  81.7
                   ----------  ----------  ----------  ----------  ----------
                        75.0 |       16.3 |        6.3 |        2.5 =     100.0
 MATERIAL QUARTZITE    60    |     13     |      5     |      2     =     80
                     20.2    |  10.2      |   5.5      |  50.0      =  15.4
                   ----------  ----------  ----------  ----------  ----------
                        86.7 |        0.0 |       13.3 |        0.0 =     100.0
         BASALT        13    |      0     |      2     |      0     =     15
                      4.4    |   0.0      |   2.2      |   0.0      =   2.9
                   ==========  ==========  ==========  ==========  ==========
                        57.1 |       24.6 |       17.5 |        0.8 =     100.0
         *COL TOTS*   297    |    128     |     91     |      4     =    520
                   100.0     |100.0       |100.0       |100.0       =100.0
```

Table 5 Crosstabulation of material by varnish

```
                                  GROUND PATINA
                                              MISSING
                      PRESENT     ABSENT       DATA      *ROW TOTS*
                    ==========  ==========  ==========  ==========

                         48.7 |       50.8 |        0.5 =     100.0
          CHALCEDONY   207    |    216     |      2     =    425
                      88.1    |  76.6      |  66.7      =  81.7
                    ----------  ----------  ----------  ----------
                         32.5 |       66.3 |        1.3 =     100.0
 MATERIAL  QUARTZITE    26    |     53     |      1     =     80
                      11.1    |  18.8      |  33.3      =  15.4
                    ----------  ----------  ----------  ----------
                         13.3 |       86.7 |        0.0 =     100.0
           BASALT        2    |     13     |      0     =     15
                       0.9    |   4.6      |   0.0      =   2.9
                    ==========  ==========  ==========  ==========
                         45.2 |       54.2 |        0.6 =     100.0
          *COL TOTS*   235    |    282     |      3     =    520
                    100.0     |100.0       |100.0       =100.0
```

Table 6 Crosstabulation of material by patina

A similar pattern emerges from the examination of ground patina (Table 3). Qcr surfaces are characterized by high frequencies of artifacts with patination while Qal surfaces produced mainly unpatinated material. Only Unit 5, again a Qcr surface, bore greater similarity to the Qal surfaces.

Crosstabulations of unit number with position of artifacts relative to the desert pavement produced less clear-cut patterns but still indicated a similar association (Table 4). Higher frequencies of partially embedded and almost completely embedded artifacts occurred on some Qcr surfaces (Units 2,3 and 7), while the highest frequency of artifacts found above the pavement was on the Qal3 surface (Unit 6).

Greater control of extraneous dependent variables was sought by considering the type of lithic material being examined. It has been long noted that some lithic~~s~~ sources appear to exhibit more patination than others. On Qal surfaces, it was readily observed that quartzite artifacts occur in far greater frequency, especially Unit 6, a Qal3 surface with 52.4 percent quartzite. The other Qal4 surface, Unit 4, also had higher frequencies of material other than chalcedony: 14.5 percent quartzite and 16.4 percent basalt. It was also observed that these materials had significantly less varnish and patina than chalcedony artifacts and that this may be a result of certain physical properties rather than differential age (Table 5 and 6). This possibility was controlled by running crosstabulations of varnish and patination for chalcedony only. Again the same associations were confirmed between surface morphology of the data recording unit and artifact attributes relative to age. Qcr surfaces had higher frequencies of varnished and patinated artifacts and greater variability from varnished to unvarnished. Again Unit 5, a Qcr surface unit, bore greater similarity to the Qal surface, but with greater variability of degrees of varnish. One possible explanation may be that the area of Qcr that was sampled contained greater numbers of more recently worked lithic material than other units sampled on Qcr surfaces. Indeed, Unit 5 was originally selected because it appeared to include a discrete chipping station, evidently of more recent date than some of the surrounding, heavily varnished lithic scatters.

GENERAL PATTERNS

Relative Sensitivity of Geomorphic Surfaces

One way to measure the relative scientific significance and sensitivity to impacts of a particular area is to estimate the density of sites, features, or artifacts. Areas with greater numbers of artifacts may be considered more significant because they offer larger artifact~~s~~ assemblages for study. At the same time, specific impacts to areas with higher artifact densities may be greater than areas where artifacts are few and widely distributed and therefore have less chance of being disturbed. Of course other research issues must be considered in making significance and sensitivity assessments but density is certainly one useful criterion that can be easily calculated. This has been done for each of the Sample Survey Units (see Appendix E, Site Forms). They have been further tabulated here to assess the relative density of artifacts and localities by geomorphic surface type (Table 7). The total number of isolates and localities was divided by the total acreage of each surface type that was surveyed. Given the survey and recording methods used, these density figures are probably too low but do provide an index of relative sensitivity between surface types.

The highest densities are found on Qcr terraces where isolated flakes and cores appear in greatest frequency of all surface types. They reflect the widespread assaying and sampling activities of the prehistoric knapper that marks the first phase of lithic procurement and processing. Chipping stations, that is core and flake or flake localities, also are very commonly found on Qcr surfaces. Clearly the highest densities are on portions of Qcr surfaces where the largest pebbles and cobbles occur. The next highest densities occur on Qal2-5 surfaces followed by Qfa, Qal1, and Qfc-f surfaces. In all of these cases, the relatively high rate of isolated flakes and cores, but low rate of chipping stations suggests that assaying and sampling activities, although frequent on all surface types, most often paid off on Qcr surfaces where good material, once located, was reduced to a final form.

Isolated tools, as well as tool and flake localities are found in low densities on all surface types, again reinforcing the interpretations made by von Werlhof and von Werlhof (1978) that the area was predominantly used for lithic extractions and only secondarily for other subsistence activities.

Density figures given here are considerably higher than the Yuha Desert, a Bureau of Land Management Area of Critical Environmental Concern within the California Desert Conservation Area (Gallegos 1980:133, Schaefer 1981:38). Just as a comparison, the density of sites, chipping stations, and the like, minus isolated finds, runs to an average of 16 per square mile. The number estimated for pebble terrace based on Table 7 is over 838 per square mile on the Qcr surface alone.

Goo
ide

Distribution of Raw Material

Chalcedony constitutes the most frequently used raw material (79 percent). This is followed by quartzite (14.9 percent), much of which is restricted to the Qal surfaces. Basalt artifacts are uncommon and largely restricted to Qal and Qfa surfaces. All other material types are extremely uncommon or poorly defined variants (see Table 8).

The term chalcedony is used here to include the entire continuum of silicon dioxide lithic material ranging from what is referred to in the literature as chalcedony, chert, agate, and jasper. Chalcedony often refers to the creamy colored fine grained silicate with a waxy lustre and exhibiting some banding.

DENSITY OF ISOLATES AND LOCALITIES PER ACRE ON GEOMORPHIC SURFACES

Geomorphic Surface =	Qcr		Qal1		Qal2-5		Qfa		Qfc-f	
Number/Density =	No	Den	No	Den	No	Den	No	Den	No	Den
Isolated Flake	457	1.29	50	.37	36	.60	136	.79	26	.31
Isolated Core	483	1.37	48	.35	48	.80	104	.60	24	.28
Isolate Tool	99	0.28	8	.06	14	.23	13	.07	3	.03
Core and Flake Locality	330	0.93	13	.10	21	.35	23	.13	13	.15
Flake Locality	122	0.34	3	.02	1	.02	14	.08	3	.03
Tool and Flake Locality	014	0.04	00	.00	02	.03	004	.02	07	.08
Acreage Surveyed	353		135		60		173		84	

Total
Qcr-1505 items
peracre

Table 7 Density of isolates and localities per acre on different geomorphic surfaces

MATERIAL

DATA RECORDING UNIT	CHALCEDONY	QUARTZITE	QUARTZ	RED PORPHYRY	BASALT	SILICATE MUD	PORPHYRY	MISSING DATA	*ROW TOTS*
UNIT 1	86.1 179 42.1	7.2 15 18.8	1.0 2 66.7	0.5 1 100.0	1.0 2 13.3	0.0 0 0.0	0.0 0 0.0	4.3 9 81.8	100.0 208 38.7
UNIT 2	100.0 17 4.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 17 3.2
UNIT 3	83.8 62 14.6	10.8 8 10.0	1.4 1 33.3	0.0 0 0.0	1.4 1 6.7	1.4 1 100.0	1.4 1 50.0	0.0 0 0.0	100.0 74 13.8
UNIT 4	67.3 37 8.7	14.5 8 10.0	0.0 0 0.0	0.0 0 0.0	16.4 9 60.0	0.0 0 0.0	1.8 1 50.0	0.0 0 0.0	100.0 55 10.2
UNIT 5	98.2 56 13.2	1.8 1 1.3	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 57 10.6
UNIT 6	41.7 35 8.2	52.4 44 55.0	0.0 0 0.0	0.0 0 0.0	3.6 3 20.0	0.0 0 0.0	0.0 0 0.0	2.4 2 18.2	100.0 84 15.6
UNIT 7	90.7 39 9.2	9.3 4 5.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 43 8.0
COL TOTS	79.0 425 100.0	14.9 80 100.0	0.6 3 100.0	0.2 1 100.0	2.8 15 100.0	0.2 1 100.0	0.4 2 100.0	2.0 11 100.0	100.0 538 100.0

Table 8 Crosstabulation of data recording unit by material

Agate is a chalcedony which exhibits banding of dark colored layers. Chert is a fine grained chalcedony, usually of one color ranging from red to brown to black. Jasper is a form of chert that is usually very fine and red in color. All of these are included under the rubric of chalcedony (Kamp 1981:8).

Distribution of Artifact Types

The high frequency of flakes, then shatter and cores reflect the predominant activity taking place on most surfaces - quarries and lithic reduction workshops (Table 9). Blanks are very uncommon but those three recorded in Units 1 and 3 indicate that part of the industry involved production of bifaces. Tools are rarely recorded due to the limited potential of the area for sustained subsistence and settlement. The highest frequency of tools within recorded assemblages occurs on Qal terraces and one area of Qcr (Unit 7).

A further look at tools shows that the majority are made of quartzite (Table 10) and that these are most frequently found on Qal surfaces. Qualitative descriptions of these tools (Appendix C), show that most are quartzite, with some chalcedony cobble hammerstones or battering stones. Many exhibit bipolar battering wear as well but do not bear any spatial association with chipping stations. The correlation of Holocene alluvial terraces overlooking a major wash with these hammerstones, suggest that woodland-wash vegetative resources were collected and processed on these terraces in the later prehistoric periods. A flat "anvil" stone derived from the Qal3 surface (No. 6-1-10) and a dual purpose hammerstone and anvil from the same terrace (No. 6-1-57) are probably also related to the same activities (Figure 4b).

Five hammerstones also occur on Qcr surfaces, some of which are in association with chipping stations. Other tool types include bifacially retouched knives, choppers, and small scrapers on Qcr surfaces. All of these objects exhibit heavy or intermediate varnish and conform to simple flake and core based tools previously attributed to the Malpais or San Dieguito Complex (Appendix C).

LITHIC TECHNOLOGY

The analysis of the lithic technology will be undertaken on two levels, a qualitative description of the technological process made from field observations, and a quantitative analysis of lithic material recorded in data recovery units. General lithic reduction techniques inferred from field observations are comparable to those described by Kamp (1981) for Lake Mead, Arizona, and in California by Pendleton (1984) for the Picacho Basin, and by Skinner (1984) and Hatley and Eckhardt (1982) for Fort Irwin. All involve the reduction of fine cryptocrystalline cobbles and pebbles for the production of core and flake based tools.

ARTIFACT TYPE

	SHATTER	FLAKE	CORE	BLANK	TOOL	*ROW TOTS*
UNIT 1	20.7	60.6	14.4	1.0	3.4	100.0
	43	126	30	2	7	208
	46.2	39.1	34.9	66.7	20.6	38.7
UNIT 2	58.8	41.2	0.0	0.0	0.0	100.0
	10	7	0	0	0	17
	10.8	2.2	0.0	0.0	0.0	3.2
UNIT 3	14.9	60.8	20.3	1.4	2.7	100.0
	11	45	15	1	2	74
	11.8	14.0	17.4	33.3	5.9	13.8
UNIT 4	16.4	50.9	21.8	0.0	10.9	100.0
	9	28	12	0	6	55
	9.7	8.7	14.0	0.0	17.6	10.2
UNIT 5	10.5	82.5	7.0	0.0	0.0	100
	6	47	4	0	0	57
	6.5	14.6	4.7	0.0	0.0	10.6
UNIT 6	7.1	52.4	23.8	0.0	16.7	100.0
	6	44	20	0	14	84
	6.5	13.7	23.3	0.0	41.2	15.6
UNIT 7	18.6	58.1	11.6	0.0	11.6	100.0
	8	25	5	0	5	43
	8.6	7.8	5.8	0.0	14.7	8.0
COL TOTS	17.3	59.9	16.0	0.6	6.3	100.0
	93	322	86	3	34	538
	100.0	100.0	100.0	100.0	100.0	100.0

Table 9 Crosstabulation of data recording unit by artifact type

MATERIAL	ARTIFACT TYPE SHATTER	FLAKE	CORE	BLANK	TOOL	*ROW TOTS*
CHALCEDONY	18.8 80 86.0	63.8 271 84.2	13.9 59 68.6	0.5 2 66.7	3.1 13 38.2	100.0 425 79.0
QUARTZITE	3.8 3 3.2	47.5 38 11.8	25.0 20 23.3	0.0 0 0.0	23.8 19 55.9	100.0 80 14.9
QUARTZ	0.0 0 0.0	33.3 1 0.3	33.3 1 1.2	33.3 1 33.3	0.0 0 0.0	100.0 3 0.6
RED PORPHYRY	100.0 1 1.1	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 1 0.2
BASALT	40.0 6 6.5	33.3 5 1.6	20.0 3 3.5	0.0 0 0.0	6.7 1 2.9	100.0 15 2.8
SILICATE MUD	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 1 2.9	100.0 1 0.2
PORPHYRY	0.0 0 0.0	50.0 1 0.3	50.0 1 1.2	0.0 0 0.0	0.0 0 0.0	100.0 2 0.4
MISSING DATA	27.3 3 3.2	54.5 6 1.9	18.2 2 2.3	0.0 0 0.0	0.0 0 0.0	100.0 11 2.0
COL TOTS	17.3 93 100.0	59.9 322 100.0	16.0 86 100.0	0.6 3 100.0	6.3 34 100.0	100.0 538 100.0

Table 10 Crosstabulation of material by artifact type

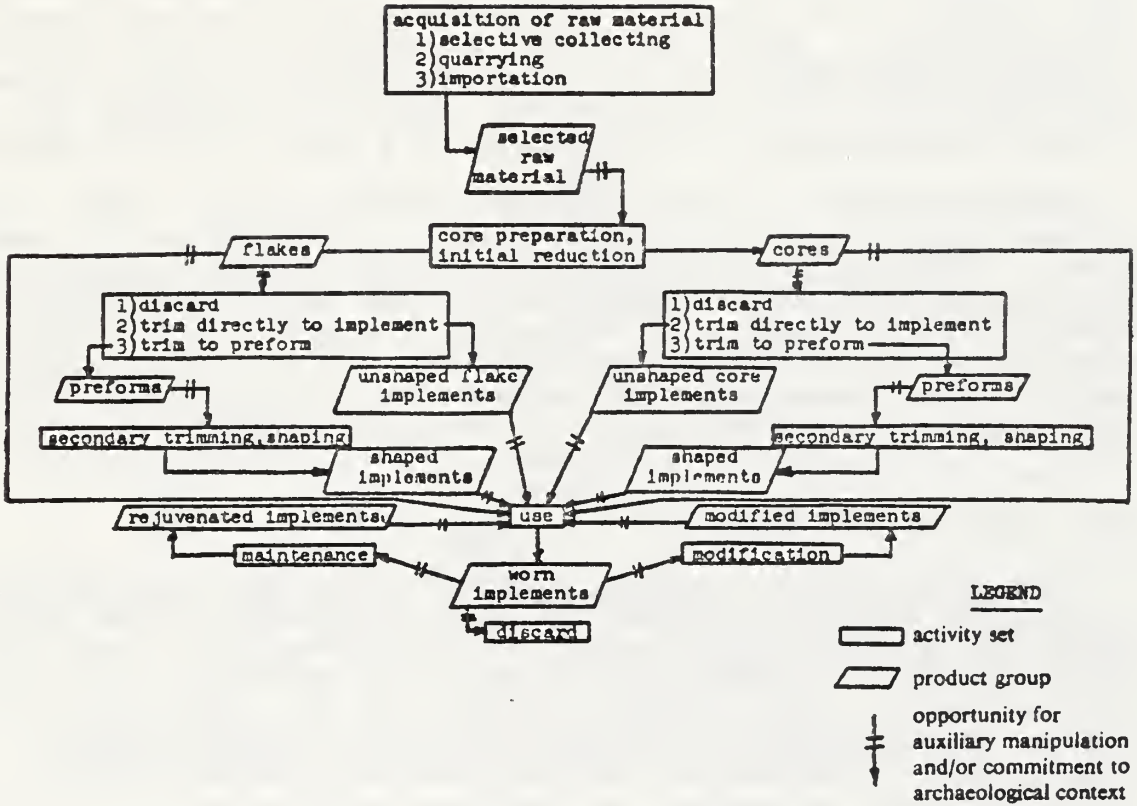
In this regard the table of isolate and locality densities on different geomorphic surfaces may be of some use (Table 7). Various permutations of artifact types may be considered as material output from a specific range of activities or processing of lithic material through a range of stages of reduction. The extent to which the stages from lithic acquisition to final artifact manufacture, use, and discard are achieved can be modelled by a paradigm of knapping patterns.

Kamp (1981) has defined four patterns, overlapping or varying slightly with that proposed by Skinner (1984). In Pattern I, only testing and assaying of material was accomplished. A test core is found with only a few flakes or shatter. There are no useable flakes, minimal reduction, small-large tabular or nodular pieces, and general poor quality material. In Pattern II, the core is completely reduced but no usable flakes or cores are produced. Debitage remaining would include unifacial, bifacial or amorphous cores with a medium to large number of flakes and shatter. No useable pieces are present but moderate to complete reduction is indicated. The usual size of nodules is medium to large and the quality of the material may be poor. In Pattern III, the core is fully reduced and usable flakes and/or cores are removed for use elsewhere. The debitage remaining may include an amorphous core or core fragments but no completely refitted core should be reconstructable from the debitage. Many primary and secondary flakes and shatter may be present but usable flakes and core fragments will be absent. Amount of reduction will be high and medium to large sized nodules will be involved. The quality of the lithic source will probably be average. In Pattern IV, cores and flakes are minimally reduced and the roughout or blank is taken away for refinement elsewhere. The debitage will consist of many primary flakes and shatter but no core. Extensive reduction may be indicated and nodule size may be variable. This pattern at Lake Mead was associated with very fine grained silicious material (Kamp 1981:26-32).

All of these patterns are present at Pebble Terrace, indicating variable use of the area for on-sight lithic reduction. The low occurrence of flake and tool localities, a pattern not discussed by previous authors in regards to lithic reduction, may be the result of two different patterns. One may be the result of mixed lithic reduction and subsistence activities as may take place at a small temporary camp or specialized resource extractive site. Another feasible explanation in the Pebble Terrace area may be, the discard of worn items from the knappers tool kit as they are replaced by newly produced items at the quarry or workshop.

An explanati

Patterns of lithic reduction may also be specified from a general model of core reduction that has been diagrammed by Collins (1975) to indicate the sequence of activity sets that result in the aquisition and selection of raw material, core preparation, primary trimming, optional secondary trimming and tertiary shaping, use, optional rejuvination or modification, and discard (Figure 9). Each activity produces a set of diagnostic archaeological remains with distinctive attributes on stone tools



A generalized flow model for the production of chipped stone tools (From Collins 1975)

FIGURE
9

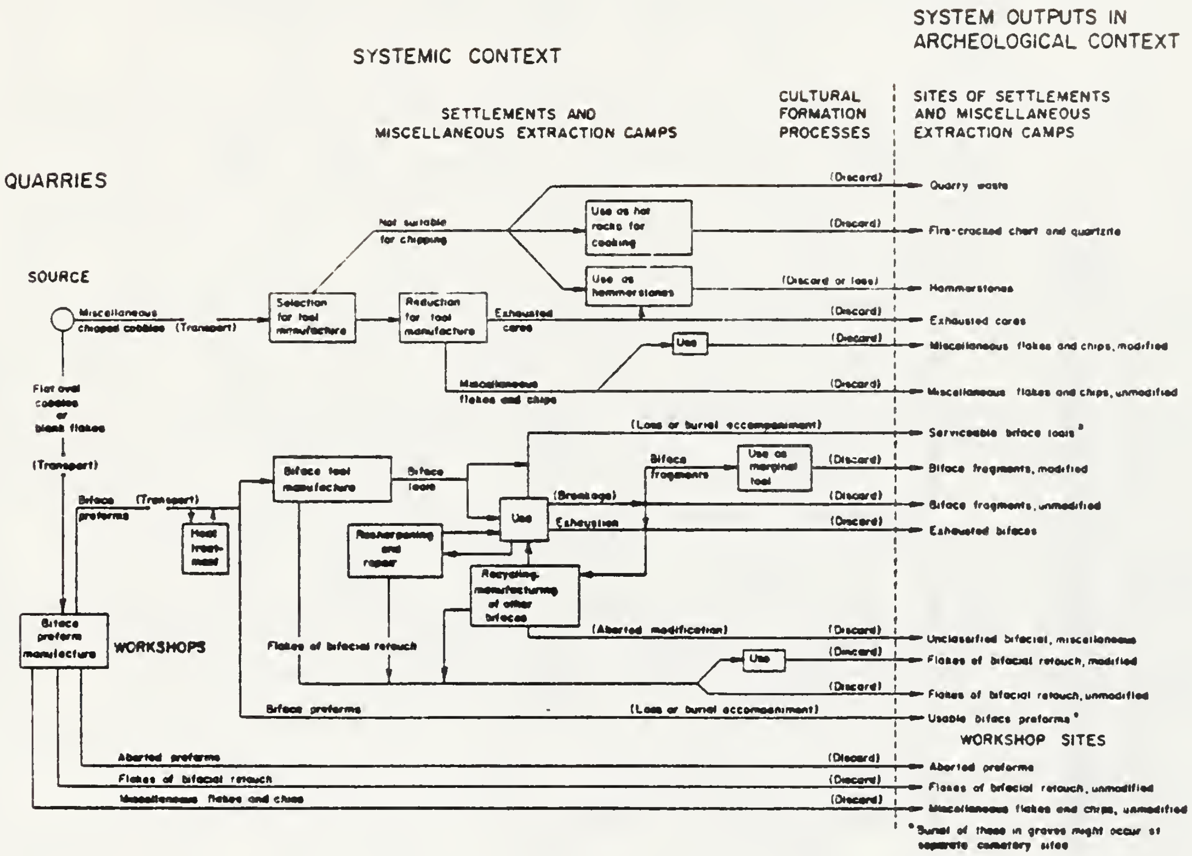
and debitage. This model has been developed even further to reflect decision-making patterns of the ancient stone-knapper that involve transport, recycling, and use. A specific application by House (1975) to the Cache River Basin lithic industry is especially relevant (Figure 10). The spatial or geographical component has been assessed, thus accounting for differences in artifact or attribute frequencies at different localities. The chain of activities involved in stone tool production and use are seen to have specific spatial contexts, interpreted as different site types: the quarry, the workshop, and the settlement or extraction camp. House has thus integrated the lithic industry, defined as a chain of activities that produce specific archaeological remains, into a more general model of settlement and subsistence applicable to site survey data and a regional approach.

Percentages of lithic debitage and tool types thus provide archaeological correlates to the range of activities and type of lithic industry characterizing a locality, site, or region. These frequencies can be compared between Qcr and Qal surfaces to access possible changes in technology through time or prehistoric adaptations to the differing lithology of these geomorphic surfaces. The comparison of frequencies across the Qcr surfaces also provide an indication of the range of variability of activities.

Core Sampling and Reduction

An analysis of 86 recorded cores, making up 16 percent of the lithic data base, indicates the modes of reduction and extent of quarry and workshop activities. Initial Pattern I sampling, and Pattern II primary decortication were the principal activities on all surfaces. Thirty-three percent of all cores had only 1-2 flakes removed, while another 36 percent show 3-4 flake scars (Table 11). Amounts of core cortex as expected confirm this pattern, with 46 percent of the cores exhibiting 75-100 percent of their original cortex, with another 50-74 percent possessing ? 50-74 percent cortex (Table 12). In that regard, the Qal3 surface (Unit 6) produced an uncharacteristically high percentage of primary cores, 85 percent, suggesting a high rate of sampling but low utilization of quartzite cobbles.

Table 13 summarizes the data on direction of flake removal. For statistical purposes and clarity, values 1,3,4,5,and 7 have been grouped as unidirectional; values 2 and 9 have been grouped as bi-polar; and values 6 and 7 have been grouped as multi-directional. The most common reduction technique is the oblique removal of flakes, holding the pebble or cobble at an oblique angle, often on an anvil, and striking the surface at an acute angle with a hard hammerstone. This results in the production of a teshoa type flake and a simple unifacial chopper (see Figure 13 below). Approximately 52 percent of the cores studied show this kind of unidirectional flake removal. Approximately 28 percent of the cores were reduced using a multi-directional technique. The margins of the pebble or cobble were bifacially worked with alternating blows to produce a roughout or blank (see



Flow model for prehistoric chipped stone of the Cache River Basin, Arkansas (From House 1975)

FIGURE 10

DATA RECORDING UNIT	NUMBER OF FLAKES REMOVED FROM CORE 1-2	3-4	5-6	7-8	9 OR MORE	MISSING DATA	*ROW TOTS*
UNIT 1	36.7 11 37.9	30.0 9 29.0	10.0 3 23.1	6.7 2 66.7	10.0 3 75.0	6.7 2 33.3	100.0 30 34.9
UNIT 2	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0
UNIT 3	26.7 4 13.8	33.3 5 16.1	40.0 6 46.2	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 15 17.4
UNIT 4	33.3 4 13.8	33.3 4 12.9	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	33.3 4 66.7	100.0 12 14.0
UNIT 5	50.0 2 6.9	0.0 0 0.0	25.0 1 7.7	25.0 1 33.3	0.0 0 0.0	0.0 0 0.0	100.0 4 4.7
UNIT 6	35.0 7 24.1	50.0 10 32.3	10.0 2 15.4	0.0 0 0.0	5.0 1 25.0	0.0 0 0.0	100.0 20 23.3
UNIT 7	20.0 1 3.4	60.0 3 9.7	20.0 1 7.7	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 5 5.8
COL TOTS	33.7 29 100.0	36.0 31 100.0	15.1 13 100.0	3.5 3 100.0	4.7 4 100.0	7.0 6 100.0	100.0 86 100.0

Table 11 Crosstabulation of data recording unit by number of flakes removed from core

CORTEX ON CORE

DATA RECORDING UNIT

	75-100%	50-74%	0-49%	MISSING DATA	*ROW TOTS*
	40.0	50.0	3.3	6.7	100.0
UNIT 1	12	15	1	2	30
	30.0	39.5	50.0	33.3	34.9
	0.0	0.0	0.0	0.0	0.0
UNIT 2	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0
	33.3	60.0	0.0	6.7	100.0
UNIT 3	5	9	0	1	15
	12.5	23.7	0.0	16.7	17.4
	41.7	33.3	0.0	25.0	100.0
UNIT 4	5	4	0	3	12
	12.5	10.5	0.0	50.0	14.0
	0.0	100.0	0.0	0.0	100.0
UNIT 5	0	4	0	0	4
	0.0	10.5	0.0	0.0	4.7
	85.0	15.0	0.0	0.0	100.0
UNIT 6	17	3	0	0	20
	42.5	7.9	0.0	0.0	23.3
	20.0	60.0	20.0	0.0	100.0
UNIT 7	1	3	1	0	5
	2.5	7.9	50.0	0.0	5.8
	46.5	44.2	2.3	7.0	100.0
COL TOTS	40	38	2	6	86
	100.0	100.0	100.0	100.0	100.0

Table 12 Crosstabulation of data recording unit by core cortex

DIRECTION OF FLAKE REMOVAL

DATA RECORDING UNIT	UNI-DIRECTIONAL	BI-POLAR	MULTI-DIRECTIONAL	MISSING DATA	*ROW TOTS*
UNIT 1	46.7 14 31.8	13.3 4 66.7	26.7 8 33.3	13.3 4 36.4	100.0 30 35.3
UNIT 2	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0
UNIT 3	50.0 7 15.9	0.0 0 0.0	50.0 7 29.2	0.0 0 0.0	100.0 14 16.5
UNIT 4	58.3 7 15.9	8.3 1 16.7	0.0 0 0.0	33.3 4 36.4	100.0 12 14.1
UNIT 5	75.0 3 6.8	0.0 0 0.0	25.0 1 4.2	0.0 0 0.0	100.0 4 4.7
UNIT 6	55.0 11 25.0	5.0 1 16.7	25.0 5 20.8	15.0 3 27.3	100.0 20 23.5
UNIT 7	40.0 2 4.5	0.0 0 0.0	60.0 3 12.5	0.0 0 0.0	100.0 5 5.9
COL TOTS	51.8 44 100.0	7.1 6 100.0	28.2 24 100.0	12.9 11 100.0	100.0 85 100.0

Table 13 Crosstabulation of data recording unit by direction of flake removal from core

Figure 12 below). In some cases, multi-directional reduction was also used to produce flakes for further reduction or modification.

An orthogonal reduction method was also observed whereby the pebble is split at right angles to the the major axis. If split laterally, a platform is produced for unidirectional flake production. Seven percent of the cores indicate a second method of orthogonal reduction involving bi-polar splitting of flat or round pebbles that would have been difficult to reduce using oblique percussion. These pebbles are split longitudinally to produce two halves that may be further reduced to form a unifacial flake based tool, or rarely a bifacial tool.

As expected, uni-directional and bipolar reduction was most commonly applied to quartzite cobbles and pebbles. Both multi-directional and uni-directional reduction were commonly applied to chalcedony (Table 14). (One porphyry core was omitted from Tables 13 and 14).

Numbers of cores were generally too low to make valid statistical comparison between the Qal (Units 4 and 6) and Qcr (Units 1,2,3,5, and 7) surfaces. While Unit 5 appears to posseses an usually high frequency of uni-directional cores, sampling error must be considered because only 4 cores were recorded. Taking all Qcr and Qal surfaces together, it becomes clear that bi-polar reduction is rare on both surface types, while the bi-polar technique occurs at a higher than average rate on Qal surfaces - the result of higher occurrrences of quartzite. On Qcr surfaces, multi-directional flake removal appears much more commonly, suggesting that biface reduction was geared toward chalcedony cobbles. Interestingly enough, no cores were recorded in Unit 2, an area of small pebbles that are not generally suited to reduction.

Flake Morphology and Spatial Distributions

Flake attributes provide additional data on lithic technology. Flakes were defined as lithic material with a definable platform and and/or characteristics on the ventral surface such as bulbs of percussion and striations. Amount of cortex and number of flake scars on the dorsal surface of each flake are good indicators of the stage of reduction being carried out at different localities. Primary phase sampling of cores produced only decortication flakes with large amounts of cortex and no flake scars. Further reduction of a core to produce a usable flake or core base tool will result in the production of secondary flakes with less than 50 percent cortex and generally several dorsal scars, or tertiary flakes from biface thinning and shaping, with no cortex and generally thinner than other flakes.

Quantitative data from the 7 recording units shows a consistent skewing to later stages of reduction. Over 67 percent flakes have less than half of the cortex remaining and 19 percent have no cortex at all (Table 15). This is because data recording units were positioned in areas of relatively high artifact den-

MATERIAL	DIRECTION OF FLAKE REMOVAL				
	UNI-DIRECTIONAL	BI-POLAR	MULTI-DIRECTIONAL	MISSING DATA	*ROW TOTS*
CHALCEDONY	49.2 29 65.9	3.4 2 33.3	37.3 22 91.7	10.2 6 54.5	100.0 59 69.4
QUARTZITE	70.0 14 31.8	15.0 3 50.0	5.0 1 4.2	10.0 2 18.2	100.0 20 23.5
QUARTZ	100.0 1 2.3	0.0 0 0.0	0.0 0 0.0	0.0 0 0.0	100.0 1 1.2
BASALT	0.0 0 0.0	0.0 0 0.0	33.3 1 4.2	66.7 2 18.2	100.0 3 3.5
MISSING DATA	0.0 0 0.0	50.0 1 16.7	0.0 0 0.0	50.0 1 9.1	100.0 2 2.4
COL TOTS	51.8 44 100.0	7.1 6 100.0	28.2 24 100.0	12.9 11 100.0	100.0 85 100.0

Table 14 Crosstabulation of material by direction of flake removal from core

DATA RECORDING UNIT	CORTEX ON FLAKE					
	100%	50-99%	1-49%	NONE	MISSING DATA	*ROW TOTS*
UNIT 1	7.9 10 90.9	13.5 17 81.0	58.7 74 34.1	19.8 25 39.7	0.0 0 0.0	100.0 126 39.1
UNIT 2	0.0 0 0.0	0.0 0 0.0	85.7 6 2.8	14.3 1 1.6	0.0 0 0.0	100.0 7 2.2
UNIT 3	0.0 0 0.0	0.0 0 0.0	82.2 37 17.1	17.8 8 12.7	0.0 0 0.0	100.0 45 14.0
UNIT 4	3.6 1 9.1	0.0 0 0.0	50.0 14 6.5	21.4 6 9.5	25.0 7 70.0	100.0 28 8.7
UNIT 5	0.0 0 0.0	0.0 0 0.0	61.7 29 13.4	34.0 16 25.4	4.3 2 20.0	100.0 47 14.6
UNIT 6	0.0 0 0.0	9.1 4 19.0	77.3 34 15.7	11.4 5 7.9	2.3 1 10.0	100.0 44 13.7
UNIT 7	0.0 0 0.0	0.0 0 0.0	92.0 23 10.6	8.0 2 3.2	0.0 0 0.0	100.0 25 7.8
COL TOTS	3.4 11 100.0	6.5 21 100.0	67.4 217 100.0	19.6 63 100.0	3.1 10 100.0	100.0 322 100.0

Table 15 Crosstabulation of data recording unit by cortex on flake

sity; areas where workshop activities were taking place. Most of the primary flakes occur in areas of low density lithic scatters where only one or two flakes would be likely to occur in a 5 by 5 meter recording unit.

The pattern of core reduction associated with lithic material is paralleled in the flake data pattern (Table 16). Chalcedony flakes have the greatest frequency of secondary and tertiary flakes associated with biface reduction and other refined tool types. Quartzite flakes, in contrast, show a greater range of variability. Secondary flakes, with 1-49 percent cortex, are the most numerous (60 percent) but primary flakes with 50 to 100 percent cortex make up a greater percentage of the flake assemblage than chalcedony flakes. This may in part be a result of sampling error and biases toward chalcedony high density scatters. It is also the result of preferred oblique core reduction on quartzite. Other lithic sources: quartz, basalt, and porphyry, occur in too few numbers to make any generalizations.

Recovered Tools and Blanks

Four artifacts were recovered from the field because they were rare or unique objects that would be difficult to relocate, or represented important aspects of the lithic industry. A brief discussion of each is provided below:

Obsidian Scraper, 4-Riv-668, Study Unit III

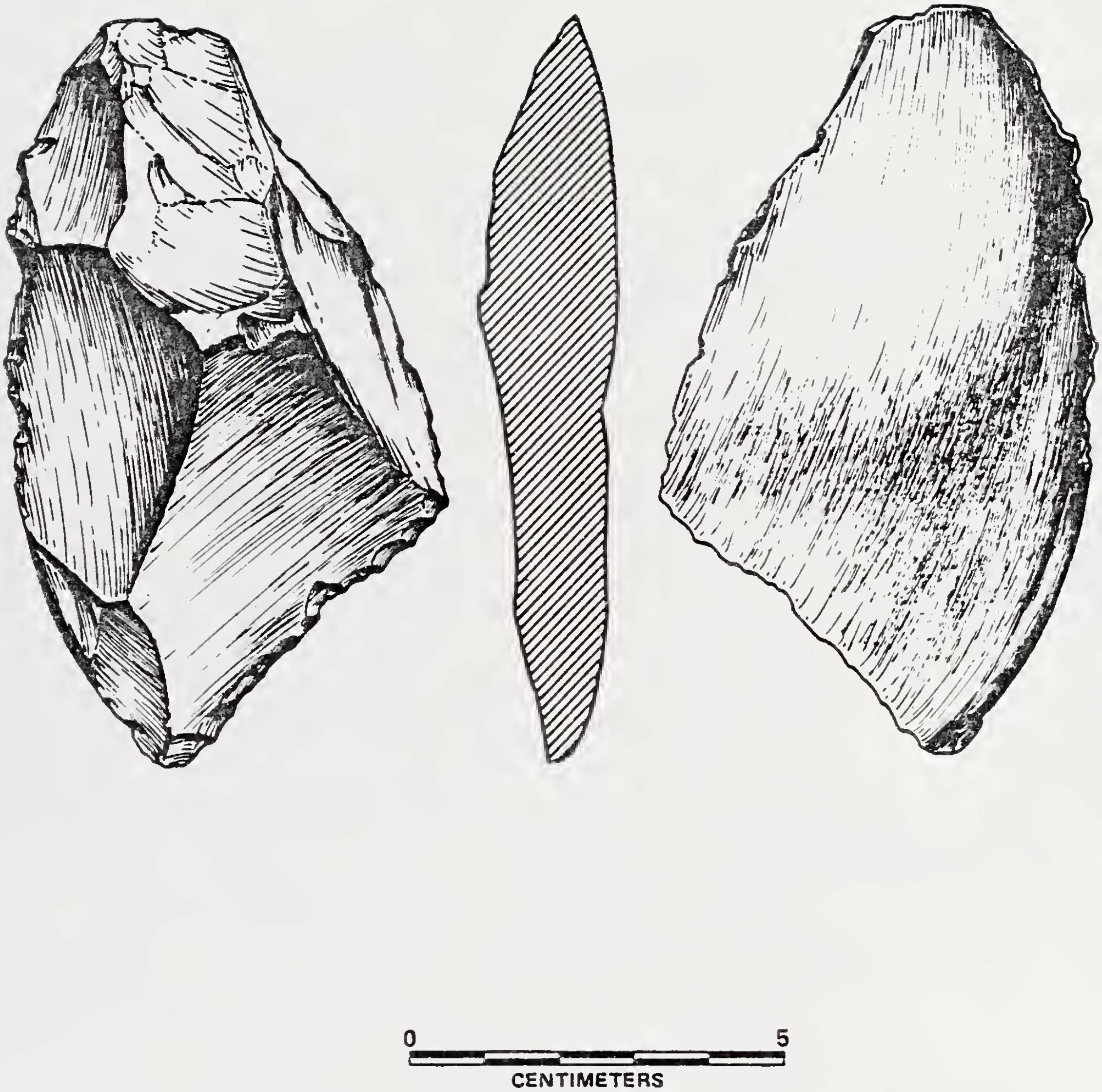
This extremely large tertiary flake bears no cortex and has been extensively worked on the dorsal side prior to removal from the core (Figure 11). The removal resulted in a hinge fracture at the distal end of the flake. The right side has been unifacially retouched using the soft hammer technique, producing a uniform series of parallel flake scars. Originally this worked edge was longer but the proximal end has broken off subsequent to the retouch. The obsidian is a dark black and grey banded type. Chemical sourcing of the stone by Paul Bouey indicates that i~~s~~t is from the Casa Diablo region at the north end of Owens Valley near Mammoth Lakes (see Appendix D). This piece is extremely unusual because it has been transported from so far north, approximately 468 kilometers (290 miles). Most California Desert obsidian comes from Obsidian Butte by the Salton Sea or the Coso Region in the Mojave Desert. It is doubly unusual because large imported obsidian artifacts are also extremely rare and usually worked into more elaborate tools than a simple unifacial scraper.

Robert Jackson optained a double hyration reading on the scraper - 4.5 microns from the ventral side and 5.3 microns from the dorsal side. Comparisons with diagnostic obsidian point types from the Long Valley sequence would produce dates typical of late Pinto or early Elko types, from approximately 2,000 to 3,000 years BP. The hot and exposed environment of the Pebble Terrace would probably accelerate the hydration process, pushing the date forward. Thus the piece may date to the end of the Pinto-Amargosan period or beginning of the Late Prehistoric per-

CORTEX ON FLAKE

MATERIAL	100%	50-99%	1-49%	NONE	MISSING DATA	*ROW TOTS*
CHALCEDONY	2.6 7 63.6	4.8 13 61.9	68.6 186 85.7	20.7 56 88.9	3.3 9 90.0	100.0 271 84.2
QUARTZITE	7.9 3 27.3	18.4 7 33.3	60.5 23 10.6	10.5 4 6.3	2.6 1 10.0	100.0 38 11.8
QUARTZ	0.0 0 0.0	0.0 0 0.0	100.0 1 0.5	0.0 0 0.0	0.0 0 0.0	100.0 1 0.3
BASALT	20.0 1 9.1	0.0 0 0.0	60.0 3 1.4	20.0 1 1.6	0.0 0 0.0	100.0 5 1.6
PORPHYRY	0.0 0 0.0	0.0 0 0.0	100.0 1 0.5	0.0 0 0.0	0.0 0 0.0	100.0 1 0.3
MISSING DATA	0.0 0 0.0	16.7 1 4.8	50.0 3 1.4	33.3 2 3.2	0.0 0 0.0	100.0 6 1.9
COL TOTS	3.4 11 100.0	6.5 21 100.0	67.4 217 100.0	19.6 63 100.0	3.1 10 100.0	100.0 322 100.0

Table 16 Crosstabulation of material by cortex on flake



An exotic obsidian scraper form 4-Riv-668, Study Unit III

FIGURE 11

iod, a time when exchange networks in obsidian are expanding and intensifying (Robert Jackson 1985, personal communication). Certainly the piece cannot be from the San Dieguito period nor from the very late Prehistoric period.

Unfinished Biface Blank, 4-Riv-1748, Data Recording Unit 3,(1)

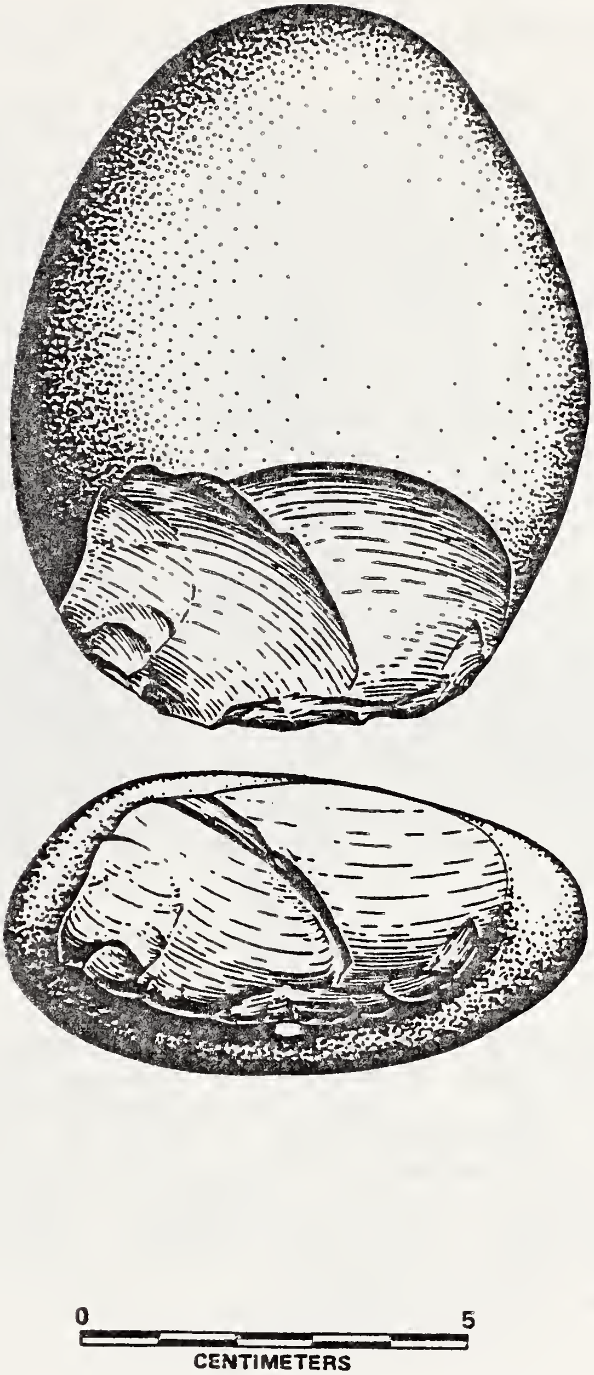
This blank is made from a small cortical flake (Figure 12a). It has been reduced with patterned alternating percussion flaking along one margin and on the other margin by first flaking the dorsal side and then the ventral side. As is often the case with discarded blanks, the knapper was unsuccessful in removing the cortex on the dorsal side of the flake. A fine grained yellow (10YR 7/6) chalcedony was used. Both the original cortex and all of the flake scars exhibit a heavy dark brown varnish (10YR 2/2) and a bright yellow to orange ground patina (7.5YR 5/8-10YR 7/4). The biface reduction technique characterizes the lithic assemblages from the San Dieguito I through Late Prehistoric periods.

Unfinished Biface Blank, 4-Riv-1748, Data Recording Unit 3,(2)

This blank is made from a round cobble by the process of patterned alternating reduction along the entire margin (Figure 12b). Portions of cortex remain on both sides. Three overlapping flakes scars indicate the only secondary retouch over one primary flake scar. The material is a course dark grey chalcedony (2.5Y 4/2) with many inclusions and vessicles. The piece has a light varnish one one side but a dark brown varnish (10YR 2/1) around the edge of the other side, surrounding a bright orange ground patina that covers the cortex and several flake scars (7.5YR 5/8).

Unifacial Chopper or Sampled Cobble, 4-Riv-668, Data Recording Unit 7

This red porphyry cobble has been flaked on only one end (Figure 13). Two large flakes were removed from one face, one overlapping the other. Then 4 or 5 smaller flakes were removed from the edge. Five more small flakes or nibbling along the retouched edge and two small flakes missing from the anterior edge indicate possible use as a chopper. The entire margin of the cobble, including the flaked surface, exhibits a thin black varnish (5YR 2.5/1) while the rest of the stone is covered with a thin reddish brown patina (5YR 4/4).



MOONEY LETTIERI AND ASSOCIATES

A unifacial quartzite chopper from 4-Riv-668, Unit 7

FIGURE 13

VI.NATIONAL REGISTER ASSESSMENT

Within the broad levels of significance established for determining National Register eligibility, only criterion d: "that have yielded, or may be likely to yield, information important in prehistory or history", can be applied to the prehistoric resources in the project area (36 CFR 60.6, 36 CFR 63). This very general guideline has been expanded by archaeologists to consider the specific aspects that make a site significant as an information-bearing cultural resource. Arguments for significance assessment procedures and criteria fill the archaeological literature to compensate for the general Federal guidelines (Schiffer and Gummerman 1977). Those more specific criteria that are applicable to the project area are reviewed below with regard to the two sites recorded in the project area.

Site Integrity

The condition of a site bears directly on its research significance. Previous impacts to the two sites have already been described in the introductions and site descriptions. Prominent among them are illegal rock collecting on a commercial scale and ORV activity. It was found that these impacts only effected a small portion of the project area, as yet. But because all of the cultural resources are surface sites, any future disturbances may be considered to further compromise site integrity. At the present, site integrity must be rated as moderate to high.

No need for this.

Native American Significance

The project area falls within the sphere of interest of the Colorado River Quechan and the Colorado River Indian Tribes (CRIT). General concerns may be expressed about all cultural resources, but of particular concern are burials, cremations, petroglyphs, pictographs, intaglios, ritual loci, and natural landmarks having symbolic or religious significance. None of these resources were positively identified during the survey and none are expected to occur within this region. The one small chalcedony flower cache within a rock ring may be an aboriginal ritual loci but it cannot be demonstrated at this time. Native American significance must therefore be rated as low.

Scientific Significance

Some of the preliminary findings of the sample survey and lithic analysis strongly indicate a high level of scientific significance at both sites under consideration. Specific research orientations that are not feasible in other parts of the Colorado Desert may be approached in the Pebble Terrace area because of the diversity of geomorphic surfaces on which sites are found. The fact that a series of Quarternary and Holocene surfaces can be chronologically ordered provides the potential for tracing changes and continuity of lithic industries and land use through time. As discussed above, most Colorado Desert sites lack any certain means of dating because of their surficial nature, lack of organic remains, and absence of stratigraphic associations. The association of varnish,patina, and pavement position with Qal and Qcr surfaces at Pebble Terrace do support the concept that these variables can be useful for relative dating in this region. These associations also support an approach whereby diachronic studies are possible when datable series of geomorphic surfaces are present. Because the terraces provide only a maximum date for remains, lithic analyses should be done on a statistical level to reflect the gradual accrual of artifacts on a surface once it is formed. Some basic temporal differentiations of lithics on specific surfaces may also be feasibily based on varnish, patina and position. Present data analysis indicate that the area was used during the entire span of human prehistory, from the San Dieguito until ~~the Late Prehis~~toric period. Hydration analysis of the Casa Diablo obsidian scraper provides the only approximation of an absolute date for any object, although very approximate at best. The date does inidcate, however, that habitation of the area includes the Pinto-Amargosan period that is otherwise underrepresented in the California Desert.

— ?

Questioned assumption based on hydration date — very difficult when one flake [illegible] was collected.

Density estimates of archaeological localities, in particular chipping stations and lithic scatters, are far higher than other areas of the Colorado Desert and thus enhance its significance for bearing a comparative data base of chipping stations. While finished tools are scarce, sufficient blanks were found, particularly in association with chipping stations, to be able to use the Pebble Terrace data base in the continuing study of biface production (Pendleton 1984, Skinner 1985). The scarcity of cleared circles and rock rings in association with finished tools also indicates that quarry and workshop lithic reduction activities were the principal uses of Pebble Terrace. Such site patterns support the collector based hunter-gatherer model, as discussed by (Pendleton (1984), whereby groups focused principally on the Colorado River floodplain utilized resources within an optimal foraging radius of their base camp. Pebble Terrace was such an area that provided among other resources of the woodland wash vegetative community, fine chalcedony and quartzite for the production of core and flake based tools.

Poor. No recommendation on N. Reg. eligibility. Has it yielded or may it be likely to yield...? What about future research questions? What answers lie here? Why are we saving this patch of ground?

REFERENCES CITED

Aikens, C. Melvin
1979 Archaeology of the Great Basin. Annual Review of Anthropoloby 7:71-87.

Antevs, Ernst
1948 The Great Basin with emphasis on glacial and post-glacial times, climatic changes and pre-white man. Bulletin of the University of Utah. 38(20):168-191.

Bean, Lowell John and Katharine V. Saubel
1972 Temalpakh: Cahuilla Indian Knowledge and Usage of Plants. Malki Museum Press, Banning.

Begole, Robert S.
1973 An archaeological survey in the Anza-Borrego Desert State Park: 1972. 1975-1976 Report. Coast Archaeological Society Quarterly. 9(2):27-55.

Bettinger, Robert
1978 Alternative adaptive strategies in the prehistoric Great Basin. Journal of Anthropological Research 34:27-46

1980 Explanation/predictive models of hunter-gatherer adaption, in Advances in Archaeological method and Theory, edited by Michael B. Schiffer 3:189-225. Academic Press, New York.

Carrico, Richard; Dennis Quillen and Dennis Gallegos
1980 Cultural resource inventory and National Register Assessment of the Southern California Edison Palo Verde to Devers Transmission Line Corrido (California Portion). Report prepared by WESTEC Services, Inc. for Southern California Edison.

Castetter, Edward F., and Willis H. Bell
1951 Yuman Indian Agriculture, University of New Mexico Press, Albuquerque.

Crabtree, Don E.
1981 Archaeology, in A Cultural Resources Overview of the Colorado Desert Planning Units by Elizabeth von Till Warren, et. al., pp. 25-54. U.S. Department of the Interior, Bureau of Land Management, California Desert District, Riverside.

Dorn, R.E., and T.M. Oberlander
1981 Microbial origin of desert varnish. Science 213(11):1245-1247.

Dorn, Ronald I.
1982 Observations of the use of "desert varnish" in the age-determination of surfaces. IVCM Newsletter 10(1):2-5. Imperial Valley College, Barker Museum, El Centro.

Eckhardt, William T. and M. Jay Hatley
1982 Preliminary report of survey, testing and documentation, assembly and offense areas, Live Fire Maneuver Range, Fort Irwin, San Bernardino County, California. Report prepared by Cornerstone Research for the U.S. Department of the Interior, National Park Service, Interagency Archaeological services, San Francisco.

Engle, E. G. and R. P. Sharp
1958 Chemical data on desert varnish: Geological Society of American Bulletin, 60:487-518.

Elvidge, Christopher David
1979 Distribution and formation of desert varnish in Arizona. masters thesis, Department of Geosciences, Arizona State University, Tempe.

Ezell, Paul H.
1984 A new look at the San Dieguito Culture Casual Papers in Cultural Resource Management 3(1):103-109.

Forde, C. Daryll
1931 Ethnography of the Yuman Indians, Publications is American Archaeology and Ethnography, 28:83-278. University of Californi, Berkeley.

Gallegos, Dennis (editor)
1980 Class II cultural resource inventory of the East Mesa and West Mesa regions, Imperial Valley, California (Vol. I). Report prepared by WESTEC Services, Inc. for the U.S. Department of the Interior, Bureau of Land Management, Riverside, California.

Hayden, Julian
1976 Pre-altithermal archaeology in the Sierra Pinacate, Sonora, Mexico. American Antiquity 41:274-289.

Hester, Thomas R. and Robert F. Heizer
1973 Bibliography of Archaeology I: Experiments, Lithic Technology and Petrographic Analysis, Addison-Wesley.

Jaeger, Edmund C. and Arthur C. Smith
1966 Introduction to the Natural History of Southern California, University of California Press, Berkeley.

Jenkins, O. P.
1962 San Diego-El Centro Sheet, Geologic map of California, scale 1: 250,000. California Division of Mines and Geology, Sacramento.

Jennings, Jesse D.
1957 Danger Cave, University of Utah Anthropological Papers, 28, Salt Lake City.

Kaldenberg, Russell Lee
1976 Paleo-technological Change at Rancho Park North, San Diego County, California. Masters Thesis, Department of Anthropology, San Diego State University.

not the most rece citation

Kamp, Katheryn
1981 Lithic procurement at Lake Mead, the collection of 26CK 2375. Western Archaeological and Conservation Center, National Park Service, Tucson, Arizona.

Kroeber, Alfred L.
1920 Yuman Tribes of teh Lower Colorado. University of California Publications in American Archaeology and Ethnology, 16(18):475-485, Berkeley.

McCarty, Richard
1981 Environmental Background, in A Cultural Resource Overview of the Colorado Desert Planning Unit by Elizabeth von Till Warren, et. al. pp. 4-24. U.S. Department of the Interior, Bureau of Land Management, California Desert District, Riverside.

McGuire, Randall H.
1982 Environmental Background, in Hohokam and Patayan, edited by Rancall H. McGuire and Michael B. Schiffer, pp. 13-56, Academic Press, New York.

McGuire, Randall H. and Michael B. Schiffer
1982 Hohokam and Patayan, Prehistory of Southwestern Arizona, Academic Press, New York.

Mehringer, P. J., Jr.
1977 Great Basin Late Quaternary Environments and Chronology, in Model and Great Basin Prehistory edited by P. D. Fowler, pp. 113-167. Desert Research Institute Publications in the Social Sciences 12.

Moratto, Michael J.
1984 California Archaeology Academic Press, Inc., Orlando, Florida.

Moriarty, James R.
1966 Culture phase divisions suggested by typological changes, coordinated with stratigraphically controlled radiocarbon dating at San Diego. Anthropological Journal of Canada 4(4):20-30.

NWA
1982 The NWA STATPAK, Version 2.1. Northwest Analytical, Inc., Portland, Oregon.

Pendleton, Lorann
1984 Archaeological Investigations in the Picacho Basin. Report prepared by Wirth Environmental Services for San Diego Gas and Electric.

', T. L.
1978 Terraces of the lower Salt River valley in relation to the late Cenozoic history of the Phoenix basin, Arizona, in *Guidebook to the Geology of Central Arizona*. Special Paper No. 2, Arizona Bureau of Geology and Mineral Technology, pp.1-46.

Potter, R. M. and G. R. Rossman
1977 Desert Varnish: The Importance of Clay Minerals, *Science* 196:1446-1448.

Ratliff, Wayne
1982 dBASE II. Assembly language relational database management system. Ashton-Tate, Culver City, California.

Schaefer, Jerome
1981 Phase II archaeological survey of the La Rosita 230kv interconnection project. Report prepared by Cultural Systems Research, Inc. for San Diego Gas and Electric.

Schiffer, Michael B. and George J. Gumerman
1977 *Conservation Archaeology, A Guide for Cultural Resource Management Studies*. Academic Press, New York.

Taylor, R. E., L. A. Payen, C. A. Prior, P. J. Slota, Jr., R. Gillespie, J. A. J. Gowlett, R. E. M. Hedges, A. J. T. Jull, T. H. Zabel, D. J. Donahue, and R. Berger
1985 Major revisions in the Pleistocene age assignments for North American human skeltons by C-14 accelerator mass spectrometre; none older than 11,000 C-14 years B.P. *American Antiquity* 50(1):136-140.

Thompson, Robert
1984 Past environment, in Archaeological Investigations in the Picacho Basin, by Lorann Pendleton, pp. 10-15. Report prepared by Wirth Environmental Services for San Diego Gas and Electric.

Van Devender, Thomas R.
1977 Holocane Woodlands in the Southwestern Deserts. *Science* 198:189-192.

Van Devender, Thomas R. and W. Geoffrey Spaulding
1979 Development of vegetation and climate in the southwestern United States. *Science* 204(4304):701-710

von Werlhof, Jay and Sherilee von Werlhof

1976 Archaeological examinations of the Sundesert Nuclear Plant Site. Report prepared by the Imperial Valley College Museum for San Deigo Gas and Electric.

1978 Archaeological examinations of west and north perimeters Sundesert Site. Report prepared by Imperial Valley College Museum, El Centro, California

von Werlhof, Jan, Sherliee von Werlhof, Morlin Childers, Howard Pritchett, Lorraine Pritchett, Ray Avels, and George Collins

1977 Archaeological survey of the Yuha Basin, Imperial County. Unpublished Ms. on file, Imperial Valley College, Barker Museum, El Centro.

Weide, David C.

1976 Regional environmental history of the Yuha Desert, in Background to Prehistory of the Yuha Desert Region, edited by P. J. Wilke, pp. 9-20. Ballena Press, Anthropological Papers 5.

Wilke, Philip J.

1976 Background to prehistory of the Yuha Desert. Ballena Press Anthropological Papers No. 5, Ramona.

Wilshire, H. G. and J. K. Nakata

1976 Off-road vehicle effects on California Mohave Desert Pavements. California Geology 1976:123-133.

APPENDIX A

Geological Investigations of the Pebble Terrace Study Area, California

by

Michael R. Waters

INTRODUCTION

Two and a half days were spent at Pebble Terrace, California examining the surficial geomorphology. This reconnaissance has resulted in 1) a generalized geologic map showing geomorphic surfaces; 2) a generalized geologic history of the study area; and 3) a generalized description of the geomorphic surfaces, their origin, and approximate age.

METHODS USED TO DIFFERENTIATE MAP UNITS AND ESTABLISH APPROXIMATE AGE

A number of criteria have been used to differentiate map units and assign approximate ages to these units. These criteria have been discussed by Shlemon (1978) and Bull (n.d.). These criteria include: 1) the presence or absence of desert pavements, their relative degree of development, and microrelief; 2) the presence or absence of desert varnish and its degree of development; and 3) the presence or absence of specific soil horizons and their degree of development.

The surfaces of the majority of the deposits in the study area are characterized by a desert pavement, a veneer of gravels one pebble thick. Desert pavements form when particles are concentrated at the surface by 1) deflation, a process in which the fine-grained fraction of a gravelly deposit is removed by wind and water erosion and results in the deflation of the heavier particles to a common surface; 2) upward movement of particles from the subsurface by soil expansion and contraction (heaving) (Springer, 1958); or 3) a combination of the above processes. The presence or absence of a pavement and its degree of development are useful in defining map units and assigning relative ages. The microrelief on the pavement surface is also useful in differentiating surfaces.

Active stream channels and recently abandoned ones have a bar-and-channel microrelief typical of braided stream flow. Older surfaces of Pleistocene or Holocene age were once also deposited by networks of braided channels diverging and rejoining around mid-channel bars. The surface microrelief on these older surfaces is similar to the modern bar-and-channel, but is referred to as a bar-and-swale topography. Bar-and-swale topography differs from its modern analog in that the topography is smoothed and subdued and desert pavements have formed. With time the bar-and-swale microrelief becomes even more subdued.

Desert varnish commonly forms on the surface of the desert pavements. Desert varnish is a black to brown colored iron-manganese coating that forms on exposed rocks and artifacts in arid regions (Dorn, 1981). The origin of desert varnish is not clearly understood and it may be polygenetic in origin (Potter and Rossman, 1977; Dorn, 1981). Little is known about rates of varnish formation except through observation. Most geologists agree that 2,000 years are required for incipient varnish formation.

Soils are a diagnostic and useful tool for differentiating surfaces and are most useful in establishing the approximate age of a surface and its associated deposit.

A soil is not a sedimentary deposit, but instead is an in situ weathering profile developed on a deposit. This profile develops identifiable characteristics with time and/or changes in climate and is influenced by parent material, vegetation, and topography. Soils are characterized by three zones or horizons, designated A, B, and C from top to bottom. The A horizon in desert soils is the zone from which clays and CaCO3 are leached. The B horizon is the zone where clay accumulated to form what is called an argillic horizon. The C horizon is the zone of CaCO3 accumulation and forms what is called a calcic horizon.

The argillic Bt horizon is an illuvial horizon in which clays have accumulated by their downward movement from the A horizon. Much time is required for argillic horizon formation and this diagnostic subsurface horizon is characteristic of Pleistocene age soils (Birkeland, 1984). They formed under a wetter and more semiarid Pleistocene climate. Argillic horizons have not formed under the arid climate of the Holocene and are therefore relicts of a former climate and very diagnostic age indicators when found. The Pleistocene-Holocene boundary can be differentiated by the presence or absence of an argillic horizon.

Calcic horizons are the most useful criteria for distinguishing soils of different age, especially where an argillic horizon is absent. Pedogenic calcium carbonate accumulates by the downward translocation of CaCO3 only in arid and semiarid regions. It forms as water percolates downward from the A horizon carrying CaCO3 in solution which is later precipiatated at depth (Birkeland, 1984). The permeability of the soil, the amount of rainfall, and surface temperature, therefore, influence the depth of water descent and the depth of CaCO3 in the study area include limestones, weathering of Ca-bearing minerals such as Ca-plagioclase in basalt, and atmospheric dust. The morphology and depth of calcic horizons on Pleistocene versus Holocene soils suggest wetter and/or cooler (semiarid) Pleistocene climates compared to more arid Holocene climates. Pleistocene soils have calcic horizons at greater depths, have greater accumulation of CaCo3, and have a more developed stage of accumulation due to a longer period of accumulation and more rapid illuviation of carbonate because of the Pleistocene semiarid climate. Calcic horizons developed on Holocene deposits usually occur at shallower depths and show an incipient stage of development compared to Pleistocene soils because of their shorter duration of formation and the drier and warmer (arid) Holocene climate.

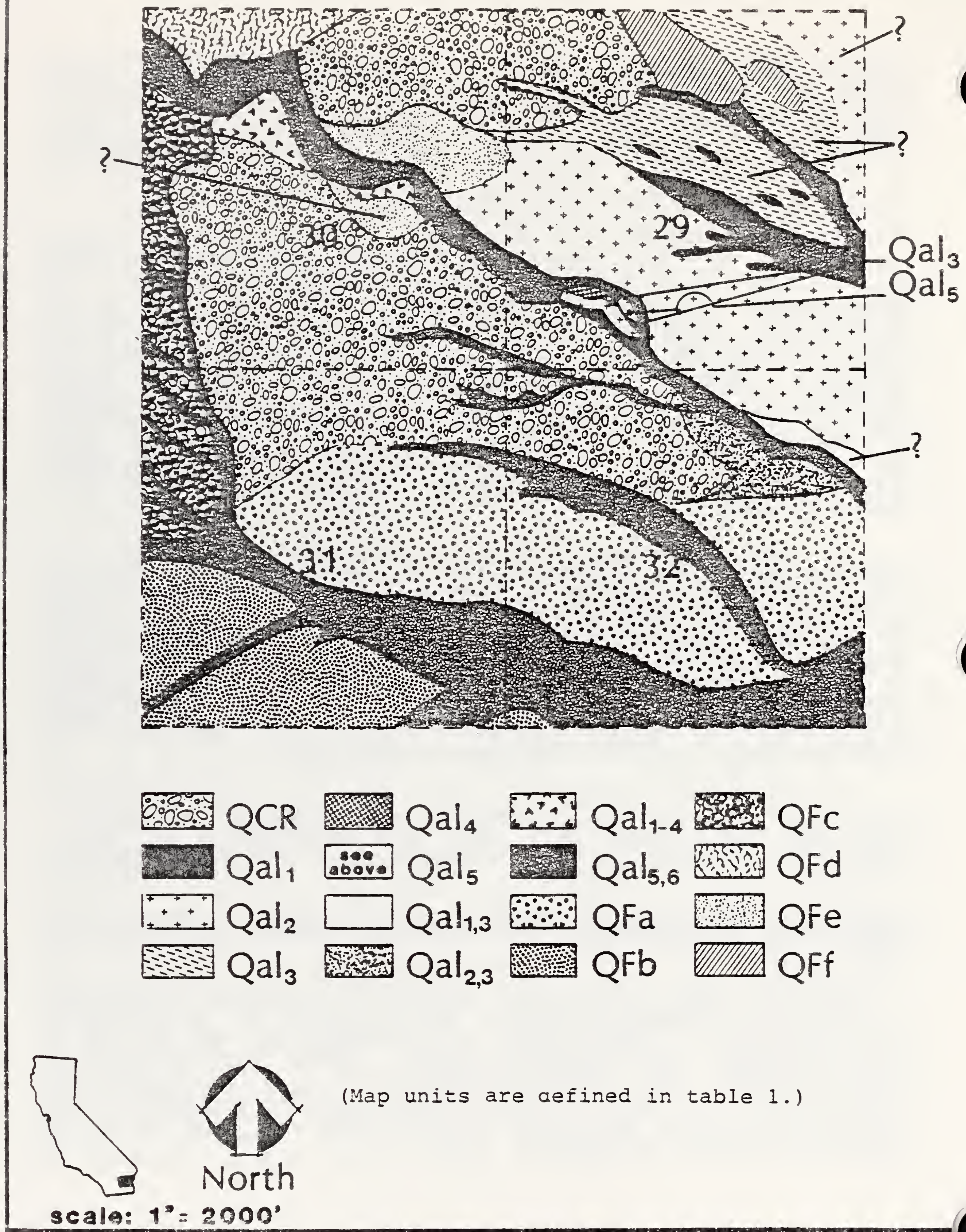
In New Mexico a developmental sequence for CaCO3 accumulation in the calcic horizon has been established by Gile (1975) and can be applied to Pebble Terrace. The morphological sequence has been established for gravelly and non-gravelly alluvium. Because the alluvium in the study area is gravelly, only that developmental sequence will be outlined: Stage I: Development of thin discontinuous CaCO3 coatings on the undersides of rock particles; Stage II: CaCO3 coatings continue to accumulate and form continuous coatings on the undersides of pebbles. Inter-pebble fillings begin to form; Stage III: Inter-pebble fillings continue to develop and the profile eventually becomes capped by pure laminated layers of CaCO3.

In the Rio Grande Valley of New Mexico stage I coatings require more than 1,000 years but less than 2,600 years to form, stage II requires 9,000 to 15,000 years to form, stage III requires from 25,000 to 50,000 years to form, and stage IV requires 400,000 to 550,000 years to form. Bull (n.d.) estimates that calcic horizons form a magnitude of order slower in the Lower Colorado River region than those in the Rio Grande region because of climatic differences (mainly a difference in rainfall--the lower Colorado River region receives only half the amount the Rio Grande region receives).

It should be cautioned that there are no absolutes in estimating ages for soils based on calcic horizon development. These are only approximate ages, with many factors (eg. CaCO3 sources) influencing the rate of morphological stage development.

GENERALIZED GEOMORPHOLOGY AND GEOLOGIC HISTORY OF THE STUDY AREA

Thirteen map units were defined in the study area during a two day reconnaissance which was augmented with aerial photo interpretation. These units are generalized and are much more complex than presented here. These map units were differentiated and assigned approximate ages based on the criteria outlined in the previous section. The characteristics of each unit are given in Table 1 and the distribution of each unit is shown in Figure 1.

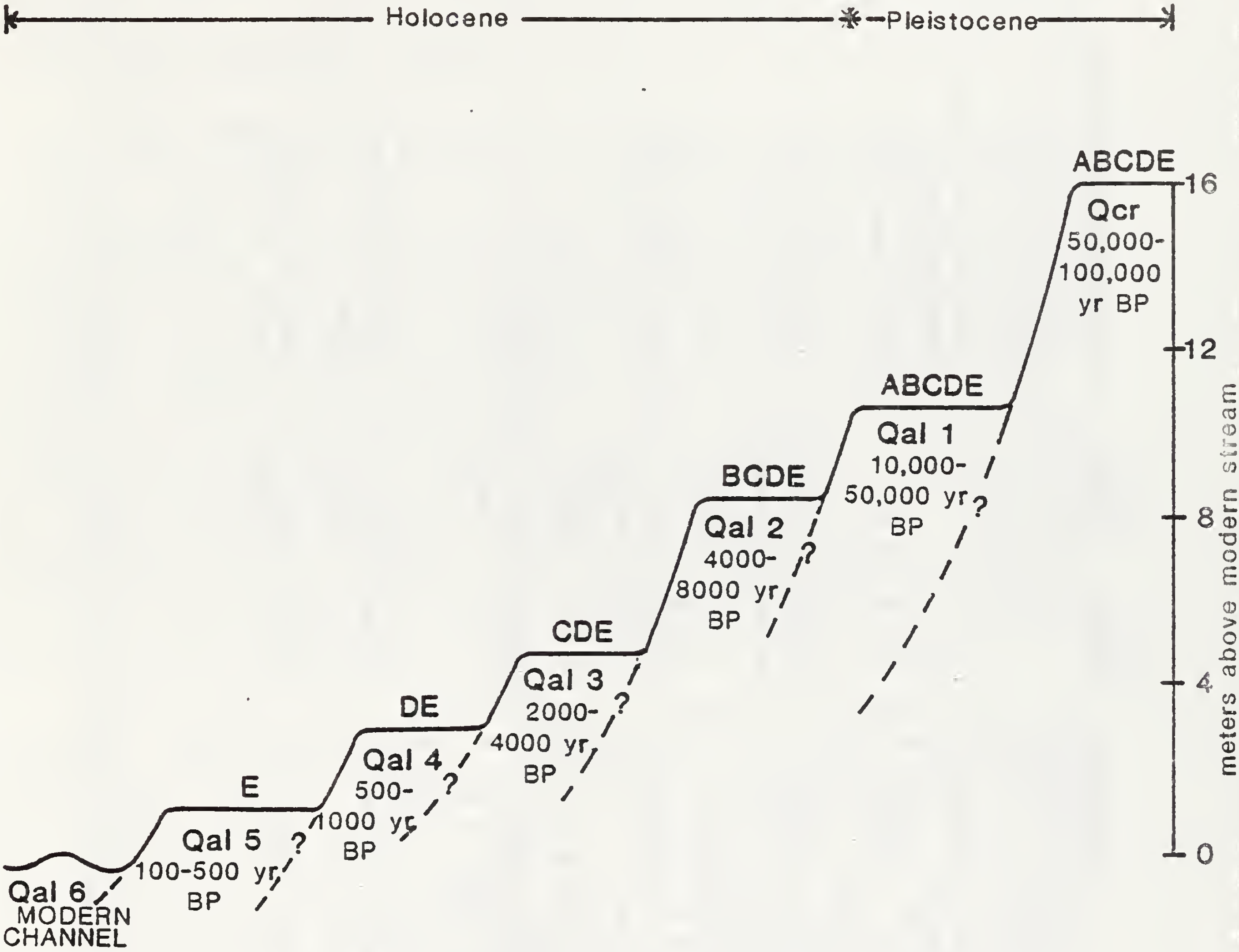


(Map units are defined in table 1.)

MOONEY LETTIERI AND ASSOCIATES

Generalized geologic map of the Pebble Terrace Study Area, California.

FIGURE 1



Unit designations follow those in figure 1 and table 1. A,B,C,D, and E represent artifacts potentially associated with each surface (e.g. artifacts designated E are contemporaneous with terrace Qal 5 but can occur at any of the older surfaces.

MOONEY LETTIERI AND ASSOCIATES

Terraces above wash dissecting study area in southwest quarter of section 29.

FIGURE

	Soil								
Unit	A2	B	C	Topography	Desert Varnish	Desert Pavement	Depositional Environment	Estimated Age	
Qal6	-	-	unweathered sand & grvael	bar-&-channel	-	-	active braided stream channels and bars	modern	HOLOCENE
Qal5	-	-	unweatherd sand & gravel	bar-&-channel	-	-	abandoned historic stream channels and bars	100-500 yr B.P.	
Qal4	+	-	unweatherd sand & gravel	bar-&-swale	-	-	fluvial braided stream	500-1,000 yr B.P. (Tumco Buff sherd)	
Qal3	+	-	Cca at 2-8cm Stage I, v. thin (<0.1mm) v. discont. coatings	bar-&-swale	Var. bars Var. swales	well devlpd on bars; mod. devlpd on swales	fluvial braided stream	2,000-4,000 yr B.P.	
Qal2	+	-	Cca at 3-16cm Stage I, thin (<0.5mm), discontinuous coatings	bar-&-swale	Var. bars Var. swales	Well developed bars and swales	fluvial braided stream	4,000-8,000 yr B.P.	
Qal1	+	B2t at 1-7cm	Cca at 7-35cm Stage II, cont. (<1mm coatings)	planar	Varnished	well developed	fluvial	10,000-50,000 yr B.P.	PLEISTOCENE
QFa to QFf	+	B2t	Cca, Stage II	bar-&-swale	Varnished	well developed	alluvial fan—braided stream	50,000 yr B.P. +	
Qcr	+	B2t	Cca, Stage II-III	planar	varnished	well developed	terrace of Colorado River	100,000 yr B.P. +	

Table 1. Characteristics of geomorphic surfaces defined in the Pebble Terrace Study area, California. Explanation: - absent; + present; B2t argillic horizon; Cca calcic horizon

The oldest sediments (designated Qcr) within the study area were deposited by the Colorado River which once flowed at this altitude. The Colorado River formed two terraces at 520 and 440 feet above sea level. After abandonment of these surfaces by the river, darkly varnished planar desert pavements formed which are characterized by high concentrations of well rounded chert and quartzite cobbles and pebbles. Soil evidence, the presence of a well developed argillic (B2t) horizon and a calcic (Cca) horizon with stage II-II CaCO3 accumulation, indicates that the Colorado River sediments and desert pavement surface formed on these sediments are well over 100,000 years old.

After abandonment of the region by the Colorado river (the river migrated eastward and downcut) the Colorado River terraces (Qcr) in the study area became eroded by braided streams originating from the adjacent mountains to the west. The streams at first eroded the landscape. This was followed by deposition of local lithologies derived from the mountains mixed with reworked Colorado River cobbles in braided stream channels and bars on the surface of alluvial fans and plains. At least six different episodes of alluvial fan deposition occurred during the Pleistocene which left deposits Qfa - Qfe in the study area. Each represents a unique episode of deposition by braided streams on an alluvial fan or plain. The fan surfaces are now characterized by a bar-and-swale topography (representing the old stream channels and bars of the braided stream), a well developed desert pavement dominated by lithologies derived from the adjacent mountains mixed with minor amounts of reworked Colorado River cobbles, a dark desert varnish, and strong soil development (argillic and calcic horizons). The reconnaissance nature of the project did not allow a sequence of fan deposition to be developed.

During the late Pleistocene, 10,000 to 50,000 years ago, streams originating from the mountains to the west downcut through the fans. Along a prominent stream cutting through the study area a sequence of five terraces composed of sand and gravel have been identified and indicate five periods of stability followed by stream downcutting from the late Pleistocene to the historic period (Figure 2). The surface of the oldest terrace, Qal1, is characterized by a planar varnished desert pavement with soil development of Pleistocene age. The next four terraces (Qal2 - Qal5) are Holocene in age based on soil development. The surface of the terraces are characterized by a bar-and-swale topography (swales representing the old stream channels and bars the old channel bars). Depending on the age of the terrace a desert pavement and desert varnish may be present (see Table 1). The active modern stream channel is designated Qal6 and is characterized by active channels which diverge and rejoin around bars and no soil development.

ARTIFACT RELATIONSHIPS

The position of artifacts on surfaces Qcr, Qfa, and Qal1 provide little information on their approximate age. These artifacts occur on surfaces of Pleistocene age ranging from 10,000 yr B.P. to over 100,000 yr B.P. However, the maximum age of artifacts on the surface of the Holocene terraces, Qal2-Qal15, can be estimated from the soil evidence (see Table 1). Artifacts on the Qal2 surface can be no older than approximately 8,000 yr B.P., those on the Qal3 surface no older than 4,000 yr B.P. those on the Qal4 surface no older than about 1,000 yr B.P., and those on the Qal5 surface no older than 500 yr B.P. Thus the chronological placement of artifacts on these surfaces will allow the archaeologist to evaluate whether there was technological change or stability through time on the basis of the four temporally distinct surfaces. The only complication would be the use of raw material on an older surface by people contemporaneous with a younger surface. For example, as illustrated in Figure 2, people contemporary and making artifacts (designated D) on surface Qal4 may also utilize lithic material on the older terraces (Qal3, 2, and 1 as well as on older surfaces) and leave these artifacts (designated A, B, and C) on a surface. However, this complication may be filtered out if difference in desert varnish formation on flake scars is observed or technological peculiarities can be isolated as belonging to a certain time period.

REFERENCES CITED

Birkeland, P. W., 1984, Soils and Gemorphology: Oxford University Press, Oxford, p. 372.

Bull, W. B., n.d., Climatic Geomorphology, manuscript in preparation.

Dorn, R. I., and Oberlander, T. M., 1981, Microbial origin of desert varnish: Science, v. 213, p. 1245-1247.

Gile, L. H., 1975, Holocene soils and soil geomorphic relations in an arid region of southern New Mexico: Quaternary Research, v. 5, p. 321-360.

Potter, R. M., and Rossman, G. R., 1977, Desert Varnish: the importance of clay minerals: Science, v. 196, p. 1446-1448.

Shlemon, R. J., 1978, Geomorphic relationships, southeastern Mojave desert, California and Arizona, in, Mahaney, W. C. (ed.), Quaternary Soils: Geo Abstracts, p. 187-207.

Springer, M. E., 1958, Desert pavement and vesicular layer of Lahontan Basin, Nevada: Soil Science Society of America Proceedings, v. 22, p. 63-66.

APPENDIX B

Pebble Terrace Lithic Data

PEBBLE TERRACE LITHIC ANALYSIS VARIABLE INDEX

A.Data Recording Unit Number
1-7

B.Grid Number
1-n

C.Artifact Number
1-n

D.Artifact Type
S. Shatter
F. Flake
C. Core
B. Blank
T. Tool

E.Material
1. Chalcedony
2. Chert(Combined with 1)
3. Quartzite
4. Quartz
5. Red Porphyry
6. Basalt
7. Silicate Mud/Chert
8. Porphyry

F.Ground Patina
T. Present
F. Absent

G.Varnish
H. High
I. Intermediate
A. Absent

H.Position in Pavement
A. Above
P. Partially embedded
I. Almost totally embedded

I.Cortex on Flake
1. 100 percent
2. 50-99 percent
3. 1-49 percent
4. none

J.Number of Dorsal Scars on Flake
1. 1
2. 2
3. 3-4
4. 5 or more
5. none

K.Position of Flake on Original Core
1.Hemispheric-longitudinal
2.Hemispheric-diagonal
3.Hemispheric-lateral
4.Internal with cortical plat.
5.Internal tertiary
6.Variation of type 4
7.Expanding flake
8.Quarter cobble
9.Variation of type 1

L.Cortex on Core
1. 75-100 percent
2. 50-74 percent
3. 0-49 percent

M.Number of Flakes Removed from Core
1-n

N.Direction of Flake Removal
1. To the inside
2. Bi-polar
3. Uni-directional
4. Lateral
5. To the outside
6. Multi-faceted
7. Downward
8. Multi-directional
9. Two directions

O.Tool Edge Angle
1. acute
2. intermediate
3. obtuse

P.Tool Edge Outline
1. convex
2. straight
3. concave
4. wavy

Comments

Comments concern wear damage on tools, tool types and functional descriptions, associations with other artifacts, and recording strategies.

PEBBLE TERRACE LITHIC DATA

```
A B  C  D E  F  G H I J K L M N O P          COMMENTS

1 1   1 F 1 .T. H A 3 2 4 0 0 0 0 0 SECONDARY FLAKE,CORTEX ON
                                    STRIKING PLATFORM ONLY
1 1   2 F 1 .F. A A 4 4 5 0 0 0 0 0 TERTIARY FLAKE
1 1   3 F 1 .T. H A 3 3 4 0 0 0 0 0 SECONDARY FLAKE
1 1   4 S 1 .T. H A 3 0 0 0 0 0 0 0
1 1   5 F 1 .T. H A 3 1 4 0 0 0 0 0 SECONDARY FLAKE
1 1   6 F 1 .T. A I 4 1 5 0 0 0 0 0 TERTIARY FLAKE
1 1   7 F 1 .T. A A 3 3 4 0 0 0 0 0 SECONDARY FLAKE
1 1   8 F 1 .T. H A 3 2 4 0 0 0 0 0 SECONDARY FLAKE
1 1   9 C 1 .F. A A 0 0 0 2 4 1 0 0
1 1  10 C 3 .T. I A 0 0 0 2 2 2 0 0
1 1  11 F 1 .F. A A 4 3 5 0 0 0 0 0 TERTIARY FLAKE
1 1  12 F 1 .T. H A 2 2 4 0 0 0 0 0 SECONDARY FLAKE
1 1  13 F 1 .T. A P 3 1 4 0 0 0 0 0 SECONDARY FLAKE
1 1  14 F 1 .T. I A 3 3 4 0 0 0 0 0 SECONDARY FLAKE
1 1  15 F 1 .T. H A 3 5 4 0 0 0 0 0 SECONDARY FLAKE
1 1  16 F 1 .T. H A 3 3 2 0 0 0 0 0 SECONDARY FLAKE
1 1  17 F 3 .T. I A 2 1 2 0 0 0 0 0 SECONDARY FLAKE
1 1  18 F 1 .T. A A 3 3 4 0 0 0 0 0 SECONDARY FLAKE
1 1  19 F 1 .T. I A 3 3 4 0 0 0 0 0 SECONDARY FLAKE
1 1  20 S 1 .T. H A 0 0 0 0 0 0 0 0 NONE
1 1  21 C 1 .T. I I 0 0 0 2 9 3 0 0
1 1  22 T 3 .T. I A 0 0 0 0 0 0 3 0 WEAR DAMAGE: BATTERING ON ONE
                                    EDGE OF HAMMERSTONE
1 1  23 S 1 .T. H A 0 0 0 2 0 0 0 0
1 1  24 S 1 .T. H I 0 0 0 2 0 0 0 0
1 1  25 F 1 .F. A I 3 3 4 0 0 0 0 0 SECONDARY FLAKE, ASSOCIATED
                                    WITH ITEM #26
1 1  26 F 1 .F. A A 3 1 4 0 0 0 0 0 SECONDARY FLAKE,ASSOCIATED
                                    W/ITEM #25
1 1  27 F 1 .T. A I 3 2 2 0 0 0 0 0 PRIMARY FLAKE
1 1  28 S 1 .T. A I 0 0 0 2 0 0 0 0
1 1  29 S 1 .T. I I 0 0 0 2 0 0 0 0
1 1  30 F 1 .F. A I 4 2 5 0 0 0 0 0 TERTIARY FLAKE, SHATTER
                                    ASSOCIATED WITH ITEMS #31,32
1 1  31 F 1 .T. I A 3 2 2 0 0 0 0 0 PRIMARY FLAKE, ASSOCIATED WITH
                                    ITEMS 30,32
1 1  32 F 1 .T. I A 3 5 0 0 0 0 0 0 PRIMARY FLAKE, ASSOCIATED W/
                                    ITEMS 30,31
1 1  33 F 1 .T. H A 2 2 2 0 0 0 0 0 PRIMARY FLAKE
1 1  34 F 1 .T. H I 3 1 2 0 0 0 0 0 PRIMARY FLAKE
1 1  35 C 4 .T. I I 0 0 0 1 1 3 0 0
1 1  36 S 0 .T. H A 0 0 0 2 0 0 0 0
1 1  37 F 1 .T. H A 2 3 2 0 0 0 0 0 PRIMARY FLAKE
1 1  38 F 1 .T. H A 3 5 2 0 0 0 0 0 PRIMARY FLAKE
1 1  39 F 1 .T. H A 3 1 2 0 0 0 0 0 PRIMARY FLAKE
1 1  40 T 3 .T. A A 0 0 0 0 0 0 3 0
1 1  41 S 1 .T. I A 0 0 0 2 0 0 0 0
1 1  42 C 1 .T. I A 0 0 0 2 1 3 0 0
```

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
1	1	43	F	1	.T.	I	A	2	1	2	0	0	0	0	0	PRIMARY FLAKE
1	1	44	S	1	.T.	I	I	0	0	0	2	0	0	0	0	
1	1	45	C	1	.T.	I	A	0	0	0	2	7	4	0	0	
1	1	46	F	4	.T.	H	A	3	5	2	0	0	0	0	0	PRIMARY FLAKE
1	1	47	C	1	.T.	A	I	0	0	0	2	5	5	0	0	
1	1	48	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
1	1	49	C	1	.T.	I	P	0	0	0	2	8	6	0	0	
1	1	50	F	1	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY FLAKE,ASSOCIATED W/ ITEM 51
1	1	51	F	1	.F.	A	I	4	1	5	0	0	0	0	0	TERTIARY FLAKE,ASSOCIATED W/ ITEM 50
1	1	52	T	1	.T.	A	A	3	0	0	0	0	0	1	4	BI-FACE,RETOUCHED KNIFE EDGE,ASSOCIATED WITH ITEMS THAT START IN GRID#2
1	1	53	F	1	.T.	I	A	3	3	2	0	0	0	0	0	SECONDARY FLAKE
1	1	54	S	1	.T.	A	I	0	0	0	2	0	0	0	0	ASSOCIATED W/ ITEM 55
1	1	55	F	1	.T.	A	I	3	1	4	0	0	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ ITEM #54
1	1	57	S	1	.F.	H	I	0	0	0	2	0	0	0	0	
1	1	58	F	1	.T.	H	P	3	3	4	0	0	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ITEM 59
1	1	59	F	0	.F.	A	A	4	1	5	0	0	0	0	0	TERTIARY FLAKE, ASSOCIATED WITH ITEM 58
1	1	60	C	1	.T.	I	A	0	0	0	1	2	7	0	0	
1	1	61	S	1	.T.	I	P	0	0	0	2	0	0	0	0	
1	1	62	F	1	.T.	I	A	3	0	4	0	2	0	0	0	SECONDARY FLAKE
1	1	63	F	1	.T.	I	A	3	5	2	0	0	0	0	0	PRIMARY FLAKE
1	1	64	S	1	.F.	I	P	0	0	0	3	0	0	0	0	
1	1	65	C	1	.T.	I	P	0	0	0	1	1	7	0	0	
1	1	66	C	1	.F.	H	A	0	0	0	1	3	6	0	0	
1	1	67	F	1	.F.	A	P	4	2	4	0	0	0	0	0	TERTIARY FLAKE
1	1	68	C	1	.T.	H	A	0	0	0	1	1	7	0	0	
1	1	69	F	1	.F.	A	A	3	1	4	0	0	0	0	0	SECONDARY FLAKE
1	1	70	F	1	.F.	A	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
1	1	71	C	1	.T.	I	A	0	0	0	2	9	6	0	0	
1	1	72	F	1	.T.	H	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE
1	1	73	C	1	.T.	I	A	0	0	0	1	1	7	0	0	
1	1	74	S	1	.T.	I	I	3	0	0	2	0	0	0	0	ASSOCIATED WITH ITEM #75
1	1	75	S	1	.T.	I	A	0	0	0	2	0	0	0	0	ASSOCIATED W/ ITEM #74
1	1	76	F	0	.T.	I	A	2	1	2	0	0	0	0	0	PRIMARY FLAKE
1	1	77	F	1	.T.	H	A	3	2	2	0	0	0	0	0	PRIMARY FLAKE
1	1	78	F	1	.F.	A	I	3	1	2	0	0	0	0	0	SECONDARY FLAKE
1	1	79	F	1	.T.	A	A	3	2	2	0	0	0	0	0	PRIMARY FLAKE
1	1	80	F	1	.F.	A	I	4	2	5	0	0	0	0	0	TERTIARY FLAKE
1	1	81	F	1	.T.	I	A	3	0	4	0	4	0	0	0	PRIMARY FLAKE
1	1	82	F	1	.F.	A	A	3	1	6	0	0	0	0	0	PRIMARY FLAKE
1	1	83	F	1	.F.	I	I	3	1	2	0	0	0	0	0	PRIMARY FLAKE
1	1	84	C	3	.F.	I	A	0	0	0	1	2	7	0	0	
1	1	85	C	1	.T.	I	A	0	0	0	2	6	0	0	0	

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
1	1	86	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
1	1	87	C	1	.F.	A	A	0	0	0	2	4	8	0	0	
1	1	88	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
1	1	89	F	1	.T.	H	A	3	1	4	0	0	0	0	0	PRIMARY FLAKE
1	1	90	T	1	.T.	H	A	0	0	0	1	0	0	2	4	CHOPPER W/EDGE WEAR,FOUND IN AREA W/ OTHER LITHIC MAT'L.
1	1	91	T	1	.T.	H	A	0	0	0	0	0	0	2	4	SCRAPER, ASSOCIATED W/ ITEM #89
1	1	92	F	0	.T.	H	A	3	2	5	0	0	0	0	0	PRIMARY FLAKE, ASSOCIATED W/ ITEMS #'S 89,91
1	1	93	F	1	.F.	A	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
1	1	94	S	5	.T.	A	A	0	0	0	2	0	0	0	0	SIX SMALL PIECES OF SHATTER GROUPED TOGETHER
1	1	95	S	1	.F.	I	A	3	0	0	2	0	0	0	0	
1	1	96	F	1	.T.	H	A	3	3	2	0	0	0	0	0	PRIMARY FLAKE
1	1	97	F	1	.T.	A	I	4	4	5	0	0	0	0	0	TERTIARY FLAKE
1	1	98	S	1	.F.	A	A	0	0	0	2	0	0	0	0	
1	1	99	F	1	.F.	H	A	3	3	4	0	0	0	0	0	SECONDARY FLAKE
1	1	100	F	1	.T.	I	A	3	3	6	0	0	0	0	0	PRIMARY FLAKE
1	1	101	F	1	.T.	A	P	3	2	2	0	0	0	0	0	PRIMARY FLAKE, ASSOCIATED WITH ITEM NO.98
1	1	102	F	1	.T.	A	A	3	3	6	0	0	0	0	0	PRIMARY FLAKE
1	1	103	F	1	.T.	H	A	3	3	6	0	0	0	0	0	SECONDARY FLAKE
1	1	104	C	1	.T.	I	I	0	0	0	2	1	7	0	0	IN ASSOCIATION WITH NO. 103
1	1	105	F	1	.F.	A	A	3	1	6	0	0	0	0	0	SECONDARY FLAKE
1	1	106	F	1	.T.	H	A	3	2	6	0	0	0	0	0	SECONDARY FLAKE
1	1	107	S	1	.T.	I	A	0	0	0	3	0	0	0	0	
1	1	108	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
1	2	1	F	1	.F.	I	P	2	2	2	0	0	0	0	0	USE WEAR SUGGESTING UTILIZED SECONDARY FLAKE, POSSIBLY 2-3 ASSOCIATED ARTIFACTS
1	2	2	F	1	.F.	A	P	3	4	7	0	0	0	0	0	SECONDARY FLAKE
1	2	3	F	1	.F.	A	0	1	0	2	0	0	0	0	0	PLATFROM DESTROYED DUE TO DEEP ANGLE OF IMPACT TO REMOVE CORTEX
1	2	4	F	1	.F.	A	0	4	3	5	0	0	0	0	0	TERTIARY FLAKE, EXPANDING WITH FEATHER TERMINATION
1	2	5	S	1	.F.	I	A	3	2	5	0	0	0	0	0	POSSIBLE BROKEN BIFACE, THINNING OR REDUCTION FLAKE W. LONG-NARROW CORTICAL PLAT
1	2	6	F	1	.F.	I		3	2	2	0	0	0	0	0	SECONDARY FLAKE, CORTICAL DISTAL AND PROXIMAL FLAKE SCARS TERMIN. ON BOTH SIDES
1	2	7	F	1	.F.	A	A	1	0	8	0	0	0	0	0	PRIMARYT FLAKE STRUCK FROM SIDE OF FLAT LARGE PEBBLE
1	2	8	S	1	.F.	I	0	3	0	4	0	0	0	0	0	TRIANGULAR IN CROSS SECTION, CORTEX ON PROXIMAL END (?)
1	2	9	C	1	.F.	A	A	0	0	0	1	3	9	0	0	TEST CORE WITH UNACCEPTABLE CHALCEDONY

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
1	2	10	F	3	.F.	A	A	1	0	2	0	0	0	0	0	PRIMARY FLAKE ASSOCIATED WITH ITEM 12
1	2	11	C	1	.F.	A	A	0	0	0	2	4	8	0	0	FRAGMENT OF LARGE COBBLE CORE
1	2	12	F	3	.F.	A	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE WITH CORTEX ON PLATFORM ONLY, ASSOCIATED WITH ITEM 10
1	2	13	F	1	.F.	I	A	1	0	2	0	0	0	0	0	PRIMARY FLAKE
1	2	14	F	3	.F.	A	A	1	0	3	0	0	0	0	0	PRIMARY FLAKE
1	2	15	S	1	.F.	H	A	4	3	5	0	0	0	0	0	TRIANGULAR SHATTER ASSOCIATED WITH ITEM NO. 16
1	2	16	F	1	.F.	I	A	1	0	7	0	0	0	0	0	TRIANGULAR PRIMARY FLAKE SHOWS INCIPIENT VARNISH UNLIKE ASSOCIATED ITEM NO. 15
1	2	17	S	1	.F.	H	P	4	0	5	0	0	0	0	0	TERTIARY SHATTER TRIANGULAR IN CROSS SECTION
1	2	18	F	1	.F.	A	A	4	1	5	0	0	0	0	0	TERTIARY FLAKE
1	2	19	S	1	.F.	A	A	1	0	0	0	0	0	0	0	PRIMARY SHATTER
1	2	20	F	1	.F.	A	P	3	2	6	0	0	0	0	0	CORTEX ON PLATFORM ONLY, NARROW LONG PLATFORM SUGGEST BIFACE THINNING
1	2	21	B	1	.T.	I	I	2	4	8	0	0	0	0	0	PLATFORM PREP. AND ANGLE SUGGEST SAN DIEGUITO, BROKEN DISTAL HALF OF SCRAPER
1	2	22	S	1	.T.	H	A	1	0	0	0	0	0	0	0	PROXIMAL END DESTROYED, PRIMARY FLAKE ASSOCIATED WITH ITEM NO. 23
1	2	23	C	1	.T.	I	A	0	0	0	2	4	8	0	0	NO. 22 SHATTER FITS THIS SQUARE COBBLE CORE HAVING TWO CORTICAL SURFACES
1	2	24	T	6	.F.	H	A	0	0	0	0	0	0	1	1	SMALL MALPAIS TESHOA FLAKE SCRAPER WITH LIGHT RETOUCH/USEWEAR ALONG ALL MARGIN..
1	2	25	T	1	.T.	I	P	0	0	0	0	0	0	2	3	SPOKESHAVE, HEAVILY VARNISHED CONCAVITY,DEFINATE WEAR/USE, MADE FROM SEC. FLAKE
1	2	26	S	1	.F.	A	A	1	0	0	0	0	0	0	0	PRIMARY SHATTER
1	2	27	C	0	.T.	I	A	0	0	0	0	0	0	0	0	CORE FRAGMENT
1	2	28	F	3	.F.	A	A	1	0	8	0	0	0	0	0	
1	2	29	F	1	.F.	A	A	3	2	4	0	0	0	0	0	CORTEX ON PROXIMAL AND DISTAL END
1	2	30	F	1	.F.	I	A	1	0	8	0	0	0	0	0	TRIANGULAR PRIMARY FLAKE ASSOCIATED WITH ITEM NO. 31
1	2	31	S	1	.F.	H	A	4	0	5	0	0	0	0	0	TRAINGULAR TERTIARY SHATTER ASSOCIATED WITH ITEM NO. 30
1	2	32	S	6	.F.	A	A	1	0	8	0	0	0	0	0	
1	2	33	S	0	.F.	A	P	1	0	8	0	0	0	0	0	TRIANGULAR PRIMARY SHATTER WITH ONE ARTIFACT IN ASSOCIATION

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
1	2	34	S	1	.F.	A	A	1	0	0	0	0	0	0	0	TRIANGULAR PRIMARY SHATTER
1	2	35	F	1	.T.	I	A	2	2	8	0	0	0	0	0	LARGE COBBLE TRIMMED SQUARE WITH FLAKES REMOVED FROM SIDES AND DISTAL END
1	2	36	S	1	.F.	A	P	4	1	5	0	0	0	0	0	TERTIARY SHATTER WITH ONE OTHER ASSOCIATION
1	2	37	S	1	.F.	0	0	3	0	0	0	0	0	0	0	CORTEX ON PLATFORM ONLY WITH ONE OTHER ASSOCIATION
1	2	38	F	1	.F.	I	A	2	2	8	0	0	0	0	0	SECONDARY FLAKE WITH ONE OTHER ASSOCIATION
1	2	39	F	1	.F.	I	P	4	2	5	0	0	0	0	0	TERTIARY BIFACE REDUCTION
1	2	40	F	1	.T.	H	P	3	2	2	0	0	0	0	0	
1	2	41	F	1	.F.	I	P	3	2	4	0	0	0	0	0	CORTEX ON PLATFORM ONLY, TRIANGULAR IN CROSS-SECTION
1	2	42	F	1	.F.	A	P	4	2	5	0	0	0	0	0	SMALL TERTIARY FLAKE WITH ONE OTHER ASSOCIATION
1	2	43	F	1	.F.	I	P	3	1	4	0	0	0	0	0	SECONDARY FLAKE WITH CORTICAL PLATFORM, ONE OTHER ASSOCIATION
1	2	44	F	1	.F.	A	I	3	2	5	0	0	0	0	0	POSSIBLE SECOND STAGE PEBBLE BIFACE REDUCTION FLAKE
1	2	45	F	1	.T.	A	P	4	3	5	0	0	0	0	0	SMALL TERTIARY FLAKE
1	2	46	F	1	.F.	A	P	3	1	2	0	0	0	0	0	SMALL SECONDARY FLAKE
1	2	47	F	0	.F.	0	0	3	1	8	0	0	0	0	0	ALMOST TERTIARY WITH LITTLE CORTEX ON LATERAL MARGIN, THIN CROSS-SECTION
1	2	48	C	1	.T.	H	A	0	0	8	0	0	0	0	0	CORE FRAGMENT, COBBLE CORNER QUARTER
1	2	49	F	1	.F.	A	A	2	1	8	0	0	0	0	0	FLAKES REMOVED ON DORSAL SIDE FOR PLATFORM PREPARATION
1	2	50	F	3	.F.	A	A	3	1	8	0	0	0	0	0	CORTEX ON PLATFORM
1	2	51	F	1	.F.	A	A	1	0	8	0	0	0	0	0	PRIMARY FLAKE
1	2	52	F	1	.F.	A	A	3	2	8	0	0	0	0	0	ASSOCIATED WITH ITEM NO.51
1	2	53	C	1	.F.	0	0	0	0	0	1	3	3	0	0	SMALL CORE WITH SINGLE MINOR FLAKE REMOVED: NO. 52
1	2	54	C	3	.T.	H	A	0	0	0	1	2	9	0	0	ASSOCIATED WITH FIRST LARGE SIDE-STRUCK FLAKE
1	2	55	F	1	.F.	A	A	1	0	2	0	0	0	0	0	PRIMARY FLAKE
1	2	56	F	1	.T.	H	A	2	2	8	0	0	0	0	0	SECONDARY FLAKE
1	2	57	F	3	.F.	0	0	2	1	4	0	0	0	0	0	CORTEX ON PLATFORM
1	2	58	B	1	.T.	I	A	0	0	0	0	0	0	0	0	FLAT BASED BIFACE ROUGH OR BLANK BROKEN IN HALF DURING MANUFACTURE
1	2	59	S	0	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY SHATTER
1	2	60	F	1	.T.	H	P	2	0	2	0	0	0	0	0	SECONDARY FLAKE
1	2	61	F	1	.F.	I	P	2	2	4	0	0	0	0	0	SECONDARY FLAKE MOSTLY CORTICAL WITH TWO SMALL DORSAL FLAKES REMOVED
1	2	62	F	1	.F.	H	P	2	1	8	0	0	0	0	0	SECONDARY FLAKE

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
1	2	63	F	0	.F.	I	P	3	2	4	0	0	0	0	0	SECONDARY FLAKE WITH FLAKE SCARS TERMINATING IN CENTRAL LONGITUDINAL RIDGE
1	2	64	F	1	.F.	A	P	4	2	5	0	0	0	0	0	TERTIARY FLAKE
1	3	1	F	1	.F.	A	I	4	2	5	0	0	0	0	0	TERTIARY FLAKE
1	3	2	F	1	.F.	A	P	3	2	4	0	0	0	0	0	SECONDARY FLAKE ASSOCIATED W/ ITEM # 1
1	3	3	S	1	.T.	I	A	3	0	0	2	0	0	0	0	
1	3	4	S	1	.F.	A	P	3	0	0	0	0	0	0	0	ASSOCIATED W/ ITEM # 2
1	3	5	F	1	.T.	I	A	3	3	1	0	0	0	0	0	SECONDARY FLAKE
1	3	6	C	1	.T.	H	A	0	0	0	3	4	7	0	0	
1	3	7	F	1	.F.	H	A	3	1	4	0	0	0	0	0	SECONDARY FLAKE
1	3	8	C	1	.T.	A	A	0	0	0	1	2	2	0	0	
1	3	9	F	1	.F.	A	A	3	2	2	0	0	0	0	0	PRIMARY FLAKE, ASSOCIATED W/ ITEM #2
1	3	10	S	1	.F.	A	A	0	0	0	3	0	0	0	0	
1	3	11	S	1	.F.	I	A	0	0	0	3	0	0	0	0	
1	3	12	S	1	.F.	I	0	0	0	0	2	0	0	0	0	
1	3	13	F	1	.F.	I	A	3	3	6	0	0	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ ITEM # 12
1	3	14	F	1	.T.	A	A	2	5	1	0	0	0	0	0	PRIMARY FLAKE
1	3	15	F	1	.F.	H	A	3	3	2	0	0	0	0	0	PRIMARY FLAKE
1	3	17	F	3	.T.	I	A	2	0	1	0	0	0	0	0	PRIMARY FLAKE
1	3	18	F	1	.T.	H	P	3	3	4	0	0	0	0	0	SECONDARY FLAKE
1	3	19	F	1	.F.	A	A	4	4	5	0	0	0	0	0	TERTIARY FLAKE
1	3	20	C	1	.T.	H	A	0	0	0	2	9	8	0	0	
1	3	21	F	1	.F.	A	P	4	3	5	0	0	0	0	0	SECONDARY FLAKE
1	3	22	F	3	.T.	I	A	3	0	2	0	0	0	0	0	PRIMARY FLAKE
1	3	23	F	1	.F.	A	A	3	4	4	0	0	0	0	0	SECONDARY FLAKE
1	3	24	F	1	.F.	A	I	3	2	4	0	0	0	0	0	SECONDARY FLAKE
1	3	25	F	1	.T.	I	A	3	4	2	0	0	0	0	0	PRIMARY FLAKE
1	3	26	S	1	.F.	A	P	4	0	0	3	0	0	0	0	THREE PIECES IN THE SAME AREA
1	3	27	F	1	.F.	A	A	4	1	5	0	0	0	0	0	TERTIARY FLAKE
1	3	28	F	1	.F.	A	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
1	3	29	F	1	.F.	A	P	4	3	5	0	0	0	0	0	TERTIARY FLAKE
1	3	30	F	1	.F.	A	A	3	3	0	0	0	0	0	0	PRIMARY FLAKE, FOUR PIECES IN THE SAME AREA, ASSOCIATED WITH ITEM NO. 26
1	3	31	F	3	.F.	0	0	0	0	0	0	0	0	0	0	PRIMARY FLAKE, ASSOCIATED WITH GROUP OF THREE FLAKES AND ITEM NO. 30
1	3	32	C	1	.T.	I	A	0	0	0	1	3	0	0	0	
1	3	33	F	1	.T.	H	A	3	2	2	0	0	0	0	0	PRIMARY FLAKE
1	3	34	F	1	.T.	I	P	3	2	4	0	0	0	0	0	SECONDARY FLAKE
1	3	35	F	1	.T.	I	P	3	2	4	0	0	0	0	0	PRIMARY FLAKE
1	3	36	C	1	.F.	H	A	0	0	0	2	5	8	0	0	
1	3	37	F	3	.F.	H	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
1	5	33	F	1	.F.	A	A	3	2	4	0	0	0	0	0	SECONDARY
2	1	1	S	1	.F.	I	A	0	0	0	2	0	0	0	0	

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
2	1	2	S	1	.F.	I	A	0	0	0	2	0	0	0	0	ASSOCIATED WITH ITEM NO.2
2	1	3	F	1	.T.	H	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE
2	1	4	F	1	.T.	A	A	3	0	2	0	0	0	0	0	PRIMARY FLAKE
2	1	5	F	1	.T.	A	P	3	2	4	0	0	0	0	0	SECONDARY FLAKE
2	1	6	S	1	.F.	A	P	0	0	0	2	0	0	0	0	
2	1	7	F	1	.F.	I	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE
2	1	8	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
2	2	1	F	1	.T.	A	P	3	3	4	0	0	0	0	0	SECONDARY FLAKE
2	2	2	F	1	.T.	A	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
2	2	3	S	1	.T.	A	P	0	0	0	2	0	0	0	0	
2	2	4	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
2	2	5	S	1	.T.	I	A	0	0	0	2	0	0	0	0	
2	2	6	S	1	.T.	A	A	0	0	0	0	0	0	0	0	PRIMARY FLAKE
2	2	7	S	1	.F.	A	I	0	0	0	2	0	0	0	0	PRIMARY FLAKE
2	2	8	F	1	.T.	A	P	3	2	2	0	0	0	0	0	PRIMARY FLAKE
2	2	9	S	1	.T.	A	P	0	0	0	2	0	0	0	0	SECONDARY FLAKE
3	1	1	C	1	.T.	I	I	0	0	0	0	2	5	0	0	
3	1	2	F	1	.T.	I	I	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	3	F	1	.T.	H	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	4	F	3	.T.	H	I	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	5	F	1	.T.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	6	F	1	.T.	H	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	7	S	1	.T.	H	A	0	0	0	2	0	0	0	0	
3	1	8	F	1	.T.	H	A	3	0	0	0	0	0	0	0	
3	1	9	S	1	.T.	I	I	3	0	0	0	0	0	0	0	
3	1	10	F	1	.T.	I	I	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	11	F	1	.F.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	12	F	1	.T.	I	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	13	C	3	.T.	I	P	0	0	0	1	1	5	0	0	
3	1	14	S	1	.T.	I	A	0	0	0	2	0	0	0	0	SECONDARY FLAKE ASSOCIATED WITH ITEM NO. 15
3	1	15	C	1	.T.	I	A	0	4	0	2	6	8	0	0	ASSOCIATED WITH ARTIFACT NO. 14
3	1	16	F	6	.T.	H	I	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	17	S	1	.T.	A	P	0	0	0	1	0	0	0	0	PRIMARY
3	1	18	C	1	.T.	H	A	0	0	0	2	4	8	0	0	PRIMARY
3	1	19	F	1	.T.	H	I	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	20	F	1	.T.	I	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	21	F	1	.F.	A	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	22	C	1	.T.	H	P	0	0	0	2	5	5	0	0	PRIMARY CORE
3	1	23	F	1	.F.	I	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE
3	1	24	C	3	.T.	I	0	0	0	0	2	3	6	0	0	PRIMARY CORE
3	1	25	C	1	.T.	I	I	0	0	0	2	3	3	0	0	
3	1	26	T	1	.T.	H	P	3	0	0	0	0	0	1	4	MALPAIS SCRAPER, NO EDGE WEAR
3	1	27	S	1	.F.	I	A	0	0	0	2	0	0	0	0	PRIMARY
3	1	28	F	1	.T.	I	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	29	F	1	.T.	H	I	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	30	F	1	.T.	I	I	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	31	F	1	.T.	I	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
3	1	32	S	1	.T.	A	A	0	0	0	2	0	0	0	0	PRIMARY
3	1	33	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	34	C	3	.T.	H	P	0	0	0	1	2	7	0	0	PRIMARY
3	1	36	C	1	.T.	I	P	0	0	0	2	3	8	0	0	PRIMARY
3	1	37	C	1	.F.	A	A	0	0	0	2	6	8	0	0	SECONDARY CORE
3	1	38	F	1	.T.	I	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE ASSOCIATED WITH ITEM NO.39
3	1	39	F	1	.T.	I	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE ASSOCIATED WITH ITEM NO. 38
3	1	40	F	1	.F.			0	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	41	F	1	.T.	I	I	4	0	0	0	0	0	0	0	TERTIARY FLAKE
3	1	42	F	1	.T.	I	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE
3	1	43	F	1	.T.	A	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	44	F	1	.T.	I	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	1	45	S	1	.F.	H	A	3	0	0	0	0	0	0	0	PRIMARY
3	1	46	C	1	.T.	I	P	0	0	0	1	6	8	0	0	PRIMARY
3	1	47	F	3	.T.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	48	S	1	.F.	I	A	4	0	0	3	0	0	0	0	SECONDARY
3	1	49	F	1	.F.	I	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	50	F	1	.T.	I	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	51	F	1	.T.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	1	52	F	1	.F.	I	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	1	C	3	.T.	I	A	0	0	0	2	5	1	0	0	PRIMARY CORE
3	2	2	S	1	.F.	A	I	3	0	0	2	0	0	0	0	SECONDARY
3	2	3	F	1	.F.	A	P	3	0	0	0	0	0	0	0	PRIMARY
3	2	4	S	1	.T.	I	I	0	0	0	3	0	0	0	0	TERTIARY
3	2	5	F	1	.F.	A	A	3	0	0	0	0	0	0	0	PRIMARY
3	2	6	F	1	.T.	A	A	4	0	0	0	0	0	0	0	
3	2	7	F	1	.T.	I	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	8	T	7	.T.	I	A	0	0	0	3	0	0	1	4	BIFACE BLANK, COLLECTED
3	2	9	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	10	S	1	.T.	H	A	0	0	0	2	0	0	0	0	PRIMARY
3	2	11	C	3	.F.	A	A	0	0	0	1	2	7	0	0	PRIMARY CORE
3	2	12	F	1	.T.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
3	2	13	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	14	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	15	F	1	.T.	A	I	4	0	0	0	0	0	0	0	TERTIARY FLAKE
3	2	16	C	1	.F.	I	A	0	0	0	2	4	8	0	0	
3	2	17	F	1	.F.	A	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	18	F	1	.T.	A	I	4	0	0	0	0	0	0	0	TERIARY FLAKE
3	2	19	F	3	.T.	A	I	3	0	0	2	0	0	0	0	PRIMARY FLAKE
3	2	20	F	1	.F.	A	P	3	0	0	0	0	0	0	0	SECONDARY FLAKE
3	2	21	B	4	.T.	H	P	0	0	0	2	0	0	1	4	BIFACIALLY WORKED BLANK, ONE COURSE OF FLAKING
3	2	22	C	8	.T.	H	A	0	0	0	1	5	8	0	0	
3	2	23	F	1	.T.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
4	1	1	C	1	.F.	A	A	0	0	0	2	4	1	0	0	PRIMARY
4	1	2	F	8	.F.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
4	1	3	C	1	.F.	A	A	0	0	0	2	0	0	0	0	PRIMARY, ASSOCIATED WITH ITEM NO. 1

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
4	1	4	F	1	.F.	A	A	3	1	0	0	0	0	0	0	CORTEX PLATFORM, PIE FLAKE
4	1	5	F	1	.T.	A	A	4	0	5	0	0	0	0	0	PART OF SHATTERING STATION, TERTIARY FLAKE
4	1	6	F	1	.F.	A	A	3	0	5	0	0	0	0	0	PART OF SHATTERING STATION, SECONDARY FLAKE
4	1	7	C	1	.F.	A	A	3	0	0	2	2	7	0	0	BROKEN COBBLE
4	1	8	F	1	.F.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
4	1	9	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
4	1	10	F	1	.F.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
4	1	11	F	1	.F.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
4	1	12	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE WITH CORTEX BACK
4	1	13	F	1	.T.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE, CORTEX BACKED
4	1	14	F	1	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE, CORTEX BACKED
4	1	15	T	1	.F.	A	A	0	0	0	2	0	0	2	2	CHOPPER, SLIGHT EDGE WEAR
4	1	16	C	1	.T.	A	A	0	0	0	1	1	7	0	0	PRIMARY
4	1	17	T	3	.F.	A	A	0	0	0	1	0	0	3	3	HAMMERSTONE, ASSOCIATED WITH CHIPPING STATION AND ITEMS 5-14, BOTH ENDS DAMAGED
4	1	18	F	1	.T.	A	I	3	1	0	0	0	0	0	0	PRIMARY FLAKE
4	1	19	S	1	.T.	A	I	0	0	0	2	0	0	0	0	PRIMARY
4	1	20	F	1	.F.	A	A	3	1	5	0	0	0	0	0	SECONDARY FLAKE
4	1	21	T	3	.F.	A	A	0	0	0	1	3	1	0	0	CHOPPER, WITH THREE BIFACIALLY REMOVED FLAKES
4	1	22	C	1	.F.	A	P	0	0	0	2	3	1	0	0	ITEMS 22-27 ARE ALL RELATED
4	1	23	F	1	.F.	A	A	3	0	2	0	0	0	0	0	PRIMARY, ASSOCIATED WITH ITEM NO. 22
4	1	24	F	1	.F.	A	P	4	1	0	0	0	0	0	0	TERTIARY
4	1	25	S	1	.F.	A	I	0	0	0	2	0	0	0	0	ASSOCIATED WITH ITEM NO. 22
4	1	26	S	1	.F.	A	A	0	0	0	3	0	0	0	0	TERTIARY, ASSOCIATED WITH ITEM NO. 22
4	1	27	F	1	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY, ASSOCIATED WITH ITEM NO. 22
4	1	28	T	3	.F.	A	A	0	0	0	1	0	0	3	1	LARGE COBBLE HAMMERSTONE WITH ONE BATTERED END
4	1	29	C	1	.F.	A	A	0	0	0	1	2	3	0	0	TABULAR PRIMARY CORE, ASSOCIATED WITH ITEMS NO. 30-31
4	1	30	F	1	.F.	A	A	3	1	2	0	0	0	0	0	PRIMARY, ASSOCIATED WITH ITEM NO.29
4	1	31	S	1	.F.	A	A	0	0	0	2	0	0	0	0	PRIMARY, ASSOCIATED WITH ITEM NO.29
4	1	32	C	3	.F.	A	A	0	0	0	1	4	3	0	0	PRIMARY
4	1	35	T	3	.F.	A	A	0	0	0	1	0	0	0	0	HAMMERSTONE, BOTH ENDS ARE BATTERED , TWO FLAKES REMOVED FROM ONE END
4	1	36	C	3	.F.	A	P	0	0	0	1	2	2	0	0	PRIMARY
4	1	37	T	3	.F.	0	0	0	0	0	0	3	3	1	0	HAMMERSTONE, BATTERING ON ONE END, ASSOCIATED WITH ITEM NO. 36

PEBBLE TERRACE LITHIC DATA

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A B   C  D E   F   G H I J K L M N O P          COMMENTS

4 1  39 C 3 .F. A P 3 0 0 1 3 1 0 0 PRIMARY
4 1  40 C 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION,
                                    NO.40-48, SUMMARILY RECORDED
4 1  41 C 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION
4 1  42 F 6 .F. A A 4 0 0 0 0 0 0 0 TERTIARY FLAKE, PART OF
                                    CHIPPING STATION
4 1  43 F 6 .F. A A 1 0 0 0 0 0 0 0 PRIMARY FLAKE, PART OF
                                    CHIPPING STATION
4 1  44 S 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION
4 1  45 S 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION
4 1  46 S 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION
4 1  47 S 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION
4 1  48 S 6 .F. A A 0 0 0 0 0 0 0 0 PART OF CHIPPING STATION
4 1  49 F 1 .F. A P 4 0 0 0 0 0 0 0 TERTIARY FLAKE, SUMMARILY
                                    RECORDED
4 1  50 F 1 .F. A P 4 0 0 0 0 0 0 0 TERTIARY FLAKE, SUMMARILY
                                    RECORDED
4 1  51 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  52 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  53 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  54 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  55 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  56 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  57 F 1 .F. A P 0 0 0 0 0 0 0 0 PRIMARY FLAKE, SUMMARILY
                                    RECORDED
4 1  58 C 1 .F. A A 0 0 0 0 0 0 0 0 PRIMARY CORE, SUMMARILY
                                    RECORDED
5 1   1 F 1 .T. A A 3 2 2 0 0 0 0 0 PRIMARY
5 1   2 F 1 .F. A A 3 1 2 0 0 0 0 0 PRIMARY
5 1   3 F 1 .T. I A 3 1 4 0 0 0 0 0 PRIMARY
5 1   4 F 1 .T. I A 4 3 5 0 0 0 0 0 TERTIARY
5 1   5 F 1 .T. I A 3 2 2 0 0 0 0 0 SECONDARY FLAKE
5 1   6 F 1 .T. I A 3 2 4 0 0 0 0 0 SECONDARY FLAKE
5 1   7 F 1 .T. H A 3 2 5 0 0 0 0 0 SECONDARY FLAKE
5 1   8 S 1 .T. I A 0 0 0 2 4 0 0 0 PRIMARY
5 1   9 F 1 .F. A A 4 1 5 0 0 0 0 0 ITEMS 9-43 ARE PART OF A
                                    CHIPPING STATION
5 1  10 F 1 .F. A A 4 1 5 0 0 0 0 0 SECONDARY FLAKE
5 1  11 F 1 .F. A A 4 2 0 0 0 0 0 0 TERTIARY FLAKE
5 1  12 F 1 .F. A A 4 1 0 0 0 0 0 0 TERTIARY FLAKE
5 1  13 F 1 .F. A A 4 1 0 0 0 0 0 0 TERTIARY FLAKE
5 1  14 F 1 .F. A I 4 3 0 0 0 0 0 0 TERTIARYT FLAKE
5 1  15 C 1 .F. A I 0 0 0 2 2 1 0 0 PRIMARY CORE
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PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
5	1	16	F	1	.F.	A	I	3	4	4	0	0	0	0	0	SECONDARY FLAKE
5	1	17	F	1	.F.	A	I	3	3	4	0	0	0	0	0	SECONDARY FLAKE
5	1	18	F	1	.F.	A	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
5	1	19	F	1	.F.	A	A	4	1	2	0	0	0	0	0	PRIMARY FLAKE
5	1	20	F	1	.F.	A	A	3	1	2	0	0	0	0	0	SECONDARY FLAKE
5	1	21	F	1	.F.	A	A	3	3	2	0	0	0	0	0	SECONDARY FLAKE
5	1	22	S	1	.F.	A	I	0	0	0	2	2	0	0	0	PRIMARY SHATTER WITH REMOVAL FROM SIDE
5	1	23	F	1	.F.	A	A	3	1	5	0	0	0	0	0	SECONDARY FLAKE
5	1	24	F	1	.F.	A	A	3	1	5	0	0	0	0	0	SECONDARY FLAKE
5	1	25	F	1	.F.	A	A	3	2	7	0	0	0	0	0	SECONDARY FLAKE
5	1	26	F	1	.F.	A	A	3	4	2	0	0	0	0	0	SECONDARY FLAKE
5	1	27	F	1	.F.	A	A	4	1	5	0	0	0	0	0	TERTIARY FLAKE
5	1	28	F	1	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY FLAKE
5	1	29	S	1	.F.	A	I	0	0	0	2	2	4	0	0	SECONDARY
5	1	30	S	1	.F.	A	A	0	0	0	2	4	0	0	0	PRIMARY FLAKE
5	1	31	F	1	.F.	A	A	3	4	2	0	0	0	0	0	PRIMARY FLAKE
5	1	32	F	1	.F.	A	A	0	0	7	0	0	0	0	0	SECONDARY
5	1	34	F	1	.F.	A	I	4	3	5	0	0	0	0	0	TERTIARY FLAKE
5	1	35	F	1	.F.	A	A	3	3	2	0	0	0	0	0	SECONDARY
5	1	36	F	1	.F.	A	A	3	3	6	0	0	0	0	0	SECONDARY FLAKE
5	1	37	S	1	.F.	A	A	0	0	0	2	1	0	0	0	PRIMARY FLAKE
5	1	38	F	1	.F.	A	A	3	4	6	2	8	8	0	0	SECONDARY FLAKE
5	1	39	C	1	.F.	A	A	0	0	0	2	8	8	0	0	PRIMARY CORE
5	1	40	F	1	.F.	A	A	3	4	2	0	0	0	0	0	SECONDARY FLAKE
5	1	41	F	1	.F.	A	A	4	3	5	0	0	0	0	0	TERTIARY
5	1	42	F	1	.F.	A	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE
5	1	43	F	1	.F.	A	A	3	3	4	0	0	0	0	0	PRIMARY FLAKE END OF CHIPPING STA., ASSOCIATED W/ ITEMS # 19 THRU 43
5	1	44	F	1	.F.	A	P	3	1	2	0	0	0	0	0	PRIMARY FLAKE
5	1	45	F	1	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY FLAKE
5	1	46	F	1	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY FLAKE, ASSOCIATED W/ ITEM 45
5	1	47	F	1	.F.	A	I	0	0	0	0	0	0	0	0	TERTIARY FLAKE, ASSOCIATED W/ ITEM 46
5	1	48	F	1	.F.	I	A	3	1	2	0	0	0	0	0	PRIMARY FLAKE, ASSOCIATED W/ ITEM 47
5	1	49	F	1	.F.	A	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE, ASSOCIATED W/ ITEM 48
5	1	50	S	1	.F.	A	P	0	0	0	3	0	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ ITEM 49
5	1	51	F	1	.F.	A	P	3	2	2	0	0	0	0	0	PRIMARY FLAKE, ASSOCIATED W/ ITEM 50
5	1	52	F	1	.T.	H	I	3	2	4	0	0	0	0	0	SECONDAY FLAKE, ASSOCIATED W ITEM 51
5	1	53	F	1	.F.	A	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ ITEM 52

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
5	1	54	F	1	.F.	A	A	3	2	4	0	0	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ ITEM 53
5	1	55	F	3	.T.	I	0	3	2	4	0	0	0	0	0	SECONDARY FLAKE
5	2	1	C	1	.T.	I	A	0	0	0	2	2	1	0	0	PRIMARY FLAKE, SLIGHT RETOUCH ON AN EDGE
5	2	2	C	1	.F.	I	A	0	0	0	2	6	1	0	0	SECONDARY FLAKE
5	2	3	F	1	.T.	I	A	3	3	4	0	0	0	0	0	PRIMARY FLAKE W/ RETOUCH ON EDGE
6	1	1	T	3	.F.	A	A	0	0	0	1	1	0	0	0	HAMMERSTONE, BATTERING ONE END,ASSOCIATED W/ #2 (W/IN 1 METER)
6	1	2	C	3	.F.	A	A	0	0	0	1	3	1	0	0	COBBLE BATTERED IN TWO-W/ 2 FLAKES REMOVED OFF EDGE-PRIMARY CORE
6	1	3	C	1	.T.	A	A	0	0	0	1	3	0	0	0	PRIMARY FLAKE
6	1	3	F	1	.F.	A	p	3	1	4	0	0	0	0	0	PRIMARY FLAKE
6	1	4	C	1	.F.	A	A	0	0	0	2	9	8	0	0	PRIMARY, LARGE COBBLE
6	1	5	F	1	.F.	A	P	3	3	4	0	0	0	0	0	PRIMARY FLAKE
6	1	6	S	3	.F.	A	P	0	0	0	2	2	0	0	0	PRIMARY
6	1	7	C	1	.F.	A	A	0	0	0	1	2	1	3	1	CORE OR HAMMERSTONE, ONE END BATTERED, ONE END HAS TWO FLAKES REMOVED
6	1	8	S	3	.T.	A	P	0	0	0	2	0	0	0	0	PRIMARY
6	1	10	T	3	.F.	A	A	0	0	0	1	0	0	0	0	ANVIL, LARGE COBBLE WITH BATTERERING ON ONE FLAT SURFACE
6	1	11	T	3	.F.	A	P	0	0	0	1	3	1	0	0	HAMMERSTONE, BIPOLAR DAMAGE, TWO FLAKES REMOVED FROM ONE END, THE OTHER BATTERED
6	1	12	C	1	.T.	A	I	0	0	0	2	3	5	0	0	PRIMARY, ASSOCIATED WITH NO. 12,13.
6	1	13	C	3	.F.	A	A	0	0	0	1	1	0	0	0	COBBLE WITH ONE FLAKE REMOVED,ITEM NO.14, SEVEN IMPACT AREAS ON THE OTHER END
6	1	14	F	3	.F.	A	A	3	0	3	0	0	0	0	0	PRIMARY FLAKE FROM CORE, ITEM NO.13
6	1	15	F	1	.F.	A	A	3	1	4	0	0	0	0	0	SECONDARY FLAKE
6	1	16	F	1	.F.	A	P	3	2	4	0	0	0	0	0	PRIMARY FLAKE
6	1	17	C	3	.F.	A	A	0	0	0	1	4	1	0	0	PRIMARY CORE, 3 FLAKES REMOVED FROM ONE SIDE, 1 REMOVED FROM ANOTHER
6	1	18	C	3	.F.	A	A	0	0	0	1	2	7	0	0	PRIMARY COBBLE, 2 FLAKES REMOVED FROM ONE END, CLOSE TO ITEM NO.17
6	1	19	C	3	.F.	A	A	0	0	0	1	1	7	0	0	PRIMARY CORE, FLAKE REMOVED FROM ONE END
6	1	20	F	3	.F.	A	P	3	0	2	0	0	0	0	0	PRIMARY FLAKE
6	1	21	C	3	.F.	A	A	0	0	0	1	1	7	0	0	LARGE PRIMARY CORE COBBLE, MANY POINTS OF IMPACT BUT ONLY ONE FLAKE REMOVED

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
6	1	22	F	3	.F.	A	A	3	0	3	0	0	0	0	0	PRIMARY FLAKE ASSOCIATED WITH ITEM NO.21
6	1	23	T	1	.F.	A	A	0	0	0	1	0	0	0	0	HAMMERSTONE,BATTERING ON ROUNDED SIDE IN ASSOCIATION W/ITEMS 21, 22
6	0	24	C	1	.T.	A	I	0	0	0	1	4	5	0	0	PRIMARY FLAKE, ASSOCIATED WITH ITEMS 25,26,27
6	0	25	F	1	.T.	A	A	3	1	4	1	4	0	0	0	SECONDARY FLAKE, ASSOCIATED W/ ITEM #24
6	0	26	F	1	.T.	A	A	3	5	2	0	0	0	0	0	PRIMARY FLAKE, IN ASSOCIATION W/ITEMS 24,25
6	0	27	S	1	.T.	A	P	0	0	2	0	0	0	0	0	SECONDARY FLAKE
6	0	28	T	3	.F.	A	A	0	0	0	1	6	1	0	1	HAMMERSTONE, 1 FLAKE REMOVED, BIPOLAR PATTERING IN FIVE DIFFERENT AREAS
6	1	29	C	1	.F.	A	A	0	0	0	1	2	1	0	0	PRIMARY
6	1	30	T	1	.T.	A	A	0	0	0	1	4	6	2	4	COBBLE CHOPPER WITH 1 LARGE LONGITUDINAL REMOVED FLAKE AND 3 REMOVED BIFACIAL
6	1	31	F	3	.T.	A	A	3	1	4	0	0	0	0	0	SECONDARY FLAKE
6	1	33	T	3	.F.	A	A	0	0	0	1	3	0	3	2	HAMMERSTONE, BATTERING AND ONE FLAKE REMOVED ON ONE END, IMPACT ON OTHER END
6	1	34	C	6	.T.	A	A	0	0	0	1	5	6	0	0	PRIMARY
6	1	35	C	1	.F.	A	A	0	0	0	1	3	7	0	0	PRIMARY, THREE FLAKES REMOVED FROM BATTERING
6	1	36	F	3	.F.	A	P	3	1	2	0	0	0	0	0	PRIMARY, SAME MATERIAL AS ITEM NO. 37
6	1	37	F	3	.F.	A	P	3	0	2	0	0	0	0	0	PRIMARY
6	1	38	C	3	.T.	A	A	0	0	0	1	2	5	0	0	PRIMARY
6	1	39	F	3	.F.	A	A	3	1	2	0	0	0	0	0	PRIMARY
6	1	40	F	0	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY FLAKE
6	1	41	F	6	.F.	A	A	3	2	7	0	0	0	0	0	SECONDARY FLAKE, SAME MATERIAL AS ITEM NO.42
6	1	42	F	6	.F.	A	A	3	1	4	0	0	0	0	0	SECONDARY FLAKE
6	1	43	C	1	.F.	A	A	0	0	0	1	3	8	0	0	PRIMARY
6	1	44	C	0	.F.	A	A	0	0	0	1	3	2	0	0	PRIMARY CORE, IMPACT MARKS ALL OVER SURFACE
6	1	45	F	1	.F.	A	A	3	1	2	0	0	0	0	0	PRIMARY FLAKE
6	1	46	F	1	.F.	A	A	3	0	4	0	0	0	0	0	SECONDARY FLAKE
6	1	47	F	1	.F.	A	A	3	3	4	0	0	0	0	0	SECONDARY FLAKE
6	1	48	C	1	.F.	A	A	0	0	0	1	6	8	0	0	PRIMARY, SAME MATERIAL AS ITEM NO. 48, ONE END HAS ALTERNATING FLAKE REMOVAL
6	1	49	F	1	.F.	A	A	3	2	6	0	0	0	0	0	SECONDARY FLAKE FROM ITEM NO. 48
6	1	50	T	1	.F.	A	A	0	0	0	1	1	0	3	1	HAMMERSTONE NEAR ITEMS NO. 48 AND 49, ONE END IS BATTERED WITH A FLAKE REMOVED

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
6	1	51	F	1	.T.	A	A	3	2	6	0	0	0	0	0	PRIMARY FLAKE
6	1	52	F	1	.F.	A	A	3	0	2	0	0	0	0	0	SECONDARY FLAKE
6	1	53	F	1	.F.	A	A	3	1	6	0	0	0	0	0	SECONDARY FLAKE
6	1	54	S	1	.T.	A	A	0	0	0	2	0	0	0	0	PRIMARY
6	1	55	F	1	.F.	I	A	3	3	6	0	0	0	0	0	SECONDARY FLAKE, SAME MATERIAL AS ITEM NO. 55
6	1	56	F	1	.T.	I	P	3	0	2	0	0	0	0	0	SECONDARY FLAKE
6	1	57	T	3	.F.	A	A	0	0	0	0	0	0	3	1	HAMMERSTONE OR ANVIL, BIPOLAR BATTERING ON BOTH ENDS, IMPACT MARKS ON FLAT SIDE
6	1	58	F	3	.F.	A	A	3	2	6	0	0	0	0	0	PRIMARY FLAKE
6	1	59	T	3	.F.	A	A	0	0	0	1	0	0	2	4	CHOPPER OR HAMMERSTONE, BATTERING ON ONE END, BIFACIAL DENTICULATION ON OTHER
6	1	60	T	3	.F.	A	A	0	0	0	1	1	0	3	1	HAMMERSTONE, BATTERING ON BOTH ENDS
6	1	61	T	3	.T.	A	A	0	0	0	1	1	0	3	1	HAMMERSTONE, BATTERING ON BOTH ENDS
6	1	62	F	3	.F.	A	P	0	0	0	0	0	0	0	0	ONE OF FIVE PRIMARY FLAKES, ONE RETOUCHED
6	1	63	F	1	.T.	A	A	3	2	5	0	0	0	0	0	SECONDARY FLAKE
6	1	64	F	3	.F.	A	A	3	0	2	0	0	0	0	0	PRIMARY FLAKE
6	1	65	S	1	.F.	A	P	0	0	0	2	0	0	0	0	SECONDARY
6	1	66	F	1	.F.	A	A	4	2	5	0	0	0	0	0	TERTIARY FLAKE
6	1	67	F	1	.T.	A	A	3	0	6	0	0	0	0	0	SECONDARY FLAKE
6	1	68	T	3	.T.	A	A	0	0	0	1	1	5	0	0	ANVIL, BATTERING MARKS ON FLAT SURFACE, ONE FLAKE REMOVED FROM END
6	1	69	F	3	.T.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
6	1	70	F	3	.T.	A	A	3	0	0	0	0	0	0	0	PRIMARY FLAKE
6	1	71	F	3	.F.	A	A	3	1	2	0	0	0	0	0	PRIMARY FLAKE
6	1	72	C	1	.T.	A	A	0	0	0	1	3	6	0	0	PRIMARY
6	1	73	F	1	.T.	A	A	3	2	6	0	0	0	0	0	SECOONDARY FLAKE
6	1	74	T	3	.T.	A	A	0	0	0	1	2	5	0	0	COBBLE CHOPPER, FLAKES REMOVED FROM ONE END
6	1	75	F	3	.F.	A	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE, CHIPPING STATION INCLUDES ITEMS NO.75-85
6	1	76	F	3	.F.	A	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE
6	1	77	F	3	.F.	A	A	4	0	0	0	0	0	0	0	TERTIARY FLAKE
6	1	78	F	3	.F.	A	A	2	0	0	0	0	0	0	0	PRIMARY FLAKE
6	1	79	F	3	.F.	A	A	2	0	0	0	0	0	0	0	PRIMARY FLAKE
6	1	80	F	3	.F.	A	A	2	0	0	0	0	0	0	0	PRIMARY FLAKE
6	1	81	F	3	.F.	A	A	2	0	0	0	0	0	0	0	PRIMARY FLAKE
6	1	82	F	3	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
6	1	83	F	3	.F.	A	A	3	0	0	0	0	0	0	0	SECONDARY FLAKE
6	1	84	S	3	.F.	A	A	0	0	0	0	0	0	0	0	
6	1	85	C	3	.F.	A	A	0	0	0	2	4	0	0	0	PRIMARY
7	1	1	F	1	.T.	A	P	3	0	0	2	4	0	0	0	SECONDARY FLAKE

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
7	1	2	S	1	.F.	I	P	0	0	0	2	5	6	0	0	SECONDARY
7	1	3	F	1	.T.	H	I	3	1	6	0	0	0	0	0	SECONDARY FLAKE
7	1	4	C	1	.T.	I	I	0	0	0	2	4	8	0	0	SECONDARY
7	1	5	S	1	.T.	H	I	0	0	0	2	0	0	0	0	PRIMARY
7	1	6	F	1	.T.	I	I	3	2	6	0	0	0	0	0	SECONDARY FLAKE
7	1	7	F	1	.T.	H	A	3	1	6	0	0	0	0	0	SECONDARY FLAKE
7	1	8	F	1	.T.	A	A	3	1	2	0	0	0	0	0	PRIMARY FLAKE
7	1	9	F	1	.T.	I	I	3	2	6	0	0	0	0	0	SECONDARY FLAKE, RETOUCHED EDGE
7	1	11	F	1	.T.	H	P	3	1	2	0	0	0	0	0	PRIMARY FLAKE, ITEM NO. 10 NO RECORDED
7	1	12	T	1	.T.	H	A	0	0	0	2	0	0	1	4	SCRAPER, EDGE RETOUCH ON ONE EDGE
7	1	13	C	1	.T.	I	I	0	0	0	3	6	8	0	0	PRIMARY
7	1	14	T	3	.T.	H	A	0	0	0	1	5	1	3	2	HAMMERSTONE, BIPOLAR BATTERING ON BOTH ENDS
7	1	15	T	1	.T.	H	A	0	0	0	1	0	0	0	1	HAMMERSTONE, BATTERING ON ONE END ONLY, NEAR ITEM NO.14
7	1	16	F	3	.F.	I	I	3	0	2	0	0	0	0	0	PRIMARY FLAKE
7	1	17	F	1	.F.	A	A	3	0	2	0	0	0	0	0	PRIMARY FLAKE
7	2	1	S	1	.T.	H	P	0	0	0	2	2	0	0	0	PRIMARY
7	2	2	C	3	.T.	I	I	0	0	0	1	1	7	0	0	PRIMARY, LARGE COBBLE WITH ONE FLAKE REMOVED
7	2	3	F	1	.T.	A	I	3	1	2	0	0	0	0	0	PRIMARY FLAKE
7	2	4	F	3	.T.	I	I	3	3	6	0	0	0	0	0	SECONDARY FLAKE
7	2	5	F	1	.T.	H	I	3	1	6	0	0	0	0	0	SECONDARY FLAKE
7	2	6	F	1	.F.	I	A	3	3	2	0	0	0	0	0	PRIMARY FLAKE
7	2	8	T	1	.F.	H	A	3	0	0	0	0	0	1	4	POSSIBLE MALPAIS SCRAPER, OVAL FLAT ROCK WITH EDGE RETOUCH ALL AROUND
7	2	9	T	1	.T.	H	P	3	0	0	0	0	0	1	4	POSSIBLE MALPAIS SCRAPER ASSOCIATED WITH NO.8, EDGED RETOUCHED 3/4 AROUND, DOMED
7	2	10	F	1	.F.	A	P	4	3	5	0	0	0	0	0	TERTIARY FLAKE, EDGE RETOUCHED
7	2	11	F	1	.F.	H	P	3	0	2	0	0	0	0	0	SECONDARY FLAKE
7	2	12	F	1	.T.	H	A	3	3	6	0	0	0	0	0	SECONDARY FLAKE
7	2	13	S	1	.T.	H	I	3	0	0	2	0	0	0	0	SECONDARY
7	2	14	C	1	.F.	I	0	0	0	0	2	4	8	0	0	SECONDARY, ASSOCIATED WITH NO.15
7	2	15	S	1	.F.	I	P	0	0	0	3	8	8	0	0	SECONDARY, ASSOCIATED WITH NO.14
7	2	16	S	1	.T.	H	A	0	0	0	2	3	0	0	0	SECONDARY
7	2	17	F	1	.T.	H	A	3	2	2	0	0	0	0	0	PRIMARY FLAKE, SAME MATERIAL AS NO. 18 AND IN ASSOCIATION
7	2	18	F	1	.F.	I	A	3	1	6	0	0	0	0	0	PRIMARY FLAKE, SAME MATERIAL AS NO. 17
7	2	19	F	1	.T.	H	I	3	2	2	0	0	0	0	0	PRIMARY FLAKE
7	2	20	F	1	.T.	H	A	3	1	2	0	0	0	0	0	PRIMARY FLAKE
7	2	21	S	1	.T.	H	I	0	0	0	2	5	8	0	0	PRIMARY

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
7	2	22	F	1	.T.	H	0	3	1	2	0	0	0	0	0	PRIMARY FLAKE
7	2	23	S	1	.T.	H	I	0	0	0	2	2	0	0	0	PRIMARY, SAME MATERIAL AS NO. 18
7	2	24	F	1	.F.	H	I	3	2	6	0	0	0	0	0	SECONDARY FLAKE
7	2	25	F	1	.T.	H	A	3	1	2	0	0	0	0	0	PRIMARY FLAKE
7	2	26	F	1	.T.	H	A	4	3	5	0	0	0	0	0	TERTIARY FLAKE
7	2	27	F	1	.T.	H	A	3	2	6	0	0	0	0	0	SECONDARY FLAKE
7	2	28	C	1	.T.	H	I	0	0	0	2	3	1	0	0	PRIMARY, BATTERING ON ONE END

PEBBLE TERRACE LITHIC ANALYSIS VARIABLE INDEX

A.Data Recording Unit Number
1-7

B.Grid Number
1-n

C.Artifact Number
1-n

D.Artifact Type
S. Shatter
F. Flake
C. Core
B. Blank
T. Tool

E.Material
1. Chalcedony
2. Chert(Combined with 1)
3. Quartzite
4. Quartz
5. Red Porphyry
6. Basalt
7. Silicate Mud/Chert
8. Porphyry

F.Ground Patina
T. Present
F. Absent

G.Varnish
H. High
I. Intermediate
A. Absent

H.Position in Pavement
A. Above
P. Partially embedded
I. Almost totally embedded

I.Cortex on Flake
1. 100 percent
2. 50-99 percent
3. 1-49 percent
4. none

J.Number of Dorsal Scars on Flake
1. 1
2. 2
3. 3-4
4. 5 or more
5. none

K.Position of Flake on Original Core
1.Hemispheric-longitudinal
2.Hemispheric-diagonal
3.Hemispheric-lateral
4.Internal with cortical plat.
5.Internal tertiary
6.Variation of type 4
7.Expanding flake
8.Quarter cobble
9.Variation of type 1

L.Cortex on Core
1. 75-100 percent
2. 50-74 percent
3. 0-49 percent

M.Number of Flakes Removed from Core
1-n

N.Direction of Flake Removal
1. To the inside
2. Bi-polar
3. Uni-directional
4. Lateral
5. To the outside
6. Multi-faceted
7. Downward
8. Multi-directional
9. Two directions

O.Tool Edge Angle
1. acute
2. intermediate
3. obtuse

P.Tool Edge Outline
1. convex
2. straight
3. concave
4. wavy

Comments

Comments concern wear damage on tools, tool types and functional descriptions, associations with other artifacts, and recording strategies.

APPENDIX C

Pebble Terrace Tool and Blank Data

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
1	1	22	T	3	.T.	I	A	0	0	0	0	0	0	3	0	WEAR DAMAGE: BATTERING ON ONE EDGE OF HAMMERSTONE
1	1	40	T	3	.T.	A	A	0	0	0	0	0	0	3	0	
1	1	52	T	1	.T.	A	A	3	0	0	0	0	0	1	4	BI-FACE,RETOUCHED KNIFE EDGE,ASSOCIATED WITH ITEMS THAT START IN GRID#2
1	1	90	T	1	.T.	H	A	0	0	0	1	0	0	2	4	CHOPPER W/EDGE WEAR,FOUND IN AREA W/ OTHER LITHIC MAT'L.
1	1	91	T	1	.T.	H	A	0	0	0	0	0	0	2	4	SCRAPER, ASSOCIATED W/ ITEM #89
1	2	21	B	1	.T.	I	I	2	4	8	0	0	0	0	0	PLATFORM PREP. AND ANGLE SUGGEST SAN DIEGUITO, BROKEN DISTAL HALF OF SCRAPER
1	2	24	T	6	.F.	H	A	0	0	0	0	0	0	1	1	SMALL MALPAIS TESHOA FLAKE SCRAPER WITH LIGHT RETOUCH/USEWEAR ALONG ALL MARGIN..
1	2	25	T	1	.T.	I	P	0	0	0	0	0	0	2	3	SPOKESHAVE, HEAVILY VARNISHED CONCAVITY,DEFINATE WEAR/USE, MADE FROM SEC. FLAKE
1	2	58	B	1	.T.	I	A	0	0	0	0	0	0	0	0	FLAT BASED BIFACE ROUGH OR BLANK BROKEN IN HALF DURING MANUFACTURE
3	1	26	T	1	.T.	H	P	3	0	0	0	0	0	1	4	MALPAIS SCRAPER, NO EDGE WEAR
3	2	8	T	7	.T.	I	A	0	0	0	3	0	0	1	4	BIFACE BLANK, COLLECTED
3	2	21	B	4	.T.	H	P	0	0	0	2	0	0	1	4	BIFACIALLY WORKED BLANK, ONE COURSE OF FLAKING
4	1	15	T	1	.F.	A	A	0	0	0	2	0	0	2	2	CHOPPER, SLIGHT EDGE WEAR
4	1	17	T	3	.F.	A	A	0	0	0	1	0	0	3	3	HAMMERSTONE, ASSOCIATED WITH CHIPPING STATION AND ITEMS 5-14, BOTH ENDS DAMAGED
4	1	21	T	3	.F.	A	A	0	0	0	1	3	1	0	0	CHOPPER, WITH THREE BIFACIALLY REMOVED FLAKES
4	1	28	T	3	.F.	A	A	0	0	0	1	0	0	3	1	LARGE COBBLE HAMMERSTONE WITH ONE BATTERED END
4	1	35	T	3	.F.	A	A	0	0	0	1	0	0	0	0	HAMMERSTONE, BOTH ENDS ARE BATTERED , TWO FLAKES REMOVED FROM ONE END
4	1	37	T	3	.F.	0	0	0	0	0	0	3	3	1	0	HAMMERSTONE, BATTERING ON ONE END, ASSOCIATED WITH ITEM NO. 36
6	1	1	T	3	.F.	A	A	0	0	0	1	1	0	0	0	HAMMERSTONE, BATTERING ONE END,ASSOCIATED W/ #2 (W/IN 1 METER)
6	1	10	T	3	.F.	A	A	0	0	0	1	0	0	0	0	ANVIL, LARGE COBBLE WITH BATTERERING ON ONE FLAT SURFACE
6	1	11	T	3	.F.	A	P	0	0	0	1	3	1	0	0	HAMMERSTONE, BIPOLAR DAMAGE, TWO FLAKES REMOVED FROM ONE END, THE OTHER BATTERED

PEBBLE TERRACE LITHIC DATA

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	COMMENTS
6	1	23	T	1	.F.	A	A	0	0	0	1	0	0	0	0	HAMMERSTONE,BATTERING ON ROUNDED SIDE IN ASSOCIATION W/ITEMS 21, 22
6	0	28	T	3	.F.	A	A	0	0	0	1	6	1	0	1	HAMMERSTONE, 1 FLAKE REMOVED, BIPOLAR PATTERING IN FIVE DIFFERENT AREAS
6	1	30	T	1	.T.	A	A	0	0	0	1	4	6	2	4	COBBLE CHOPPER WITH 1 LARGE LONGITUDINAL REMOVED FLAKE AND 3 REMOVED BIFACIAL
6	1	33	T	3	.F.	A	A	0	0	0	1	3	0	3	2	HAMMERSTONE, BATTERING AND ONE FLAKE REMOVED ON ONE END, IMPACT ON OTHER END
6	1	50	T	1	.F.	A	A	0	0	0	1	1	0	3	1	HAMMERSTONE NEAR ITEMS NO. 48 AND 49, ONE END IS BATTERED WITH A FLAKE REMOVED
6	1	57	T	3	.F.	A	A	0	0	0	0	0	0	3	1	HAMMERSTONE OR ANVIL, BIPOLAR BATTERING ON BOTH ENDS, IMPACT MARKS ON FLAT SIDE
6	1	59	T	3	.F.	A	A	0	0	0	1	0	0	2	4	CHOPPER OR HAMMERSTONE, BATTERING ON ONE END, BIFACIAL DENTICULATION ON OTHER
6	1	60	T	3	.F.	A	A	0	0	0	1	1	0	3	1	HAMMERSTONE, BATTERING ON BOTH ENDS
6	1	61	T	3	.T.	A	A	0	0	0	1	1	0	3	1	HAMMERSTONE, BATTERING ON BOTH ENDS
6	1	68	T	3	.T.	A	A	0	0	0	1	1	5	0	0	ANVIL, BATTERING MARKS ON FLAT SURFACE, ONE FLAKE REMOVED FROM END
6	1	74	T	3	.T.	A	A	0	0	0	1	2	5	0	0	COBBLE CHOPPER, FLAKES REMOVED FROM ONE END
7	1	12	T	1	.T.	H	A	0	0	0	2	0	0	1	4	SCRAPER, EDGE RETOUCH ON ONE EDGE
7	1	14	T	3	.T.	H	A	0	0	0	1	5	1	3	2	HAMMERSTONE, BIPOLAR BATTERING ON BOTH ENDS
7	1	15	T	1	.T.	H	A	0	0	0	1	0	0	0	1	HAMMERSTONE, BATTERING ON ONE END ONLY, NEAR ITEM NO.14
7	2	8	T	1	.F.	H	A	3	0	0	0	0	0	1	4	POSSIBLE MALPAIS SCRAPER, OVAL FLAT ROCK WITH EDGE RETOUCH ALL AROUND
7	2	9	T	1	.T.	H	P	3	0	0	0	0	0	1	4	POSSIBLE MALPAIS SCRAPER ASSOCIATED WITH NO.8, EDGED RETOUCHED 3/4 AROUND,DOMED

APPENDIX D

Pending

APPENDIX E

Site Forms

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD

Page 1 of 11.

Permanent Trinomial: 4-Riv-668 Supplement ☐

Temporary Number: Pbl Terr 1

Agency Designation:

1. County: RIV

2. USGS Quad: Palo Verde Mts, CA (7.5') ______ (15') '53 Photorevised N/A

3. UTM Coordinates: Zone 11 / ______ Easting / ______ Northing (X)

4. Township 8S Range 21E . ______ ¼ of ______ ¼ of ______ ¼ of ______ ¼ of Section Sections 29, 30, 31 & 32 Base (Mer.) SB (X)

5. Map Coordinates: ______ mmS ______ mmN (from NW corner of map) 6. Elevation 480', 440' & 435 ASL

7. Location: Pebble Terrace 1, BLM Surface Artifact Density Study Area/Site is located atop of a series of alluvial terraces bordered by several wide, unnamed washes which, when active, flow NW to SE from the base of the Mule Mountains to the Palo Verde Mesa. The site is located in southeastern Riverside County and is situated west (X)

8. Prehistoric X Historic ______ Protohistoric ______ 9. Site Description: Quaternary alluvial terraces with continuous lithic scatter that vary from very sparse to heavy concentrations, depending upon the existing geological surface formation (i.e. alluvial pebble terraces). Four 1/4 Section areas were specifically examined within this site during the course study in order to gauge the variability of lithic density (X)

10. Area: 850A m(length) x ______ m(width) ______ m². Method of Determination: Land Area and Slope indicator

11. Depth: 0.5 cm Method of Determination: Artifact imbeddment observed ( )

12. Features: Two aboriginal trail segments were found: one in the NW 1/4 of study unit III and one in the SW 1/4 of study unit IV. Three cleared circular areas of approximately 2-3 meters each and a small (approximately 30-40 cm dia.) (X)

13. Artifacts: Survey of the four study units in site Pbl Terr 1 was accomplished by performing linear transects with four persons spaced approximately 20 to 40 meters apart from each other. Survey crew members observed, noted and (X)

14. Non-Artifactual Constitutients: Numerous areas of thermally fractured rock and fractured rocks attributed to assaying by rock hounds ( )

15. Date Recorded: 11-15-84 16. Recorded By: J.Cook, C. Nordby, D. McFadden (X)

17. Affiliation and Address: Mooney-Lettieri & Associates, Inc. 9925-C Businesspark Avenue (X)

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD

Permanent Trinomial: 4-Riv-668 / ____ mo. ____ yr.

Temporary Number: Pbl Terr 1

Agency Designation:

Page 2 **of** 11 .

18. **Human Remains:** None noted ( )

19. **Site Integrity:** Numerous ORV Tire tracks observed throughout site as well as some grading activity. Numerous places where individuals had aggregated smooth, flat garden variety pebbles were seen; evidence of rock hound assaying activity and a few "glory holes" (miner's prospects) were also noted. Given that a commercial market already exists for the patinated pebbles of the type found on these (X)

20. **Nearest Water (type, distance and direction):** Arroyos to north and south of site ( )

21. **Largest Body of Water within 1 km (type, distance and direction):** same ( )

22. **Vegetation Community (site vicinity):** Creosote bush scrub [Plant List ( )] ( )

23. **Vegetation Community (on site):** Same [Plant List ( )] ( )

References for above: Munz, Philip A. A Flora of Southern California, University of (X)

24. **Site Soil:** Argillic (B2T) horizon (X) 25. **Surrounding Soil:** Same ( )

26. **Geology:** Chalcedony, quartzite (X) 27. **Landform:** Terraces

28. **Slope:** Flat to 10° slope to NW ( ) 29. **Exposure:** Open ( )

30. **Landowner(s) (and/or tenants) and Address:** U.S. Government; adminstered by the Bureau of Land Management, Riverside, CA 92507 ( )

31. **Remarks:** This site is within the area of the non-defunct Sun Desert Nuclear generator project ( )

32. **References:** Jay von Werlhof and Sherilee von Werlhof, May 1978 Archaeological Examinations of West and North Permimeters, Sundesert Site and Request for Determination of Eligibility for the National Register Sundesert Site, A Twin (X)

33. **Name of Project:** Pebble Terrace, BLM Surface Artifact Density Study, November 1984 ( )

34. **Type of Investigation:** Controlled area surface survey and inventory ( )

35. **Site Accession Number:** Pbl Terr 1 **Curated At:** Mooney-Lettieri & Associates (X)

36. **Photos:** color slides - 35mm **Taken By:** J. Cook ( )

37. **Photo Accession Number:** Pbl Terr 1 - slides **On File At:** Mooney-Lettieri & Associates

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD
Continuation Sheet

Page 3 of 11 .

Permanent Trinomial: 4-Riv-668 / ______ mo. yr.

Temporary Number: Pbl Terr 1

Agency Designation: ______

Item No.	Continuation

3 NE - A) 703750 E/3703350 N
A')704350 E/3702500 N

SE - B) 704500 E/3701575 N

SW - C) 702350 E/3701950 N

NW - D) 700750 E/3703700 N
D')701950 E/3704000 N

4 Pbl Terr 1 is located within Township 8S, Range 21E, in the SW 1/4 of Section 29, the NW, SW, and SE 1/4's of Section 30, the NW, NE and SE 1/4's of Section 31, and the SE 1/4 and western 1/2 of Section 32.

7 of the Palo Verde Mesa and east of Coon Hollow and the Mule Mountains. On the south, it is bordered by a wide, unnamed wash which has abounds with ironwood trees. This wash is directly north of the Imperial-Riverside County boundary line. On the north, the site is, again, bordered by another wide, unnamed wash which is situated in a northwest to southeast direction./ From the south edge of the town of Palo Verde, turn west on a dirt road (at the Wheel Tavern) off of State Highway 78 to a dirt road that leads to the Opal Mine (signed). Continue on this dirt road to the ranch house (.9 km from S-78) and go past the Old Butterfield Stage stop at the ranch. Continue west for approximately .5 km then proceed north for .2 km. Turn west and continue on dirt road for 8.3 km. This will place one near the epicenter of the site area.

9 that might occur upon the different geomorphic surfaces in Sections 29 thru 32 (See maps, pages 6 and 9 of 11 ; an explanation of the various geomorphic surfaces is attached in pages 7 and 8 of 11). The greatest frequency of lithic materials was found in the areas of dense Colorado River cobbles designated as QCR, specifically in study units I and II. This surface is characterized by very black desert varnished pavement surfaces which are smooth and tightly packed consisting primarily of rounded quartzite and chert pebbles from the Colorado River. A break down of the artifactual material types found within each study unit and the particular surfaces that they were found upon is listed in Item 13. It should be noted that this study was concentrated in the study units depicted in the accompanying map (page 9 of 11) and that the undetermined site boundary shown in that map is based strictly upon the geomorphology of the area.

12 A small (approximately 30-40 cm dia.) rock ring filled with chalcedony flowers was found in study unit III.

13 tallied the number of artifactual material per transect in order to establish some relative density within a given area.

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD
Continuation Sheet

Page 4 of 11 .

Permanent Trinomial: 4-Riv-668 / ______ mo. yr.

Temporary Number: Pbl Terr 1

Agency Designation: ______

Item No. | Continuation

13 Study Unit I

	Geomorphic Surface Type	
	QCR	Qfc
# of Isolated Flakes	135	0
# of Isolated Cores	125	1
# of Isolated Tools	18	1
# of Core and flake Localities	132	1
# of Flake Localities	31	1
# of Tool and Flake Localities	6	0

Other: 12 lithic scatters in QCR

13 Study Unit III

	Geomorphic Surface Type	
	QCR	Qfa
# of Isolated Flakes	97	51
# of Isolated Cores	115	55
# of Isolated Tools*	46	9
# of Core and Flake Localities	52	14
# of Flake Localities	30	10
# of Tool and Flake Localities	5	4

*An obsidian scraper, possibly of Coso Range origin was found in N.E. 1/4 of study unit III (collected)

13 Study Unit II

	Geomorphic Surface Type			
	QCr	Qal_1	QAL_{234}	Qfa
# of Isolated Flakes	32	38	14	4
# of Isolated Cores	29	33	24	3
# of Isolated Tools	5	6	9	0
# of Core and Flake Localities	7	9	14	0
# of Flake Localities	2	2	1	0
# of Tool and Flake Localities	0	0	2	0

13 Study Unit IV

	Geomorphic Surface Type
	QFA
# of Isolated Flakes	30
# of Isolated Cores	46
# of Isolated Tools	4
# of Core and Flake Localities	9
# of Flake Localities	4
# of Tool and Flake Localities	0

NOTE: These figures are only a talley of items observed while performing transects in a given study area and do not reflect the actual frequency in which they might occur

Other: 2 pot sherds

16 Tirzo González

17 San Diego, CA 92131

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD
Continuation Sheet

Page 5 of 11 .

Permanent Trinomial: 4-Riv-668 / ____
mo. yr.

Temporary Number: Pbl Terr 1

Agency Designation: ____

Item No.	Continuation
19	terraces, the potential for further disturbance of the site is substantially increased.
23	California, Page 4
24	and calcic horizons characterized by stage I-II-III calcium carbonate accumulation
26	cherts, basalts, gruss, porphyrics
32	Report, San Diego Gas and Electric Company, San Diego, CA Waters, Michael R., November 2, 1984 Preliminary Map of Geomorphic Surfaces and explanation. On file with Mooney-Lettieri & Associates, Inc. San Diego, CA
35	San Diego, CA
37	Roll #1,2,3 San Diego, CA

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

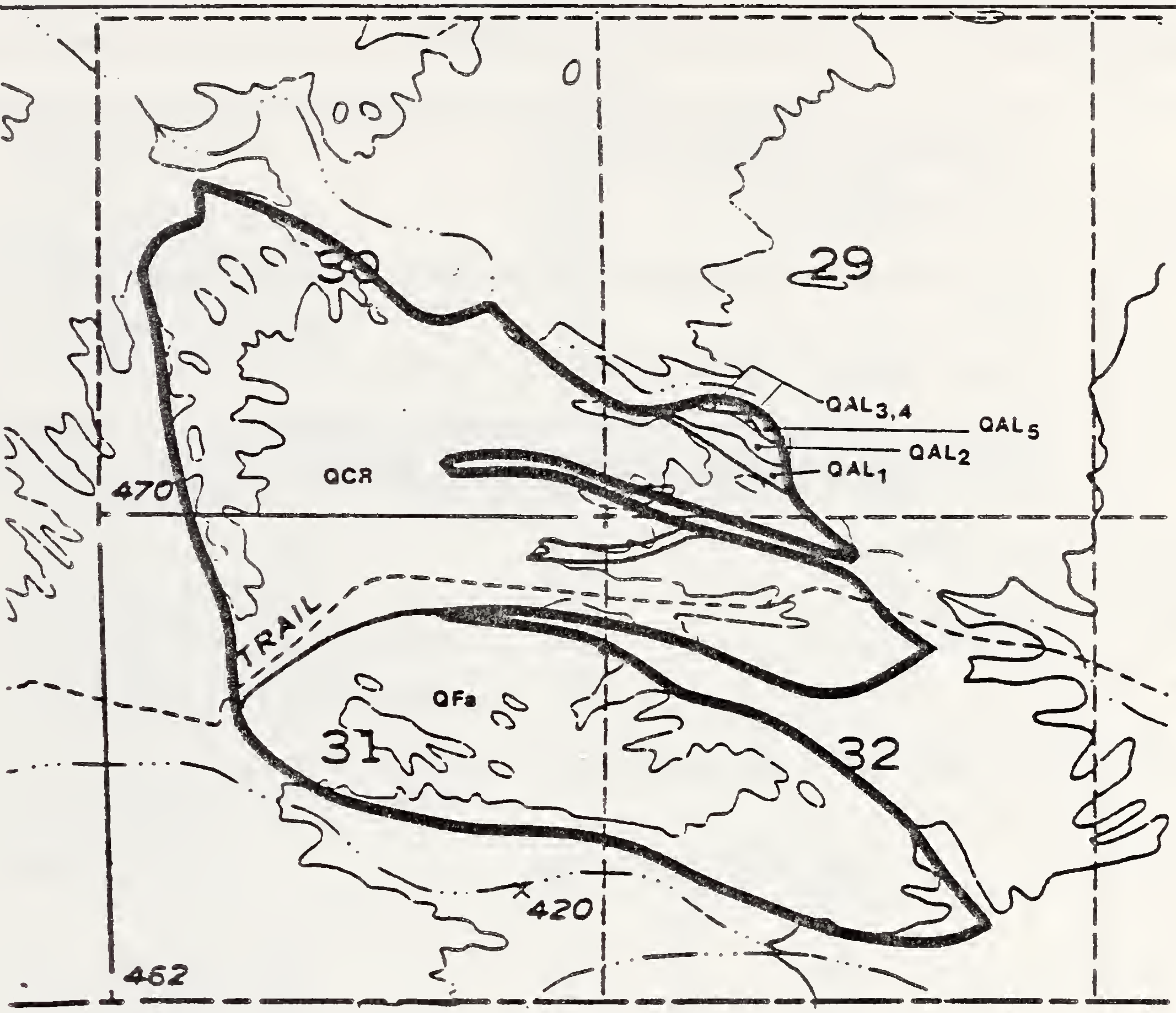
ARCHEOLOGICAL SITE MAP

Page 6 of 11.

Permanent Trinomial: 4-Riv-668 / ____ mo. ____ yr.

Temporary Number: Pbl Terr 1

Agency Designation: ____



Site Boundaries and Geologic Surfaces

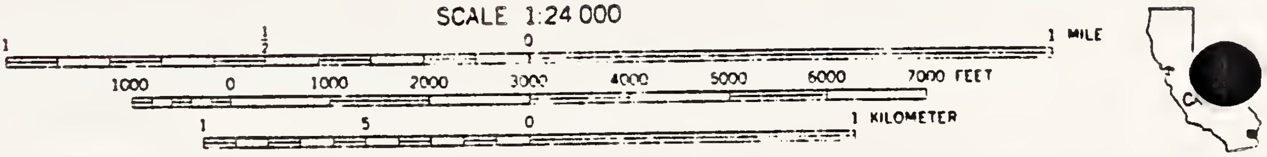
KEY

Site boundary ▬

Qcr,QFF,etc., are geologic surface types

PALO VERDE MTS. QUADRANGLE
CALIFORNIA

SCALE 1:24 000



DPR 422F (Rev. 8/82)

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE MAP
Geologic Surfaces
Page 7 of 11.

Permanent Trinomial: 4-Riv-668 / ______
mo. yr.

Temporary Number: Pbl Terr 1

Agency Designation: ______

Map Explanation:

QCR Area of dense Colorado River Cobbles. Two distinct terrace surfaces of the Colorado River. Highest and oldest terrace is in the western sector of section 30 (highest surface above wash). Lower terrace occurs below this surface to the west. Both surfaces characterized by very black desert varnished pavement surfaces, pavements are tightly packed and smooth, lithology dominated by rounded quartzite and chert pebbles derived from the Colorado River. Soils consist of argillic (B2t) horizons (where not eroded) and calcic horizons characterized by stage II-III calcium carbonate accumulation. Estimated age Pleistocene (greater than 100,000 years).

QF Alluvial fan remnants which originated from the mountains and are characterized by local source rocks of the mountains and reworked Colorado River pebbles. All have argillic horizons (where preserved) and calcic horizons with stage-II calcium carbonate development. Estimated age Pleistocene. A number of fans were broken out based on lithology and position.

a) many local basalt boulders
b) local rock--grussy, few Colorado River pebbles
c) ditto b
d) ditto b
e) local rock--grussy, moderate number of Colorado River pebbles
f) ditto e

Holocene Surfaces:

Qal Locally derived alluvium deposited in braided stream channels. Bar-and-Swale topography, no argillic horizons, calcic horizons characterized by stage I and II development. Six subunits are defined.

Qal_6 modern active wash alluvium of braided stream

Qal_5 inactive floodplain areas adjacent and elevated above modern active channel. may represent 100 year floodplain.

Qal_4 bar-and-swale topography, elevated as a terrace above the modern channel, no desert varnish, very thin, very discontinuous light dusting of calcium carbonate in the calcic horizon which lies less than 5 cm below the surface.

Qal_3 bar-and-swale topography elevated as a terrace above the modern channel, no desert varnish, very thin and very discontinuous pebble coatings in the calcic horizon (stage-I) at a depth of 5-7cm below the surface. Both Qal4 and Qal3 are probably late Holocene surfaces less than 2,000 years old.

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE MAP
Geologic Surfaces
Page 8 of 11.

Permanent Trinomial: 4-Riv-668 / mo. yr.
Temporary Number: Pbl Terr 1
Agency Designation:

Qal_2 bar-and-swale topography elevated as a terrace above the modern channel, desert varnish on bars, but swales unvarnished, thin (less than 1mm) discontinuous calcium carbonate coatings in calcic horizon (stage-I). Surface is late to middle Holocene in age.

Qal_1 subdued bar-and-swale topography elevated as a terrace above the modern channel, desert varnished bars and swales, thin (1-2mm thick) calcium carbonate coatings on the undersides of pebbles in the calcic horizon of the soil at a depth of 10 cm or more (stage-I-II). Surface is probably middle to early Holocene in age (6,000 - 15,000 yr B.P.).

Outline of Geologic History:

1) Formation of a high terrace of the Colorado River (at ca. 520 ft. asl).

2) Formation of a lower terrace by the Colorado River (at ca. 440 ft. asl) during the Pleistocene.

3) Six episodes of Pleistocene alluvial fan building. These episodes destroyed much of the older Colorado River terraces.

4) Erosion of Pleistocene sediments during the Holocene by braided streams which originated in the mountains. These streams deposited at least 6 recognizable alluvial deposits (including the modern channel alluvium).

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

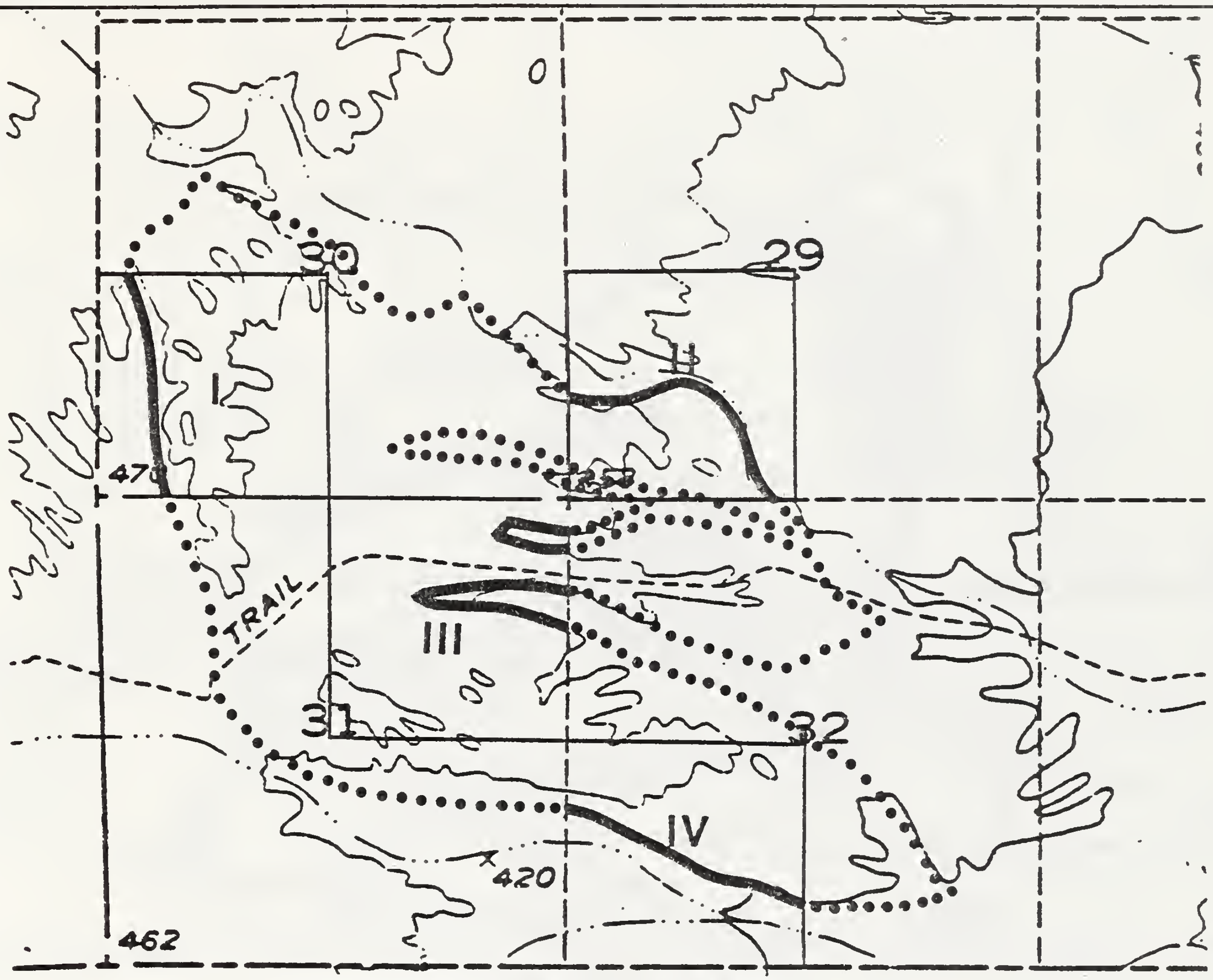
ARCHEOLOGICAL SITE MAP

Page 9 of 11.

Permanent Trinomial: 4-Riv-668 / mo. yr.

Temporary Number: Pbl Terr 1

Agency Designation:



Study Units within Site area

KEY

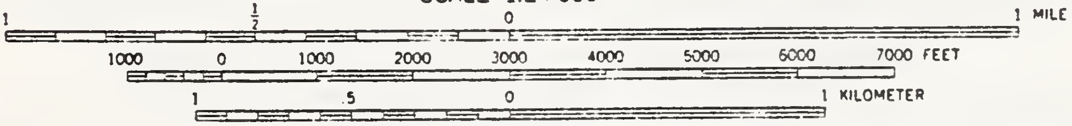
Site boundary ━

Undetermined site boundary • • •

Study unit block V

PALO VERDE MTS. QUADRANGLE
CALIFORNIA

SCALE 1:24 000



State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

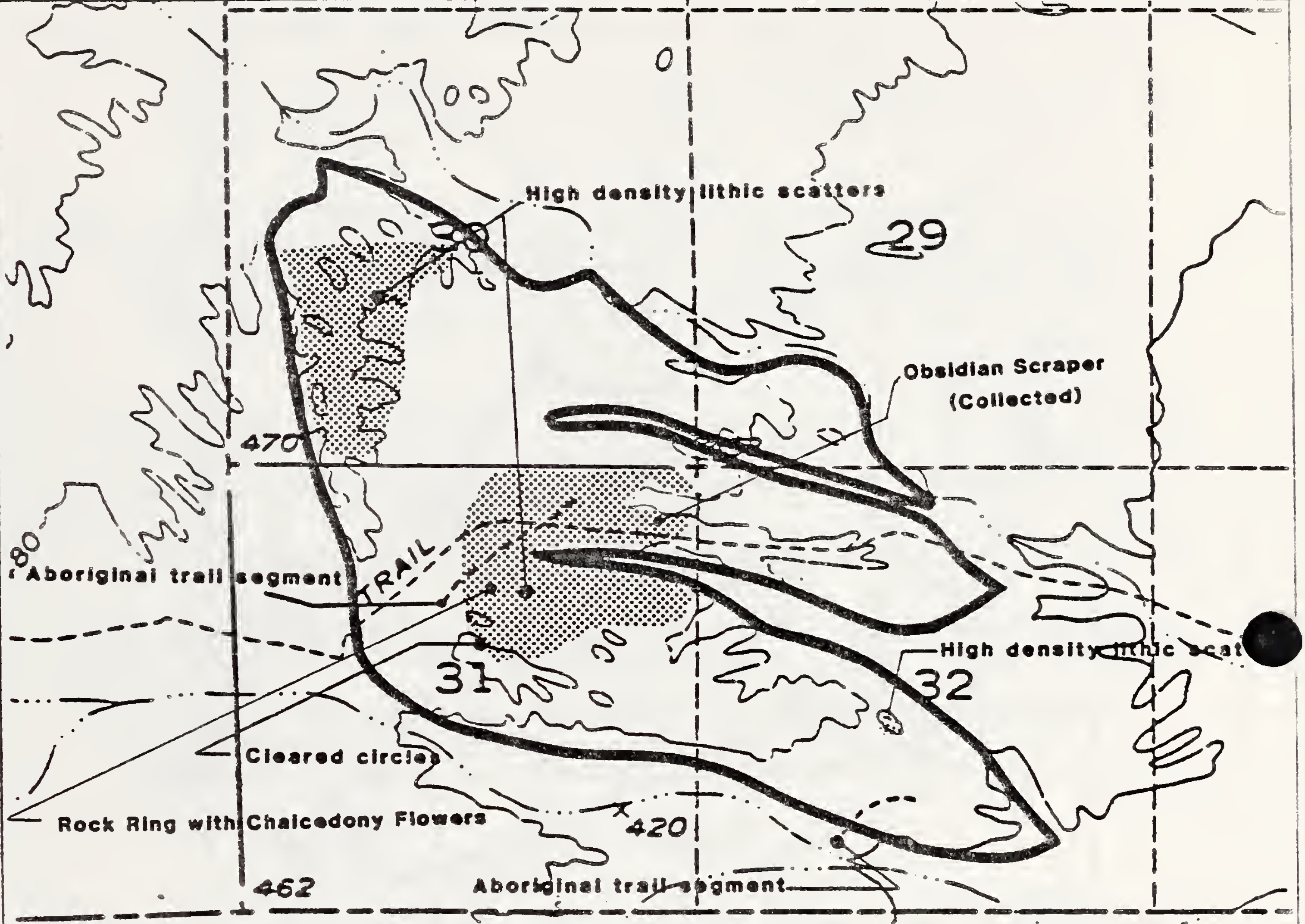
ARCHEOLOGICAL SITE MAP

Page 10 of 11.

Permanent Trinomial: 4-Riv-668 / ______ mo. ______ yr.

Temporary Number: Pbl Terr 1

Agency Designation: ______



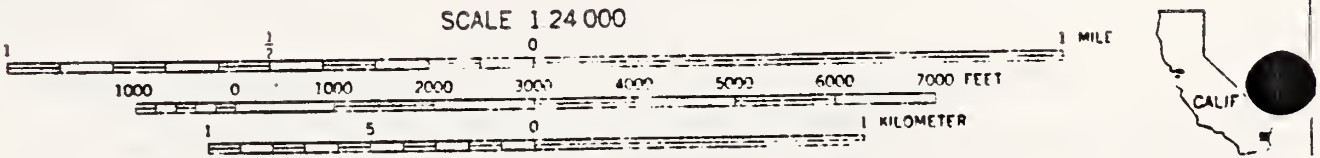
Lithic Concentrations and Features

KEY

- Site boundary ⌒
- High density lithic scatters ▒
- Low to moderate lithic areas (unmarked)

PALO VERDE MTS. QUADRANGLE
CALIFORNIA

SCALE 1:24 000



DPR 422F (Rev. 8/82)

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

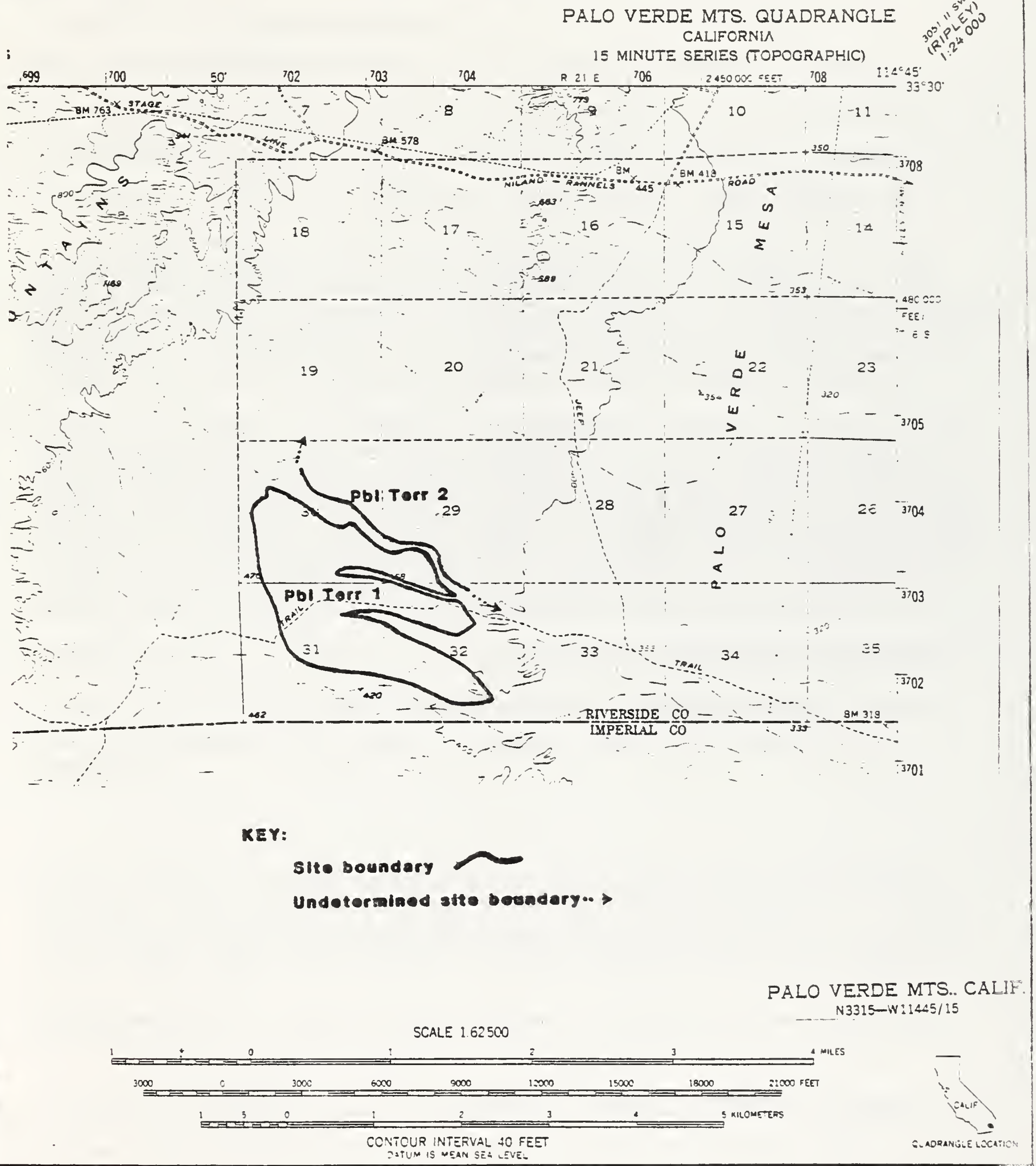
ARCHEOLOGICAL SITE LOCATION MAP

Page 11 of 11.

Permanent Trinomial: 4-Riv-668 / ______ mo. ______ yr.

Temporary Number: Pbl Terr 1

Agency Designation: ______



DPR 422G (Rev. 8/82)

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD

Permanent Trinomial: 4-Riv-1748 Supplement ☐

Temporary Number: Pbl Terr 2

Page 1 of 10.

Agency Designation:

1. County: RIV

2. USGS Quad: Palo Verde Mts, CA (7.5') (15') '53 Photorevised N/A

3. UTM Coordinates: Zone 11 / Easting / Northing (X)

4. Township 8S Range 21E ; ¼ of ¼ of ¼ of ¼ of Section Base (Mer.) SB (X)

5. Map Coordinates: mmS mmN (from NW corner of map) 6. Elevation 480; 400' 415' ASL

7. Location: Pebble Terrace 2, BLM surface Artifact Density Study Area/ The site is located atop of a series of alluvial terraces bordered to the south by a large, wide, unnamed wash which, when active, flows NW to SE from the base of the Mule Mountains to the Palo Verde Mesa. The site is located in the southeastern Riverside County and is situated west of the Palo Verde Mesa and east of Coon Hollow and the Mule Mountains. On the south, it is bordered by a wide unnamed wash filled with ironwood trees. This is the second large wash directly north of the Imperial- (X)

8. Prehistoric X Historic Protohistoric 9. Site Description: Quaternary alluvial terraces with continuous lithic scatters that vary from very sparse to heavy concentrations, depending upon the existing geological surface (i.e. alluvial pebble terraces). Three 1/4 section areas were targeted for examination within this site during the course of this study in order to gauge the variability of lithic density that might occur upon the different geomorphic surfaces in Sections 29 and 30 (see maps pages 5 and 8 of 10; an explanation of the various geomorphic surfaces is attached in pages 6 and 7 of 10) The greatest frequency of lithic materials was found in the areas of dense Colorado River cobbles designated as QCR specifically in study (X)

10. Area: N/A m(length) x m(width) m². Method of Determination: Boundaries undetermined (X)

11. Depth: 0-5 cm Method of Determination: Artifact imbeddment observed ( )

12. Features: One aboriginal trail segment was found in the NE 1/4 of Section 30 in Study unit V. ( )

13. Artifacts: Survey of the three study units in site Pbl Terr 2 was accomplished by performing linear transects with four persons spaced approximately 20 to 40 meters apart from each other survey crew members observed, noted, and tallied the number of artifactual material per transect in order to establish some relative density within a given area. (X)

14. Non-Artifactual Constitutients: Numerous areas of thermally fractured rock and rocks broken by rock hounds.

15. Date Recorded: 11-15-84 16. Recorded By: J. Cook, C. Nordby, D. McFadden (X)

17. Affiliation and Address: Mooney-Lettieri and Associates, 9925-C Businesspark Avenue (X)

DPR 422A (Rev. 8/82)

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD

Permanent Trinomial: 4-Riv-1748 / mo. yr.

Temporary Number: Pbl Terr 2

Agency Designation:

Page 2 of 10.

18. **Human Remains:** None noted ( )

19. **Site Integrity:** Numerous ORV tire tracks observed throughout the site as well as some grading activity. Numerous places where individuals had aggregated smooth, flat garden variety pebbles were seen; evidence of rock hound assaying activity and a few prospectors "glory holes" were also seen. Given that a commercial market already exists for the patinated pebbles of the type found on these terraces, (X)

20. **Nearest Water (type, distance and direction):** Large, wide wash which forms southern boundary (X)

21. **Largest Body of Water within 1 km (type, distance and direction):** Same ( )

22. **Vegetation Community (site vicinity):** Creosote bush scrub [Plant List ( )] ( )

23. **Vegetation Community (on site):** Same [Plant List ( )] ( )

References for above: Munz, Philip A. A Flora of South California, University of (X)

24. **Site Soil:** Argillic (B2T) horizon (X)

25. **Surrounding Soil:** Same ( )

26. **Geology:** Chalcedony, quartzite (X)

27. **Landform:** Terraces (

28. **Slope:** Flat to 10° slope to NW ( )

29. **Exposure:** Open ( )

30. **Landowner(s) (and/or tenants) and Address:** U.S. Government; Administerd by the Bureau of Land Management, Riversie, CA 92507 ( )

31. **Remarks:** This site is within the area of the non-defunct Sun Desert Nuclear generator project. ( )

32. **References:** Jay Werlhof and Sherilee Von Werlhof, May 1978, Archaeological Examinations of West and North Perimeters Sundesert Site and Request for Determination of Eligibility for the National Register Sundesert Site, A Twin Report, San (X)

33. **Name of Project:** Pebble Terrace, BLM Surface Artifact Density study, November, 1984 ( )

34. **Type of Investigation:** Controlled area surface survey and inventory ( )

35. **Site Accession Number:** Pbl Terr 2 **Curated At:** Mooney-Lettieri & Associates (X)

36. **Photos:** Color slides - 35 mm **Taken By:** J. Cook ( )

37. **Photo Accession Number:** Pbl Terr 2 - slides **On File At:** Mooney-Lettieri & Associates (

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD
Continuation Sheet

Page 3 of 10 .

Permanent Trinomial: 4-Riv-1748 / mo. yr.

Temporary Number: Pbl Terr 2

Agency Designation:

Item No.	Continuation

3 Site Pbl Terr 2 has only one partially definite boundary which is formed by a wide wash which is situated in a NW to SE direction. This wash forms only a portion of the southern boundary of the site. The rest of the site boundary is undetermined, as only a portion of the site was surveyed. UTM coordinates for the NW portion and the SE portion of the defineable southern boundary are as follows:

- NW end point of defineable southern boundary
  Easting 702450 Northing 3704000

- SE end point of defineable southern boundary
  Easting 704150 Northing 3703000

4 The surveyed portion of site Pbl Terr 2 is located in the NW and SW 1/4's of Section 29 and the NE and SE 1/4's of Section 30.

7 Riverside County boundary line. The north perimeter of the site is of yet undefined/Directions: from the south edge of the Town of Palo Verde, turn west on a dirt road (at the Wheel Tavern) off of State Highway 78 to a dirt road that leads to the Opal Mine (signed). Continue on this dirt road to the ranch house .9 km from S-78) and go past the old Butterfield Stage stop at the ranch. Continue west for approximately .5 km then proceed north for .2 km. Turn west and continue on dirt road for approximately 4.4 km. This will place one at the east Section line of Section 32 which is federal land, and the west boundary line of Section 33 which belongs to San Diego Gas and Electric. From this point one goes north across a wide wash and follows a trail to the NW for approximately 1.6 km. This will place one at approximately a mid point between the center of Section 29 and 30.

9 units V and VI. The QCR surface is characterized by very black desert varnished pavement surfaces which are smooth and tightly packed consisting primarily of rounded quartzite and chert pebbles from the Colorado River. An itemized count of the artifactual material types observed in each study unit and the particular surface upon which they were found is listed in Item 13. It should be noted that this study was concentrated in the study units depicted in the accompanying map (page 8 of 10) and that the site boundaries were not defined as this study took into account only a portion of the site.

13 The figure for the various material classes are as follows:

Study Unit II	QCR	QAL_1	$QAL_{2,3,4}$	QFA
# of Isolated Flakes	32	38	14	4
# of Isolated Cores	29	33	24	3
# of Isolated Tools	5	6	9	0
# of Core and Flake Stations	7	9	14	0
# of Flake Stations	2	2	1	0
# of Tool and Flake Stations	0	0	2	0

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD
Continuation Sheet

Page 4 of 10 .

Permanent Trinomial: 4-Riv-1748 / ______ mo. yr.

Temporary Number: Pbl Terr 2

Agency Designation: ______

Item No.	Continuation

13

Study Unit V	QCR	QAL_{34}	Qfe	Other Areas (No designation)
# of Isolated Flakes	101	2	25	5
# of Isolated Cores	81	1	10	6
# of Isolated Tools	8	0	1	0
# of Core and Flake Stations	61	0	7	1
# of Flake Stations	29	0	1	1
# of Tool and Flake Stations	1	0	1	0

13

Study Unit IV	QCR	QAL_1	QAL_{234}	Qff
# of Isolated Flakes	92	12	20	1
# of Isolated Cores	87	15	23	13
# of Isolated Tools	18	2	5	1
# of Cores and Flake Stations	69	4	7	5
# of Flake Stations	26	1	0	1
# of Tool and Flake Stations	2	0	0	6

Other: 1 pottery sherd in QAL_1

16 Tirzo Gonzalez

17 San Diego, CA 92131

NOTE: These figures are only a talley of the items observed while performing transects in a given study area and do not reflect the actual frequency in which they might occur.

19 the potential for further disturbance of the site is substantially increased.

20 Of site Pbl Terr 2.

23 California, Page 4

24 and calcic horizons characterized by stage I-II-III calcium carbonate accumulation.

26 cherts, basalts gruss, porphyrics

32 Diego Gas and Electric Company, San Diego, CA

32 Waters, Michael R. November 2, 1984 <u>Preliminary Map of Geomorphic Surfaces</u> and explanation. On file with Mooney-Lettieri & Associates Inc, San Diego, CA

35 San Diego, CA

37 Rolls #1, 2, 3
San Diego, CA

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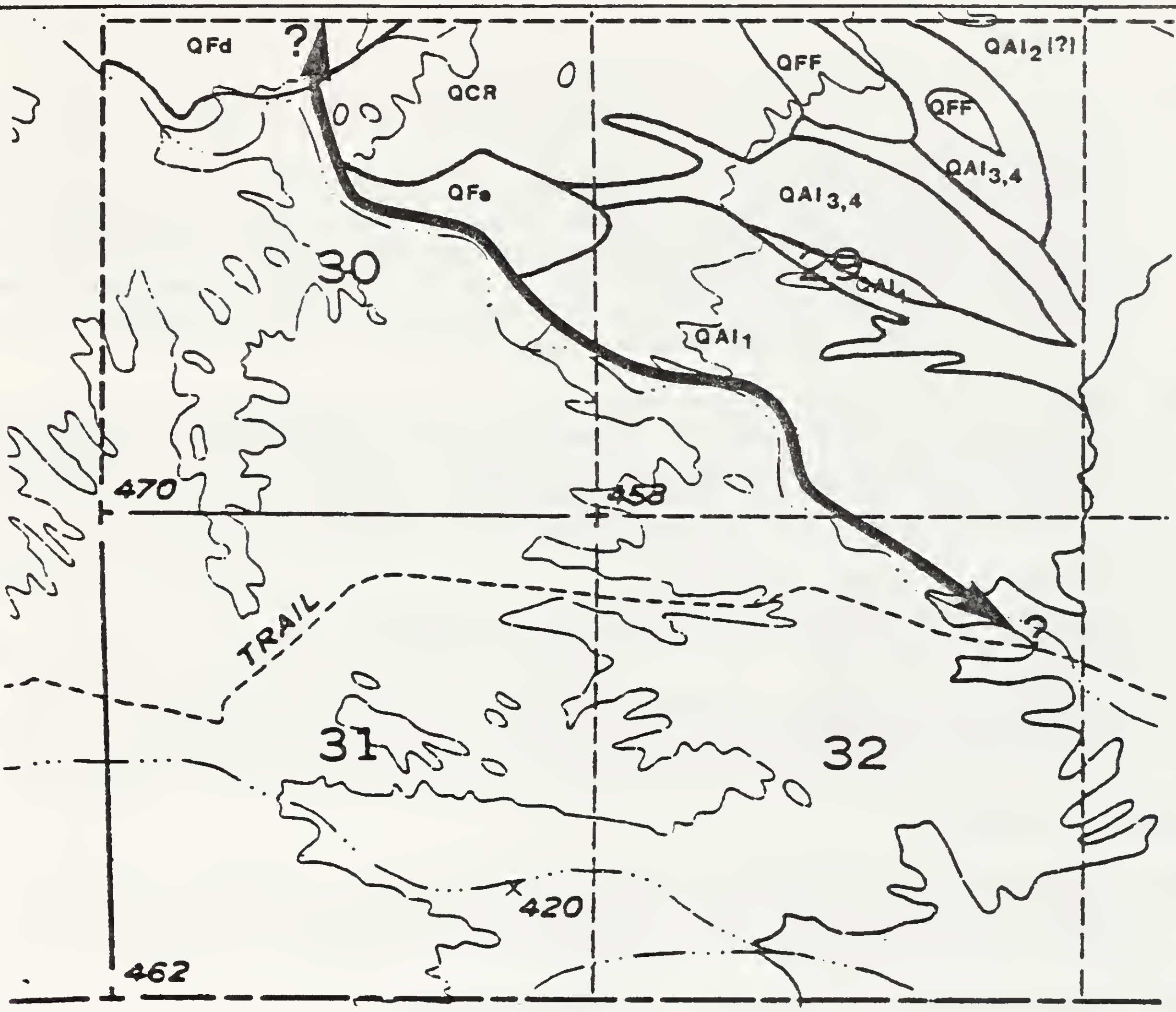
ARCHEOLOGICAL SITE MAP

Page 5 of 10.

Permanent Trinomial: 4-Riv-1748 / ____ mo. ____ yr.

Temporary Number: Pbl Terr 2

Agency Designation: ____



Site Boundaries and Geologic Surfaces

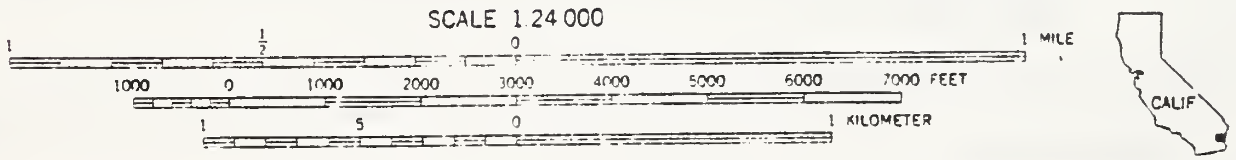
KEY

Site boundary ━━

Undetermined site boundary ➔ ?

Qcr, QFF, etc., are geologic surface types

PALO VERDE MTS. QUADRANGLE
CALIFORNIA



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ARCHEOLOGICAL SITE MAP
Geologic Surfaces
Page 6 of 10.

Permanent Trinomial: 4-Riv-1748 / mo. yr.
Temporary Number: Pbl Terr 2
Agency Designation:

Map Explanation:

QCR Area of dense Colorado River Cobbles. Two distinct terrace surfaces of the Colorado River. Highest and oldest terrace is in the western sector of section 30 (highest surface above wash). Lower terrace occurs below this surface to the west. Both surfaces characterized by very black desert varnished pavement surfaces, pavements are tightly packed and smooth, lithology dominated by rounded quartzite and chert pebbles derived from the Colorado River. Soils consist of argillic (B2t) horizons (where not eroded) and calcic horizons characterized by stage II-III calcium carbonate accumulation. Estimated age Pleistocene (greater than 100,000 years).

QF Alluvial fan remnants which originated from the mountains and are characterized by local source rocks of the mountains and reworked Colorado River pebbles. All have argillic horizons (where preserved) and calcic horizons with stage-II calcium carbonate development. Estimated age Pleistocene. A number of fans were broken out based on lithology and position.

a) many local basalt boulders
b) local rock--grussy, few Colorado River pebbles
c) ditto b
d) ditto b
e) local rock--grussy, moderate number of Colorado River pebbles
f) ditto e

Holocene Surfaces:

Qal Locally derived alluvium deposited in braided stream channels. Bar-and-Swale topography, no argillic horizons, calcic horizons characterized by stage I and II development. Six subunits are defined.

Qal$_6$ modern active wash alluvium of braided stream

Qal$_5$ inactive floodplain areas adjacent and elevated above modern active channel. may represent 100 year floodplain.

Qal$_4$ bar-and-swale topography, elevated as a terrace above the modern channel, no desert varnish, very thin, very discontinuous light dusting of calcium carbonate in the calcic horizon which lies less than 5 cm below the surface.

Qal$_3$ bar-and-swale topography elevated as a terrace above the modern channel, no desert varnish, very thin and very discontinuous pebble coatings in the calcic horizon (stage-I) at a depth of 5-7cm below the surface. Both Qal4 and Qal3 are probably late Holocene surfaces less than 2,000 years old.

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ARCHEOLOGICAL SITE MAP
Geologic Surfaces
Page 7 of 10 .

Permanent Trinomial: 4-Riv-1748 / mo. yr.

Temporary Number: Pbl Terr 2

Agency Designation:

Qal_2 bar-and-swale topography elevated as a terrace above the modern channel, desert varnish on bars, but swales unvarnished, thin (less than 1mm) discontinuous calcium carbonate coatings in calcic horizon (stage-I). Surface is late to middle Holocene in age.

Qal_1 subdued bar-and-swale topography elevated as a terrace above the modern channel, desert varnished bars and swales, thin (1-2mm thick) calcium carbonate coatings on the undersides of pebbles in the calcic horizon of the soil at a depth of 10 cm or more (stage-I-II). Surface is probably middle to early Holocene in age (6,000 - 15,000 yr B.P.).

Outline of Geologic History:

1) Formation of a high terrace of the Colorado River (at ca. 520 ft. asl).

2) Formation of a lower terrace by the Colorado River (at ca. 440 ft. asl) during the Pleistocene.

3) Six episodes of Pleistocene alluvial fan building. These episodes destroyed much of the older Colorado River terraces.

4) Erosion of Pleistocene sediments during the Holocene by braided streams which originated in the mountains. These streams deposited at least 6 recognizable alluvial deposits (including the modern channel alluvium).

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HEOLOGICAL SITE
MAP

9 of 10 .

Permanent Trinomial: 4-Riv-1748 / ______ mo. ______ ye

Temporary Number: Pbl Terr 2

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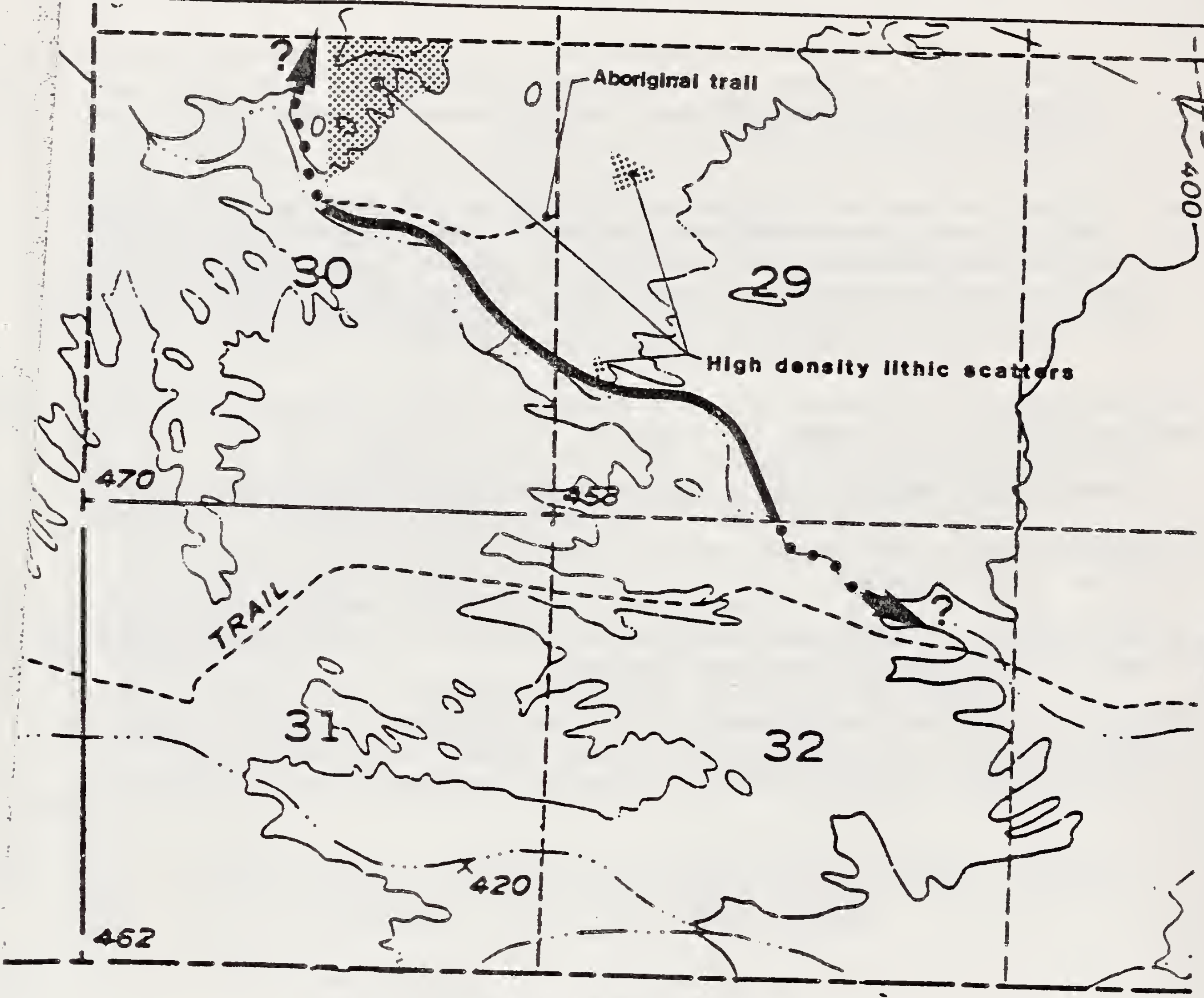


Lithic Concentrations and Features

KEY

Site boundary ⌒

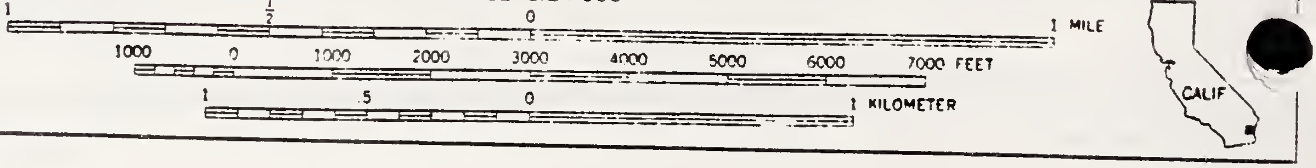
Undetermined site boundary ●●●➤?

High density lithic scatters ▨

Low to moderate lithic areas (unmarked)

PALO VERDE MTS. QUADRANGLE
CALIFORNIA

SCALE 1:24 000



'R 422F (Rev. 8/32)