SCRATCHING THE SURFACE OF CERAMICS IN THE COLORADO DESERT: PETROGRAPHIC AND NEUTRON ACTIVATION ANALYSIS OF THREE LOWER COLORADO BUFF WARE POT DROPS

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1. INTRODUCTION

Data recovery of three pot drops followed an inventory and evaluation of cultural resources along the Imperial Irrigation District's (IID) A3-Transmission Line (Schaefer and Pallette 1997; Schaefer and O'Neill 1998). The pot drops occurred in the Area of Potential Affects (APE) for the proposed pole replacement and partial re-routing of the A3-Line. The pot drops are located in an IID right-of-way through lands administered by the Bureau of Land Management, El Centro Field Office. In compliance with Section 106 of the National Historic Preservation Act, the pot drops were determined to be not eligible for the National Register of Historic Places. Although there was no obligation to further treat these pot drops, IID elected to conduct data recovery in order to retrieve what cultural information the sherd scatters might still contain because direct impacts were expected from the project. The recovery was undertaken under ASM Affiliates's Cultural Resource Use Permit with BLM.

Among the most ubiquitous of prehistoric archaeological sites in the Colorado Desert are ceramic scatters or "pot drops", remains of accidentally or intentionally discarded vessels most often found along trails and routes of travel. Such sites played an important role in Malcolm Rogers development of a Patayan ceramic chronology (Rogers n.d., 1936, 1945; Waters 1982a:276). In the absence of stratified archaeological sites, Rogers developed a "horizontal trail stratigraphy". Some trail segments were found to be abandoned and when cut by erosion were replaced by new routes. Sometimes obsolete trails were symbolically closed with rock alignments and replaced by new intersecting routes. In other places, ceramics were apparently ceremonially placed on trail shrines. Observed differences in ceramic types associated with these trails could therefore be used to date the types, at least relatively to each other. Additional chronological control was also provided by associations with ancient Lake Cahuilla. Rogers also found significant difference in ceramics along trails that ran through different historically documented tribal territories.

While some progress has been made in refining Rogers ceramic sequence and in finding meaningful cultural significance to prehistoric ceramic variability (see Schaefer 1994a), considerably more needs to be accomplished, especially in the Colorado River area where buried or stratified archaeological sites are extremely rare. Refinements to dating, defining spatial distributions, and deriving new meaning come with each technical study of ceramics in the Colorado Desert (see Schaefer 1994a). This modest examination of three pot drops is hopefully a contribution to that goal.

ACKNOWLEDGMENTS

Thanks go to G. Edward Collins of IID for his support and patience during the course of this study. Associate Archaeologist, Ken Victorino supervised the team for this data recovery. Thanks go to Dr. Hector Neff and his staff at the Research Reactor Center, University of Missouri-Columbia, for their continuing efforts with Colorado Desert ceramics analysis. I am especially grateful to Dr. John Hildebrand of Scripps Institution, La Jolla, under whose grant the

NAA study was conducted and who provided facilities for thin-sectioning sherds and photomicroscopy. As ever, Marcia Sandusky overcame all challenges involved with formatting my drafts. Robert Mutch prepared all the graphics for this report. To all, I am deeply grateful.

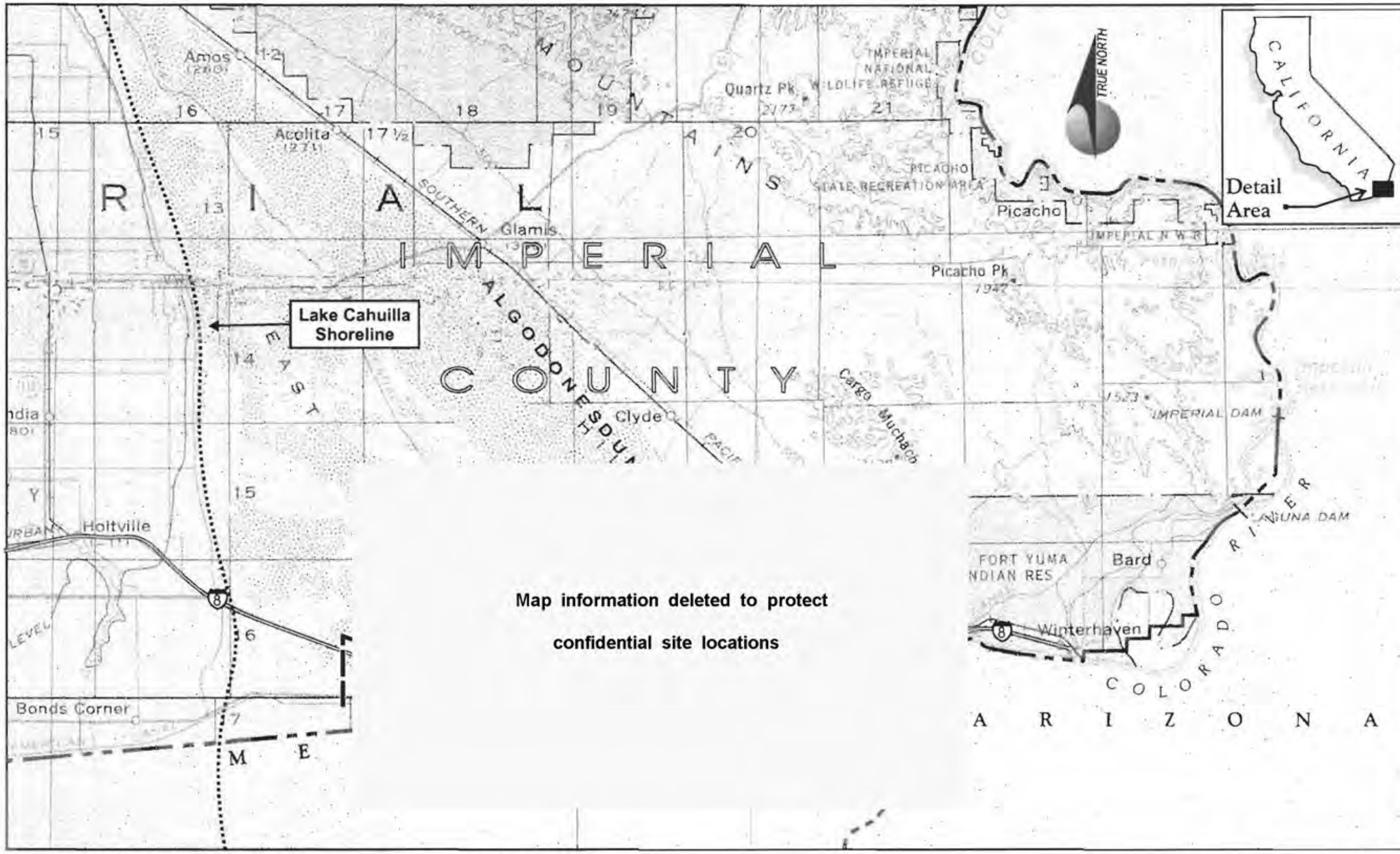
2. NATURAL AND CULTURAL HISTORY

The A3-Line ceramics project is in the East Mesa topographic zone, which is characterized by shallow dunes stabilized by desert creosote scrub community and overlying an alluvium of fines sand and pebbles (Figure 1). The western portion of the project area is almost entirely flat open desert with extensive growths of creosote. To the east are the Algodones Dunes, also known as the Sand Hills, which may have been produced by prevailing westerly winds that blew material off the exposed bed of Lake Cahuilla during interlacustral periods. The dunes increase in size toward the eastern portion of the project.

The project area lies within the Colorado Desert region, a subarea of the Sonoran Desert (Sharp 1972:34-41). Few areas of North America are hotter and dryer due to the Peninsular Range rain shadow and very low elevation. Current climatic conditions provide for mild winters and dry, hot summers. Yuma weather records indicate mean winter lows of 44° F and a mean summer temperature of 104° F. with records as high as 120°F. Precipitation in the region is insignificant, with less than 2.5 inches being provided by sporadic winter rains and a few, often violent, summer thunderstorms. The only nearby permanent water source is the Colorado River. As a result, the region's vegetation is sparse and widely distributed. Elevations within the project area range from 115 to 130 feet AMSL.

The most important natural phenomenon with relevance to the pot drops discussed below is the periodic floodings of the Salton Basin by the Colorado River, forming ancient Lake Cahuilla. The archaeological sites along the relic shoreline of Lake Cahuilla and along trails connecting it to the populated Colorado River Valley are an irreplaceable record of prehistoric adaptations to a dynamic environmental phenomenon. In one of the hottest and driest deserts in North America, wetland habitats suddenly emerged from the natural diversion of the Colorado River into the Salton Sink. Lasting for decades or centuries at a time, the lakeshore would then periodically recede, estimated to take about four times longer than the approximately 16 years it took the lake to form. Each time the lake filled, Indians from the Colorado River to the east and the Peninsular Range and desert fringes to the west established seasonal settlements along the sandy beaches of the shore line. Especially favored locations where sand bars that formed marshy embayments or where creeks or washes ran into the lake. The lake provided abundant fish, a species of freshwater mollusc, migratory waterfowl, cattail reeds, and other marsh vegetation. Mesquite groves also thrived in the surrounding desert fringe, providing seed pods that were a highly nutritious staple (Wilke 1978; Schaefer 1994b).

With regards to efforts at dating the infillings, Laylander (1994, 1995, 1997) conducted the most recent appraisal of 85 radiocarbon dates from archaeological investigations over the past 35 years. He organized the dates into those from maximum elevation shoreline sites and those from recessional sites, discerning a minimum of six clusters. T-tests of statistical contemporaneity indicate the probability that the clusters represent three infilling periods and three recessional periods over the last 1000 years, at least two of the infillings which were to the 40 ft. shoreline. (Laylander did not consider the A.D. 700-950 phase for which there are a number of radiocarbon



Adapted from: USGS 1:500,000 State of California (southern half) Compiled 1968, Revised 1983

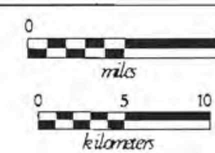


Figure 1. Project location, pot drops, and associated sites.

dates.) His conservative analytical approach provides a weighted mean estimate of each phase but not the duration of each phase or of fluctuations within each phase. Four of the phases correspond roughly to both Wilke's (1978) and Water's (1983) reconstructions, but without the interpreted date ranges made by them. In summary, Laylander's dates indicate a full flooding in the thirteenth century, a recession in the late fourteenth or early fifteenth century, another infilling in the fifteenth century, a recession in the late fifteenth or early sixteenth century, a final filling in the seventeenth century, and a final recession at the end of the seventeenth century.

The seventeenth century infilling and recession is one not previously acknowledged but which has been clearly demonstrated by recent archeological investigations. In fact, almost half of Wilke's dates were less than 400 years B.P. for which he provided thoughtful alternative explanations (Wilke 1978). They had to be reconciled with historical accounts, beginning in 1540 with Hernando de Alarcón's navigation of the lower Colorado River. He could not have accomplished that feat if the Colorado River flowed into the Salton Basin instead of through the delta to the Gulf of California. From that time on, the longest gap between historical accounts of Colorado River navigations or overland visits was 95 years. Don Juan de Oñate's A.D. 1604-5 overland expedition descended the Bill Williams River and followed the Colorado River down to the delta, observing no diversion to the Salton Basin. Kino was next to reach the confluence of the Colorado and Gila rivers in 1700 and wrote of no great lake to the west. In fact, he observed the river slowing south to the Gulf of California through a telescope perched on a mountaintop. Wilke cited this information and inconclusive bead and ceramic assemblage data to discount a protohistoric phase of Lake Cahuilla.

Radiocarbon dates from several recessional fish camps and other habitation sites with abundant lacustrine resource remains have now been recovered that demonstratively prove Lake Cahuilla existed in the seventeenth century, between the visits of Oñate and Kino (see Schaefer 1986, 1994b, 2000; Apple et al. 1997; Laylander 1994). Comparable dates derive from natural peat deposits at several locations along the Lake Cahuilla shoreline (Gurrola and Rockwell 1996; Thomas and Rockwell 1996). The Cahuilla Indian stories of fishing at Lake Cahuilla may therefore have been passed down through fewer generations than previously thought. Questions remain, however, as to whether this infilling was partial or extended to the maximum shoreline. Given the number of late dates from sites in 40 ft. elevation contexts, it probably was a complete infilling.

Late Prehistoric Period (Patayan) (1,500 to 100 yrs BP)

The archaeological pattern defined for the Late Prehistoric Period in the Colorado Desert and western Arizona is called the Patayan, a term derived by Colton (1945) from a Walapai word for "old people". The Late Prehistoric period is divided into four phases, including a pre-ceramic transitional phase from 1,500 to 1,200 yrs B.P. and three subsequent phases (Patayan I-III). Dates and cultural lifeways associated with each phase are imprecisely understood, especially the earliest phases in the Colorado River Valley where habitation sites are concealed under alluvial deposits or destroyed by modern agriculture. The eastern Colorado Desert pattern will be emphasized here given the project location. In the absence of archaeological remains the Patayan cultural pattern is largely based on ethnographic example (see Forbes 1965; McGuire and Schiffer 1982; Weide 1976). Housing was typified by jacal structures, semisubterranean pit houses, simple ramadas, or brush huts, depending on the season and settlement type. They were dispersed in seasonal settlements with larger rancherias located on the upper terraces of the Colorado River during seasonal flood phases, and on the flood plain during planting and growing season. Fish, wild plants, and animals were important components, perhaps accounting for 50 percent or more of the diet depending on the season and environmental perturbations (Castetter and Bell 1951). Away from the river, a hunting and gathering lifestyle focused on seasonal temporary camps at reliable water sources and specialized resource collecting sites. The major innovations of this period are the introduction of pottery making by the paddle-and-anvil technique around 1,200 yrs B.P. and the introduction of floodplain agriculture at about the same time (Rogers 1945). Exact dating of early domesticates is lacking (Schroeder 1979). Both these technological advancements were introduced from either Mexico or through the Hohokam culture of the Gila River (Schroeder 1975, 1979, Rogers 1945, McGuire and Schiffer 1982). The flooding of Lake Cahuilla, referred to above, corresponds to Patayan II, 950 to 300 yrs B.P., although there were certainly earlier stands as well that predate the Late Prehistoric period.

At this time between A.D. 1000 and 1700, desert peoples of this region shifted focus somewhat from the Colorado River floodplains to a more mobile, diversified resource procurement pattern with increased travel between the Colorado River and Lake Cahuilla (Pendleton 1984). An array of archaeological sites along the eastern shoreline have been previously investigated (Gallegos 1980, 1986; Schaefer and Moslak 2001; von Werlhof and McNitt 1980; von Werlhof et al. 1979). 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 (von Werlhof 1988; Johnston and Johnston 1957; Johnston 1980). These trails are often found associated with pot drops, trail-side shrines, and other evidence of transitory activities. In fact, the project area could well have been part of the natural transportation corridor between Lake Cahuilla or Salton Trough and the Colorado River, as will be discussed at the conclusions of this study.

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 are difficult to determine. The Patayan III phase emerged with the final recession of Lake Cahuilla about A.D. 1700. Some questions remain as to whether to define the beginning of the Patayan III by ceramic types, in which case one of the hallmark types, Colorado Buff, appears by about A.D. 1600 before the final infilling of Lake Cahuilla (Schaefer 1994a). The Patayan III is marked by more exclusive use of the Colorado River floodplain and adjacent areas, and some floodplain agriculture along the New and Alamo Rivers, in a mixed horticulture/hunter-gatherer economy. On the west side of Lake Cahuilla, hunters and gatherers of the Peninisular Ranges no longer included the lacustrine habitat in their seasonal rounds, found new resource bases among the mesquite groves and akali plant communities on the now-dry lake bed, and probably resumed more direct cultural interaction with the Colorado River.

Ethnohistoric Yuman (450 to 100 yrs BP)

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 group which ethnohistorically inhabited the Imperial Irrigation Districts Project area was the Quechan (pronounced Kwut-sán). Their traditional lifeways were documented by Forde (1931) in what remains the standard work. The complexities of their traditional economy, a mix of flood plain horticulture, fishing, and hunting and gathering are detailed by Castetter and Bell (1951). Ethnographies have also been prepared for many of the neighboring groups, as has an area synthesis (Crabtree 1981:40-41; Gifford 1918; Weide 1974:85-87).

The Quechan are a Yuman-speaking group of the Hokan super-family, having linguistic and cultural ties to the Cochimi, Cocopah, Halyikwamai, Kohuana, Kumeyaay, Kiliwa, Walapai, Havasupai, Yavapai, Halchidhoma, Maricopa, and Mohave (Forde 1931, Kroeber 1920). In addition, desert Kumeyaay clans, also known as the Kamia, occupied residential sites throughout Imperial Valley and were permitted a village location at the foot of Pilot Knob (Gifford 1931). The Quechan maintained friendly relationships with the Kumeyaay, Yavapai, Papago and Mohave, but at the time of principal European contact were traditional enemies of the Cocopah and Maricopa to the south and east, respectively. Between 1700 and 1850, the Quechan experienced contracted hostilities with the Halchidhoma to the north resulting in the ultimate displacement of the Halchidhoma from the Colorado River to the middle Gila river. The Quechan lived in dispersed settlements along the Colorado and lower Gila rivers. Today the 33,000 acre Ft. Yuma Indian Reservation remains the center of cultural and political life for the more than 3,000 members of the Quechan Nation (Bee 1981, 1983, 1989).

3. FIELD AND LABORATORY METHODS

Data recovery took place on October 20-21, 1998 under the direction of Jerry Schaefer and Ken Victorino. The same approach was applied to each of the three sites. In each case, the pot drops were recovered as discrete features. The only spatial reference is to the feature, proper, because each was a surface or barely subsurface phenomenon with no other spatial relationships to other cultural features, such as trails, or to other artifacts. There was no need for a permanent datum or to recover the sherds within a grid system. First, pin flags were used to mark the areas of greatest sherd concentration and the spatial limits of the sherd scatter. Then all ceramics were collected and bagged separately. The purpose of segregating surface material was to provide an accurate assessment of how much of each feature lay buried and in the event that any concealed components of a different nature were revealed during excavation. In that event more spatial controls would have been instituted, but no separate components were found. Once all the surface material was collected, shovel scrapes were begun in the zone of greatest surface concentration. Sand and silt was scraped off in 3-5 cm levels and sifted through ⅛ in.-gauge screens. Considerable amounts of buried sherds from the pot drops were discovered this way, but usually not reaching a depth of more than 5-10 cm. In some cases the ceramics were buried under 30-40 cm of accumulated sand especially if the pot drop extended under or near creosote bushes or other vegetation that catches blow-sand. Shovel scraped continued to a depth until no more ceramics were found in the screens. The shovel scraped area was then expanded in every direction, again until no more ceramics were found.

Michael Water's (1982a, 1982b) ceramic typology, based on Malcolm Rogers' (n.d.) laboratory notes was used to identify the ceramics. The author has also made reference to the extensive type collections by both Rogers and Waters at the San Diego Museum of Man.

4. RESULTS

A summary of information about each of the recovered pot drops appears below in Table 1. It is followed by detailed descriptions of each pot drop and macroscopic observations of the ceramics and microscopic petrographic analysis. The last section of this chapter discusses the results of Neutron Activation Analysis.

Table 1. A3-Line Ceramics Data Recovery

Site No.	Ceramic Type	Surface Sherds	Subsurface Sherds	Total	Color and Comments
IMP-7648	Tumco Buff	57	88	145	5R 5/3-5YR 6/6, carbon streak
IMP-7653	Black Mesa Buff	16	43	59	2.5YR 6/6-5YR 4/2
IMP-7722	Black Mesa Buff	86	74	160	5 YR 4/1-5/4

CA-IMP-7648 (SITE IID-1)

Site Description

Situated 3.2 km east of the Brock Experimental Farm, this site consisted of a surface scatter of 57 sherds in a 4 x 2 m heavily deflated area on the east side of some stabilized dunes (Figure 2). The site was 15 m north of the A-3 pole line access road midway between poles. While one rim sherd was reported during the survey phase, none were found during data recovery and it may have been a body sherd mistaken for a rim. Upon recover, the total sherd inventory increased to 145 sherds distributed over an area of 7 x 6 m. Mends could be found for only 31 sherds and this was insufficient to reconstruct the vessel shape. Again, no rim or neck sherds were recovered.

Ceramics

All 145 sherds belong to what appears to be a single Tumco Buff vessel of indeterminate shape. This was a very large vessel with sherd thicknesses ranging between 0.5 and 0.9 cm. The ceramic was originally classified as Black Mesa Buff during the survey because some of the surface sherds exhibited the characteristic surface crazing of this type and there were no rim sherds with which to confirm the designation (Straight rims are specific to Black Mesa Buff and other Patayan I types while recurved rims indicate a Patayan II date specific to Tumco Buff.) Upon recovering a much larger sample of pottery, clearly the majority have the even-walled and finely wet smoothed surface finish as well a hard fracture of Tumco Buff. The fabric is very characteristic for Tumco Buff. It consists entirely of angular unpulverized clay particles with no mineral inclusions, whatsoever. In thin-section with polarized light, the homogeneous fabric is apparent, but with traces of different colored clays resulting from the pronounced carbon streak that every sherd exhibits (Figure 3a). Some of these may also represent crushed sherd temper although macroscopic examination failed to identify any. (White lines represent material separation during preparation of the thin sections while the white dots represent vugs or spaces.)

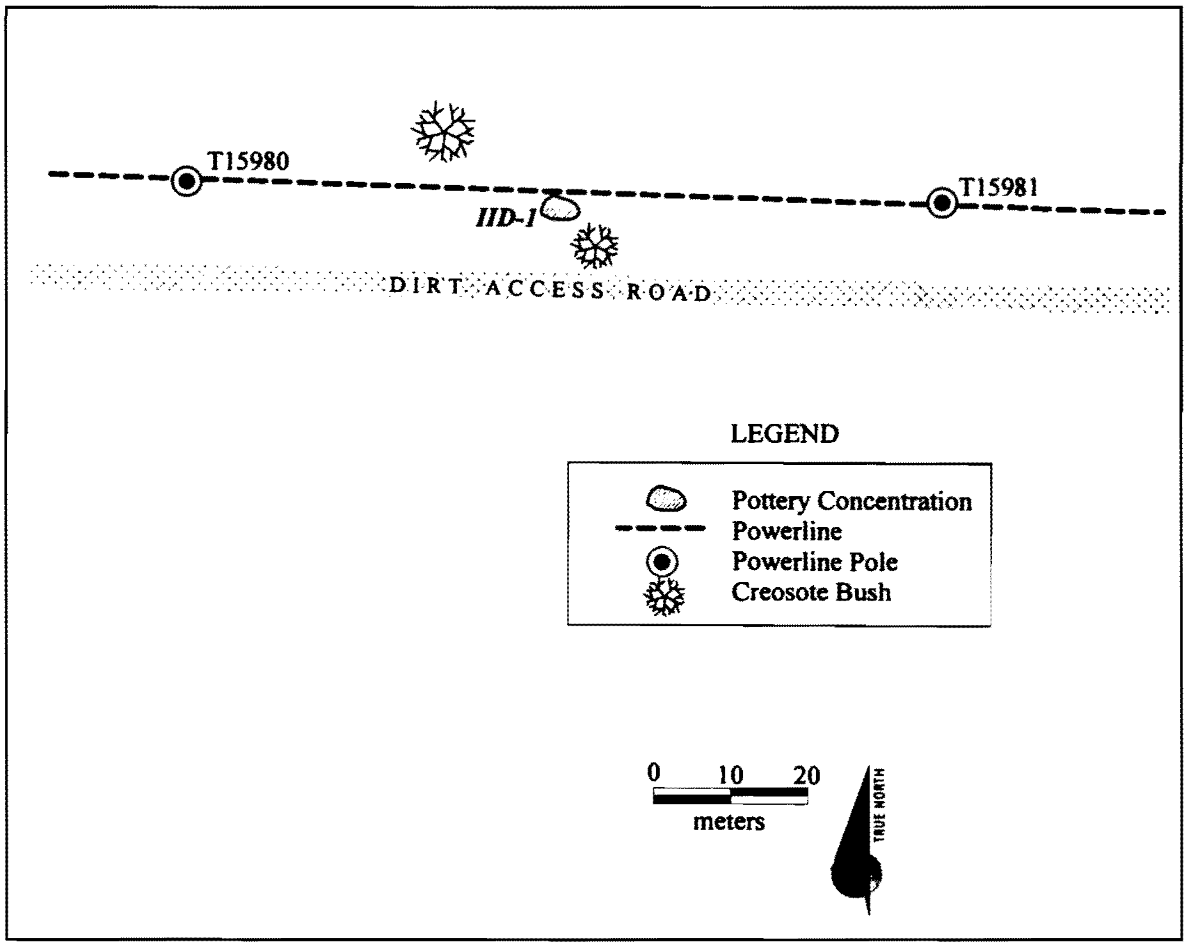
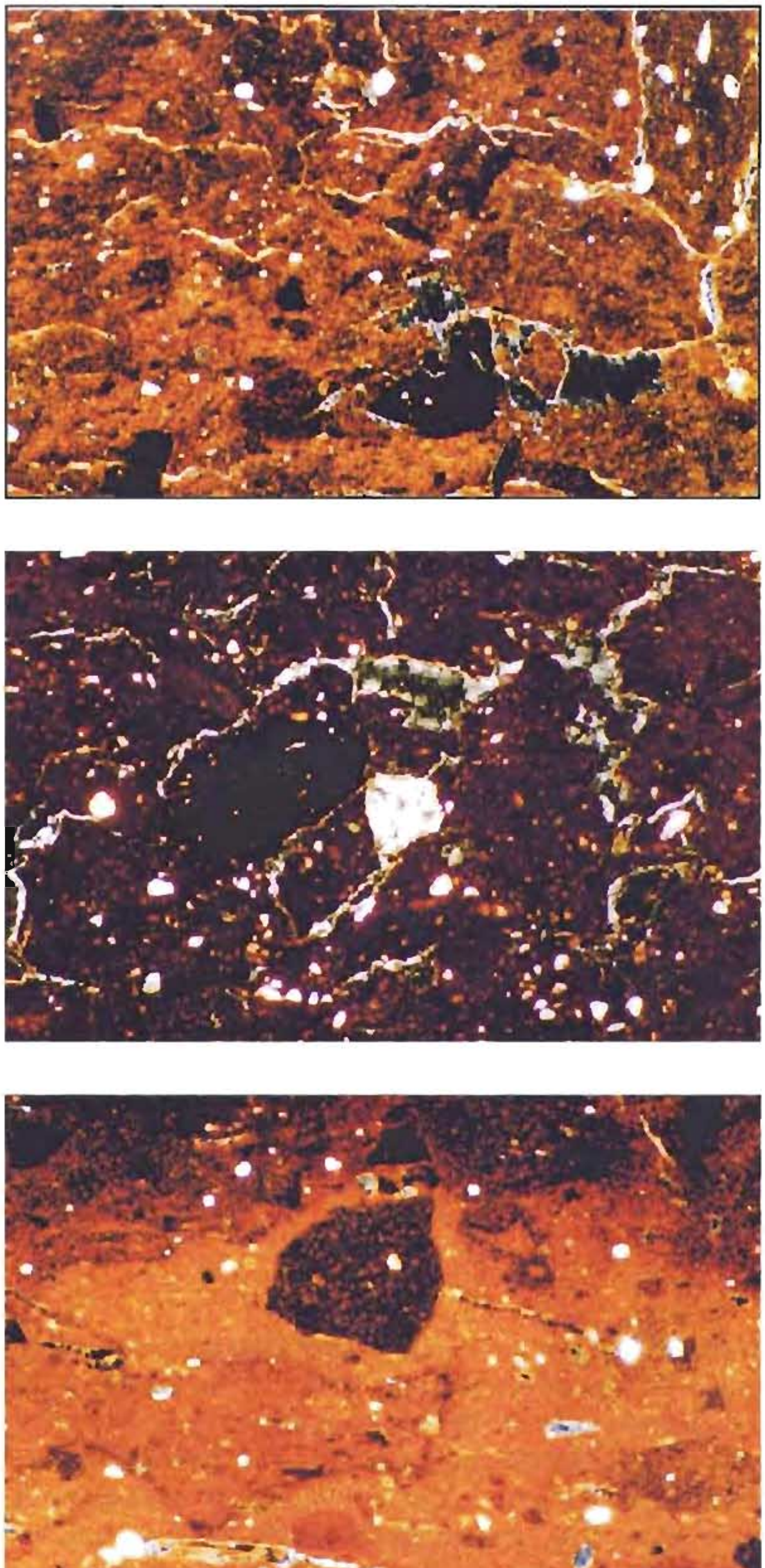


Figure 2. Map of pot drop at CA-IMP-7648 (IID-1).



a)

b)

c)

Figure 3. Polarized light photomicrographs of thin-sections. a) Tumco Buff, CA-IMP-7648; b) Black Mesa Buff, CA-IMP-7653; c) Black Mesa Buff, CA-IMP-7722.

CA-IMP-7653 (SITE IID-5)

Site Descriptions

This small pot drop was located in an open sand and gravel alluvial flat 0.8 km west of the Sidewinder Road exit to Interstate 8. It was situated on the north side of the A3-Line access road and south of the Old Highway 80 berm (Figure 4). There was some disturbance from vehicular activity over the site. Creosote and saltbush are scattered throughout the area and the stump of a dead ironwood tree is located nearby. The surface sherd scatter covered an area of about 6 x 6 m and subsurface testing revealed that most of the subsurface distribution was confined to the same area. Only 16 of the 59 sherds occurred on the surface. The remainder resulted from shovel scrapes to a depth of about 5 cm. A disappointing 25 percent of the vessel was recovered. The largest number of mends (20 sherds) were from the base while only two other mends precluded a reconstruction of vessel shape.

Ceramics

All of the 59 sherds derive from a single large Black Mesa Buff jar. It exhibits the characteristically thick and uneven walls (0.6-0.9 cm) with irregular surface finish. One substantial rim fragment also has the distinctive Patayan I direct rim with roughly finished round lip (Figure 5a). The rim diameter of 16 cm suggests a large-mouthed olla, storage jar, or cooking pot; although there is no sooting on the partially restorable base. One sherd also has the distinctive bevel of a "Colorado shoulder", although it is not pronounced. Unlike most Black Mesa Buff, the sherds have a hard fracture. The paste is a well variegated crushed clay like the later Tumco Buff, but with sparse rounded milky quartz grains and rounded grains of unidentified gray and black minerals, some of which may be quartzite. An unidentified black mineral and quartz grain can be seen in thin section at the center of Figure 3b. The paste also has a conspicuous number of vugs or spaces that are visible as epoxy-filled lines in thin section and small bright white spaces. These are not caused by thin section preparation are clearly visible in broken sherd sections with a 10 x lens.

CA-IMP-7722 (SITE H0903D-1)

Site Description

This large pot drop was located just north of the All-American Canal and just south of the A3-Line, approximately 1.5 km east of the Midway Well exit on Interstate 8. It was located in an open flat sandy area of creosote, burrobush, and Mormon tea (Figure 6). The scatter covered an area of 34 x 17 m and subsurface shovel scrapes were largely restricted to the four areas with the greatest sherd concentrations. The sherds all appear to come from a single vessel despite recovery from four spatially distinct clusters. Almost all the sherds, whether surface or subsurface finds, were heavily worn by wind-blown sand. This suggests the scatter has been repeatedly covered and uncovered by shifting surface sediments. Very few sherds could be mended because of the heavily worn edges and fragmentary nature of the sherds. Four rim sherds were present, two of which were mended.

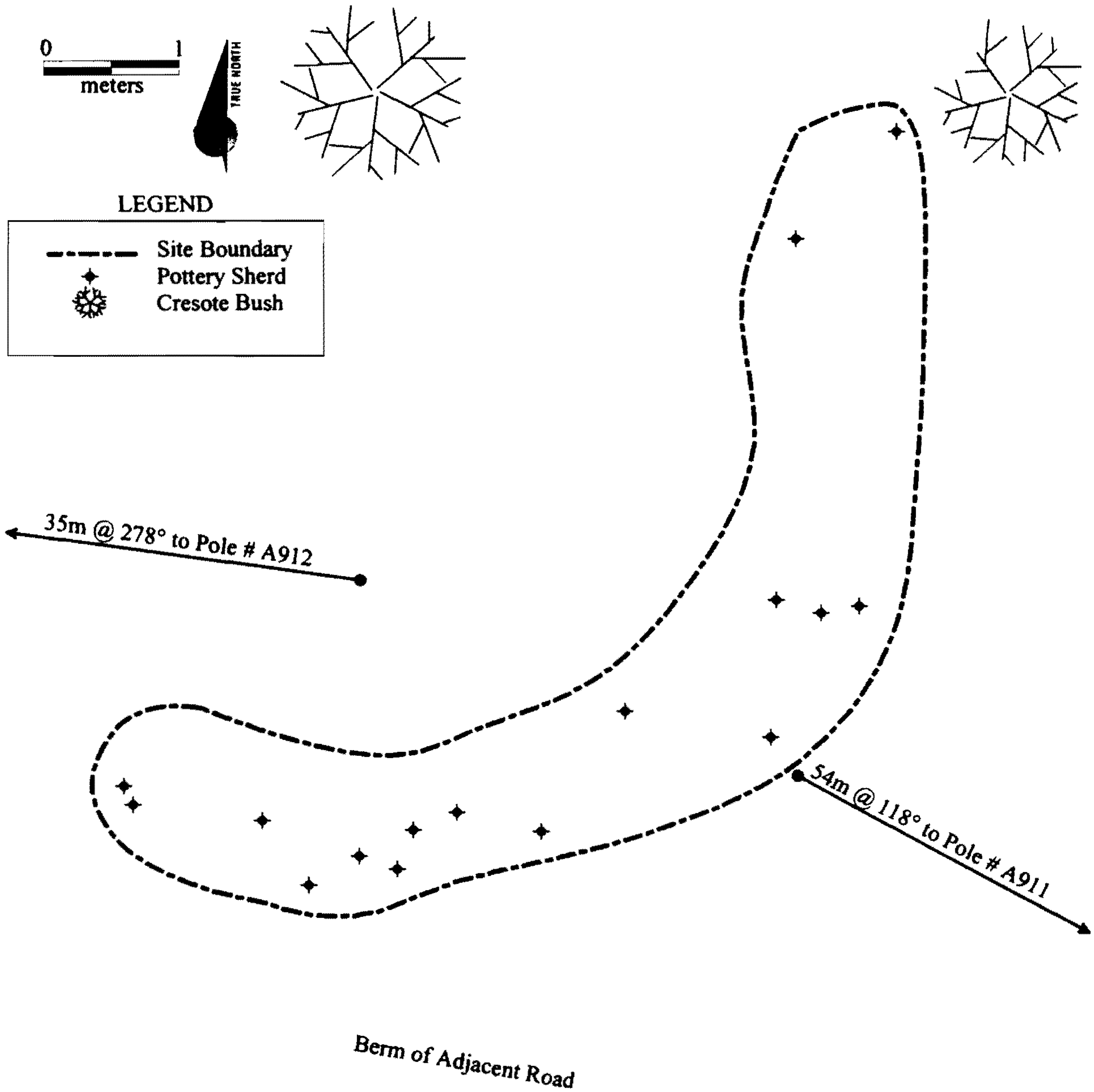


Figure 4. Map of pot drop at CA-IMP-7643 (IID-5).

Ceramics

The sherds were originally typed as Tumco Buff during the field survey (Schaefer and O'Neill 1998:13) because field sketches of rim sherds suggested some recurve. Upon recovering the rims, they were observed to be barely recurved and with the laboratory examination of the entire assemblage, the pot drop has been reclassified as Black Mesa Buff. The vessel is a large mouthed jar with a rim diameter of 22 cm. It is of indeterminate shape but with a straight rim and square lip (Figure 5b) . Wall thicknesses are relatively even but vary between 0.4 and 0.8 cm. The surface finish is moderately even and exhibit only a small amount of crackling. Fracture is harder than expected for this early type. The paste is a well variegated crushed clay like the later Tumco Buff, but with sparse and very small rounded milky quartz and quartzite grains, some of which can be seen in thin section (Figure 3c). The fabric of the body sherds has three distinct layers caused by a well defined carbon streak. The thin section illustration shows the interface between the well oxidized interior layer (bottom) and the darker central carbon streak (top). Much of the exterior is a light gray color (not shown). The darker large grain near the center of the thin section illustration is a carbonized clay particle at the carbon streak interface.

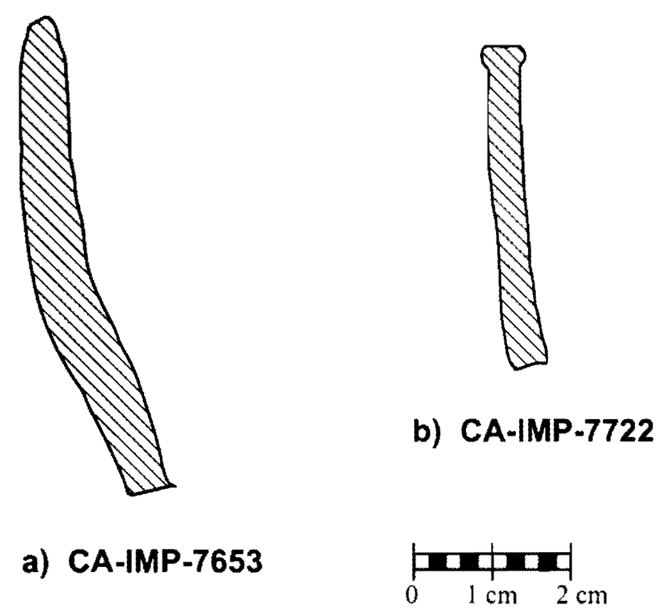


Figure 5. Black Mesa Buff jar rim profiles from a) CA-IMP-7653 and b) CA-IMP-7722.

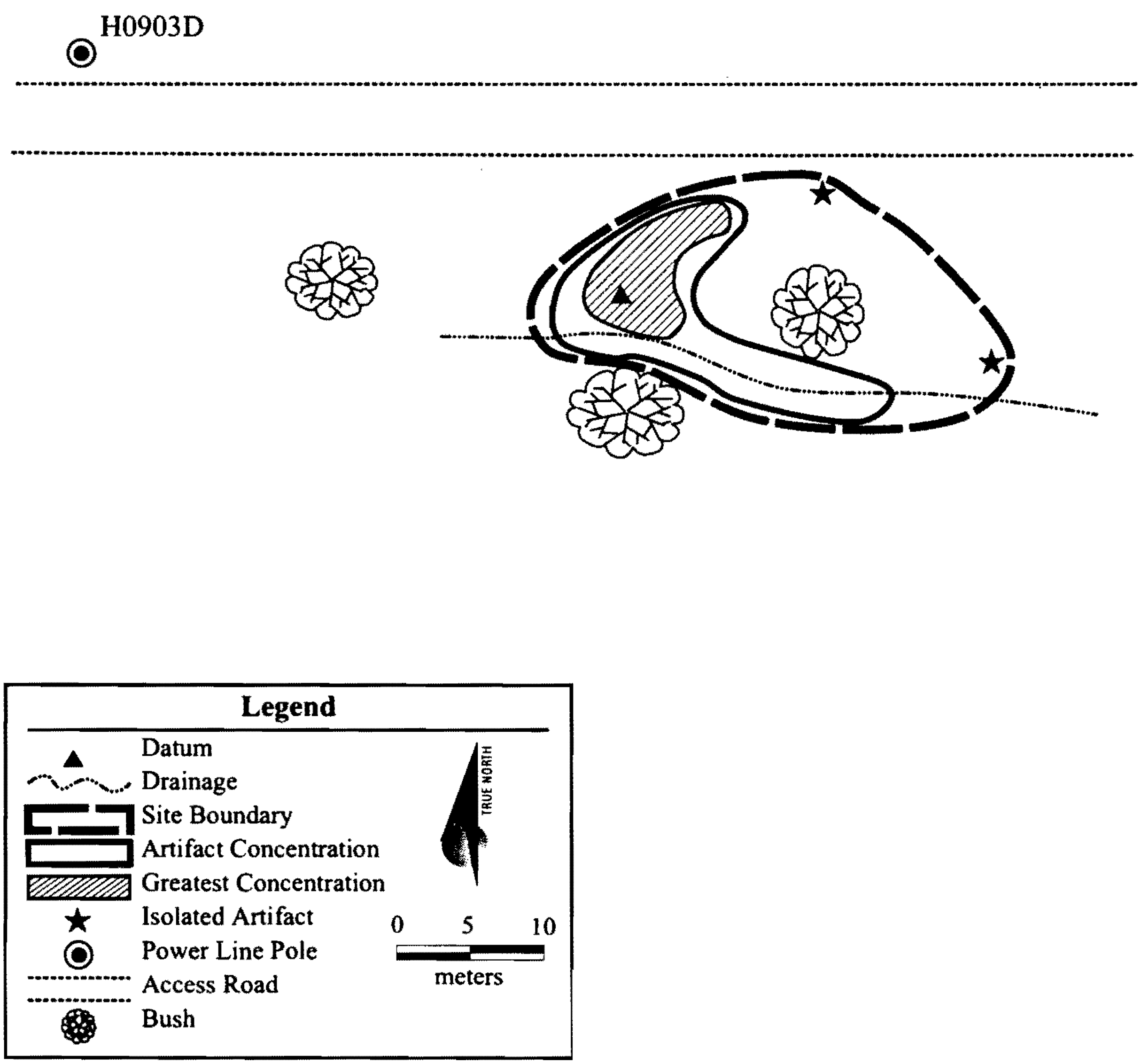


Figure 6. Map of pot drop at CA-IMP-7722 (H0903D-1).

NEUTRON ACTIVATION ANALYSIS

One sample from each of the three pot drops was submitted to Dr. Hector Neff of the University of Missouri-Columbia Research Reactor Center for Neutron Activation Analysis (NAA). In addition, similar results are included from a fourth sherd from a pot drop (IMP-7652) that was recorded during the survey but was not recovered. The purpose of the examination was to characterize the chemical composition of the ceramics and also to contribute to an expanding data base of southern California ceramics. Interpretations of the first 100 contributions of this data base are in print (Hildebrand et al. n.d.) and these additional sherds, along with many others from throughout the region, bring the data base to 370 analyses (Neff 2001). The results presented here replicate the first study with regard to the Lower Colorado Buff Ware assemblage.

The sherds were prepared according to standard MURR procedures (Glascock 1992). Elemental concentrations were derived from two irradiations and three gamma spectra counts to assay a total of 33 elements. Based on results from previous studies, nickel was dropped from the data analysis as it always fell below the level of detection. Concentration data from the 32 remaining elements were subjected to principal components analysis to distinguish source-related subgroupings of sherds and clays. This method provides a series of linear combinations of the concentration data, that can be arranged in decreasing order of variance subsumed. Hypothetical sherd groupings can then be evaluated by application of Mahalanobis distance multivariate statistics (Bishop and Neff 1989) which are then converted into probabilities of group membership for individual specimens (Table 2). Each specimen is removed from its presumed group before calculating its own probability of membership (Baxter 1994; Leese and Main 1994).

Table 2. A3-Line Ceramics Neutron Activation Analysis Results

Lab No.	Cat No	Material	Ceramic Type	Site No.	Provenience	Chem '01 Assign.	Probability
SIC 204	1	Pottery	Tumco Buff	IMP-7648	Pot Drop	Desert Buff	99.187
SIC 206	3	Pottery	Black Mesa	IMP-7652	Pot Drop	Desert Buff	97.714
SIC 207	4	Pottery	Black Mesa	IMP-7653	Pot Drop	Desert Buff	79.669
SIC 208	5	Pottery	Tumco Buff	IMP-7722	Pot Drop	Desert Buff	95.23

Lab No.	la	lu	nd	sm	u	yb	ce	co	cr	cs	eu
SIC 204	9.4677	36.7321	0.3662	33.1725	6.1766	4.1889	2.4904	74.6766	12.0830	60.0229	10.1329
SIC 206	6.2155	40.5076	0.4383	36.3977	6.9563	5.8136	2.8340	81.3184	13.8215	65.3619	8.8974
SIC 207	10.8039	39.8543	0.3856	35.0213	6.5288	3.5619	2.5612	78.3638	13.0780	67.8805	8.9370
SIC 208	10.7846	44.6686	0.4310	41.6316	7.7351	4.1926	2.8400	90.5905	16.3420	65.5611	10.9002

Lab No.	fe	hf	ni	rb	sb	sc	sr	ta	tb	th	zn
SIC 204	37619.2	5.028	0.00	118.07	0.9051	12.8483	506.90	1.0777	0.7555	12.5607	102.26
SIC 206	36265.5	5.731	48.49	109.37	1.0638	13.0117	356.28	1.0533	0.8370	12.2759	95.06
SIC 207	37422.7	4.437	0.00	114.22	0.9887	12.8710	460.95	1.0677	0.8623	12.9962	115.80
SIC 208	42073.6	4.897	43.90	119.18	1.1686	14.4115	352.41	1.1517	0.9874	13.5737	104.87

Lab No.	zr	al	ba	ca	dy	k	mn	na	ti	v
SIC 204	102.26	145.82	84891.5	566.6	42149.5	4.233	25800.8	596.93	13541.6	4306.2
SIC 206	95.06	165.69	77863.5	674.7	53867.6	4.378	25690.9	728.36	14612.1	2850.7
SIC 207	115.80	115.65	88666.7	805.4	55883.0	4.516	23269.8	592.78	4335.0	4450.1
SIC 208	104.87	152.06	87161.4	702.0	54083.7	5.148	24454.4	728.23	7926.8	3711.5

The thin sections and epoxy-encased sherds from this analysis are now part of a large study collection of analyzed sherds and clay samples from San Diego and Imperial counties. In each case, NAA-processed sherds were portions of the same sherd for which thin sections were prepared. They are presently at John Hildebrand's laboratory at the Scripps Institution, La Jolla, but will be curated and accessible to the public at the San Diego Archaeology Center. NAA samples are treated as radioactive contaminated waste and are no longer available for study.

Of the three pot drops recovered for this project, all fit within the tight cluster of points that characterize the principal components of other types within the Lower Colorado Desert Buff Ware series (Neff 2001). They are discriminated by high concentrations of rare earth elements: potassium, rubidium, cesium, antimony and arsenic, as well as low amounts of sodium (Table 2, Figure 7). Seven clay samples from either Holocene Lake Cahuilla or much earlier deposits in from the Pliocene Palm Springs Formation in the Yuha Buttes area bear the same chemical signatures. It is likely that Pliocene Imperial Formation clays are also similar. (See Morton (1977) for the geographical extent of these deposits). The tight clustering of sherds and clay principal components, no matter which ceramic type or geological deposit, suggests a chemical homogeneity or lack of chemical diversity of sediments that were all ultimately derived from the Colorado River. The current analysis demonstrates that the Black Mesa Buff ceramics that were likely produced on the Colorado River indeed share the same chemistry as ceramics made on the western side of Lake Cahuilla. At present the total sample of desert buff clays and sherd types is insufficient to make meaningful discriminations within this group, if that is possible. Figure 8 also shows the plot of the first two principal components for clay sources (each marked by an "x") projected over the ceramic data distributions (marked by ovals). While there is overlap between desert clays of the Brawley Formation that produce Salton Brown Ware and the desert Buff Ware ceramics, together they are very well segregated from the mountain brown clays and Tizon Brown Ware. Note that many of the clay sources in the mountains do not match the ceramic chemistry, an issue still to be resolved with more clay source prospection.

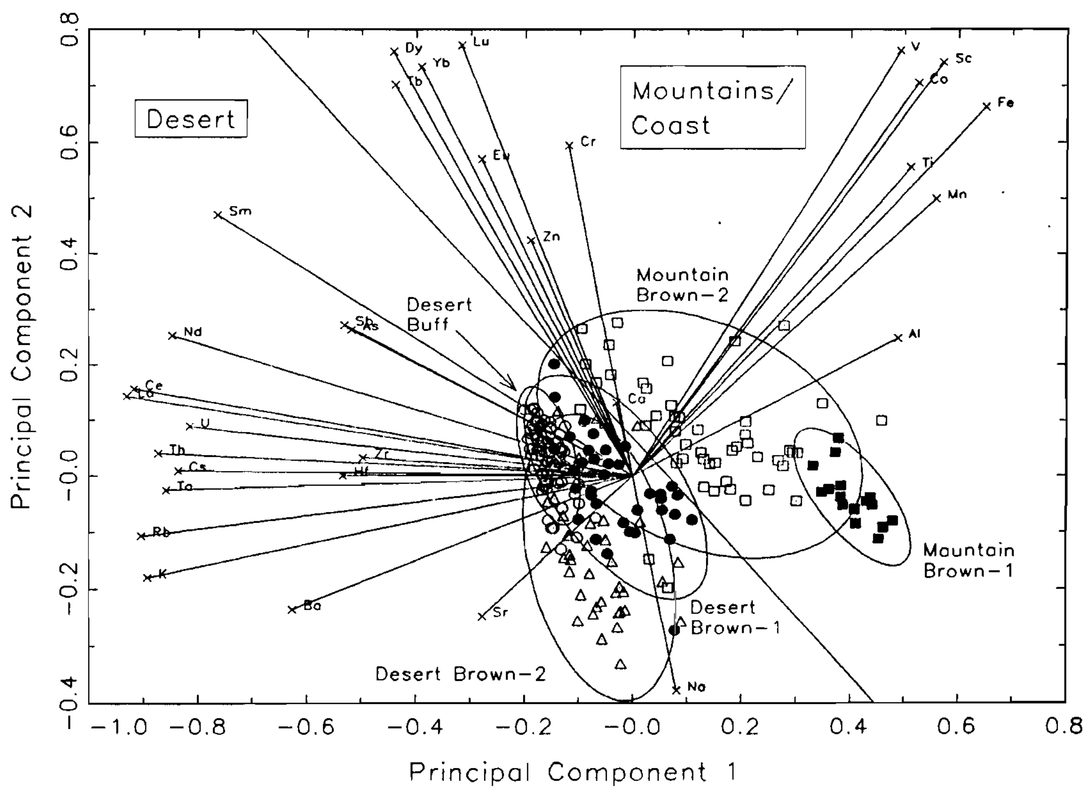


Figure 7. Plot of first two principal components of southern California ceramics (n = 370).

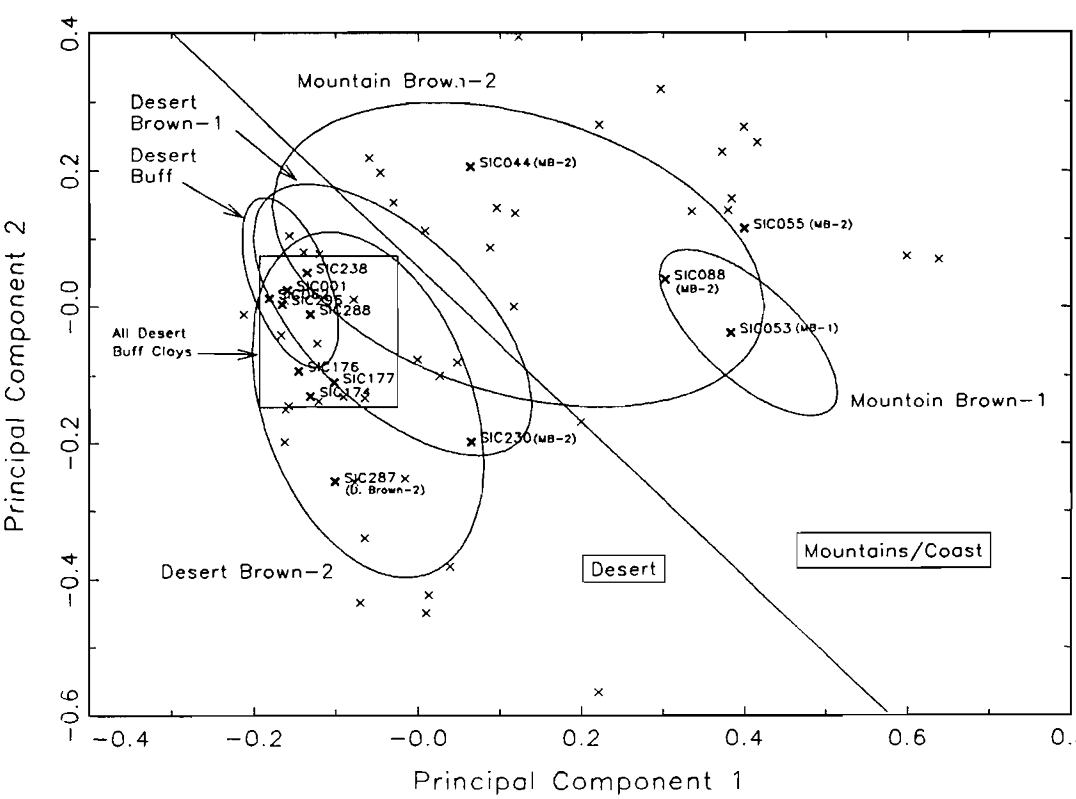


Figure 8. Native clays projected onto first two principal components of southern California ceramics (n = 370)

5. INTERPRETATIONS

Several important conclusions derive from these investigations. The first is methodological and concerns the significance of field observations in loose sands and silts. Under these conditions, even a few surface finds may indicate that a much more substantial assemblage may be buried just below the surface. At each of these sites, as much or considerably more ceramic material was buried just under the surface than what was apparent during the initial inventory. As most archaeologists who work in this area have experienced, artifact counts at previously recorded sites can vary widely with each visit as shifting sands successively cover and expose the artifact scatters. As a result, conclusions about site significance should be tempered by the aeolian or alluvial environment of each site. In all of these cases, however, the initial evaluations of low significance were proven by the data recovery. In fact, much more of each vessel remained missing than had been originally anticipated, and in each case, only a single vessel was represented by each scatter. Most likely, the remainder of each vessel has washed away from the immediate area of the pot drop. It is also possible that portions of the vessel were recovered and recycled by prehistoric peoples. Large sherds can be reformed into plates and scoops by grinding the edges. Sherds from ancient sites can also be crushed for temper in new pottery production, as reported by the Quechan (Rogers 1945:30-31) and Maricopa (Spier 1933:106).

The second conclusion involves the regional transit routes and mobility in the Late Prehistoric period. Pot drops and sherd scatters are the predominant site type adjoining the Interstate 8 corridor across Algodones Dunes and East Mesa, the so-called "Buttercup Pass". This suggests a travel route between the Colorado River and the Salton Trough that appears to have been in use for over 1000 years. The three pot drops recovered for this project are among the only prehistoric finds along the A3-Line, the others being smaller sherd scatters and one isolated chalcedony flake found near Sidewinder Road (Schaefer and Pallette 1997; Schaefer and O'Neill 1998). All five previously recorded sites near the A3-Line were also pot drops and recently Edaw (formerly KEA) recorded another five pot drops or sherd scatters in the same general area (Underwood, personal communication 2002). Similarly, previously recorded prehistoric archaeological finds along the parallel C-Line on East Mesa, west of Gordon's Well, also tend to be either isolated sherds or sherds scatters, some reported to be associated with trail segments. Habitation sites with a diversity of artifact types are noticeably absent or infrequent.

Underwood (2001) found exactly the same pattern on the eastern side of the Algondones Dunes, stretching east from the entrance of Buttercup Pass to Pilot Knob. He recorded 16 pot drops while surveying along a utility corridor, fourteen of which had no other associated cultural materials. Two trail segments were also recorded. An additional six pot drops had been previously recorded in the same general vicinity. Underwood convincingly argues that these pot drops mark a Patayan trail system that extended from the important Yuma crossing and the very large Quechan village of *Xuksi'l*, west through Buttercup Pass, and on into the Salton Trough. This was historically known as the Yuma Trail and was located north of the Spanish De Anza Trail and the later American Southern Emigrant Trail that skirted the southern end of the Algodones Dunes rather than attempt a dune crossing. The pot drops of this current study very likely remain from activities on the Yuma Trail at the western approach to Buttercup Pass.

The array of ceramic types indicate the trail system was used throughout the Patayan cultural sequence in the Late Prehistoric Period. It was very likely used even before then. Travel along the trail may have been especially regular during periods of Lake Cahuilla infillings, hence the presence of Tumco Buff in our collection. The Black Mesa Buff (tentatively dated between A.D. 700-1000) could either represent travel during an interlacustral Patayan I phase or during the beginning of a lacustral phase that is tentatively dated between A.D. 950-1150 (Waters 1983). There could have been any number of cultural factors for travel to the Salton Trough and points west in this early period but our understanding of this early period remains scant at best.

CA-IMP-69, a specialized occupation site with abundant ceramic finds, is one type of destination to which the Yuma Trail may have lead. The Archaeological Survey Association (ASA) collected over 1,000 sherds from this large site that is located at 135 ft. above sea level between the Algodones Dunes and the Coachella Canal, some 8 km northwest of Interstate 8 and Grays Well (see Figure 1). Stuart Peck (1953) did a commendable job of describing and attempting to classify the sherds prior to any generally accepted ceramic typology. The site, numbered 4-IM-11 by ASA, was interesting for a number of reasons. It covered a very large area but very few artifacts except ceramics were observed on the surface. A few chert flakes, one metate fragment, a stone disk, three projectile points, and one cremation were present. Although not connected with the Lake Cahuilla shoreline, the site may remain from centuries of specialized resource collecting where water would accumulate in blow-outs and interdunal depressions on the western flanks of the Algodones Dunes. The ceramics appear to span the entire Patayan cultural sequence. Jar and olla rim forms range from direct (Patayan I) to recurved (Patayan II-III). Peck's ceramic types were based on color, a dubious diagnostic attribute, but descriptions of temper and illustrated rim forms suggest Black Mesa Buff, Tumco Buff, Salton Buff, Parker Buff, and possibly Colorado Buff. Sooted stucco coatings on some sherds indicated cooking activities at the site. Sites such as this suggest that the western side of the dunes may have been a seasonal destination in addition to places like the Lake Cahuilla when it was present.

I hope that this examination of three pot drops provides a basis for more ambitious and regionally expansive research on the question of Patayan ceramic use and cultural interaction along major transit corridors. Although individual pot drops would appear to have limited research value, this study demonstrates the potential exists for more substantive contributions that can be made if a large sample were obtained across specific cultural landscapes.

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