Ceramics from Lovejoy Springs, a Western Mojave Desert Waterhole

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Abstract

All known ceramics from the Lovejoy Springs site, CA-LAN-192, have been analyzed. The pottery derives from recent excavations (Price et al. 2009) and from 90 years of surface collecting. If the present ceramic analysis had omitted the surface collections, it might be concluded that the site's ceramics consisted entirely of locally made brown ware. The surface specimens include the following types: Lower Colorado Buff, Southern California Brown, an intermediate brown/buff ware herein called California Desert Intermediate Brown, and Hohokam Red-on-buff. This expanded sample indicates that many exotic ceramics were brought to the site over the centuries. All the ceramics that were not brown ware were surface collected between 1920 and 1968. In addition to unmodified potsherds, the earlier collections contained perforated and unperforated disks as well as worked sherds used as scraping tools. The ceramics from Lovejoy Springs provide evidence of long-distance importation. It is uncertain who brought the many different types of pottery to the site. Were they transported by their makers, by intermediaries such as Mojave traders (see Kroeber 1925:612; Davis 1961), or by local residents after visiting surrounding areas?

Ancient people and goods traveled west from the lower Colorado region through the Mojave Valley and also traveled north from the San Bernardino Mountains across the desert to Lovejoy Springs. Petrographic analysis demonstrates that brown ware ceramics at the Lovejoy Springs site were likely made from local clays and that none of the sampled clays derived from the Panamint/Owens Valley region to the north of Antelope Valley; this supports Sutton's (1989) proposed boundary between these areas. The ceramic collection from Lovejoy Springs provides a tantalizing glimpse of the rich diversity of cultures that visited or resided at this desert waterhole over the centuries.

The Ceramic Sample

The ceramic sample from Lovejoy Springs (Figure 1) derives from five investigations: (1) a surface collection by Bob Wubben (BW); (2) a surface collection and test units excavated by the Archaeological Survey Association of Southern California (ASA); (3) a surface collection by the University of California at Los Angeles (UCLA); (4) a test excavation by Cerro Coso College; and (5) test units excavated by Applied EarthWorks (AE) prior to recent construction activities in 2005. One hundred and sixteen items (not counting fragments of the same item) comprise the combined ceramic sample (Table 1): 107 sherds are fragments of utilitarian vessels, seven sherds have been reworked into other tool forms, and two specimens are low-fired or unbaked clay. Only eight vessel rims (7 percent), compared to 99 body sherds (93 percent), were recovered. Clearly, the earlier collections contained the most diverse ceramic forms. Table 2 describes the surface and subsurface distribution of the sample. Sixty-nine sherds (64 percent) were collected from the surface and represent the broadest range of variation in ceramic types. Thirty-eight sherds (36 percent) came from excavations.

The largest and most diverse sample (79 specimens; 66 percent of the total ceramic sample) was surface collected in 1954 by the ASA. Precise information on the location of ASA's investigations is unknown. Reportedly the investigations centered on an area later destroyed by construction. The ceramics recovered by ASA include a wide range of buff and brown wares, all but one of the worked sherd tools, and the bulk of the decorated ceramics including one Hohokam sherd. Only one of the worked sherd disks was collected by Bob Wubben. If the ASA and BW collections had been excluded from the site sample, a very different picture

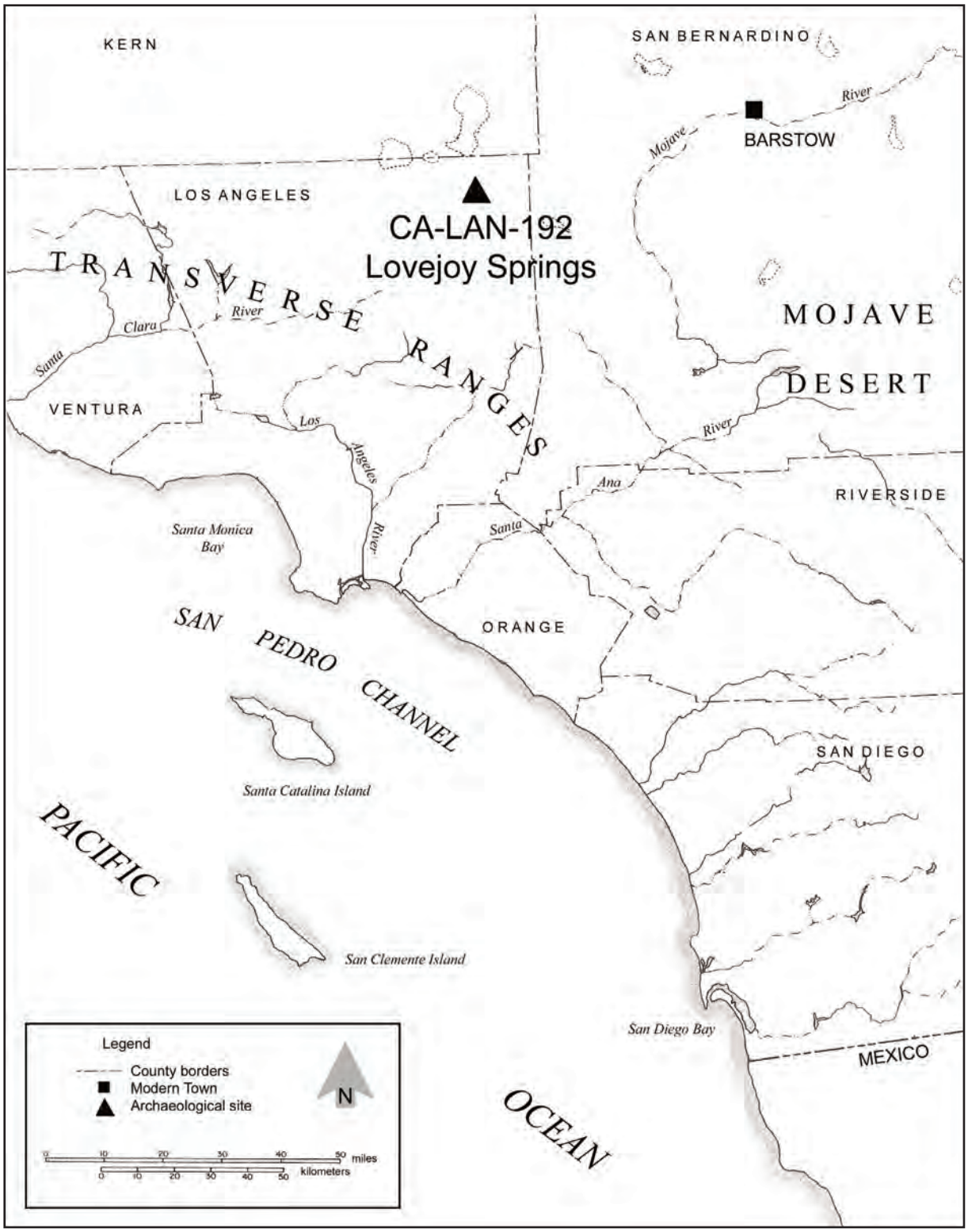

Figure 1. Location of the Lovejoy Springs site in northeastern Los Angeles County. By Rusty van Rossmann.

Table 1. Origins of the CA-LAN-192 Ceramic Sample.

Collector	Coll. ID[1]	Year Collected	Sample Type	Rims	Body Sherds	Worked Sherds (WS)	Other	Total
BW	7	1920s	Surface	–	–	1 disk	–	1
ASA	4	1954	Surface/Test Exc	6	67	4 disks; 1 WS; 1 WS?[2]	–	79
UCLA	6	1968	Surface	1	4	–	–	5
Cerro Coso	5	1989	Test Exc		1	–	1 baked clay (4 fragments)	2
AE	11	2005	Test Exc	1	27	–	–	28
Unproven.	10	?	?	–	–	–	1 un-fired? clay daub	1
TOTAL	–	–	–	8	99	7	2	116

1. Unique ID number assigned by AE to each collection.
2. Originally classified as a rim; appears to be a neck sherd of a narrow-mouthed vessel that had been reworked as a tool.

Table 2. Stratigraphic Distribution of the Ceramic Vessel Sample.

Collector	Surface	0-10[1]	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
ASA	64	9	–	–	–	–	–	–	–	73
UCLA	5	–	–	–	–	–	–	–	–	5
Cerro Coso	–	–	–	1	–	–	–	–	–	1
AE	–	–	–	2	4	16	1	3	2	28
TOTALS	**69**	**9**	–	**3**	**4**	**16**	**1**	**3**	**2**	**107**

1. ASA's subsurface collection derived from 0–6" below surface.
Note: All levels in centimeters below surface.

would have been drawn of the ceramic industries represented at Lovejoy Springs.

Analytical Methods

The surfaces of each specimen were examined for evidence of manufacturing techniques: degree of oxidation, type and direction of wiping marks and their placement on the vessel, paddle/anvil impressions, degree of smoothness, and presence and type of nonplastics and vugs visible on the surface. Surfaces were also examined for evidence of use wear patterns and residues, post-deposition residues, types and placements of decoration, and decorative elements. A freshly broken edge of each sherd was examined under a binocular microscope to observe gross clay and nonplastic percentages and degrees of mixing, grain shape and size, and mineral content. Rim sherds were coded for vessel rim form, estimated diameter at the rim for sufficiently large rim sherds, and shape and thickness of the rim lip. Rim sherd profiles were drawn, and vessel form was recorded when possible. Worked sherds were examined for evidence of use wear, and they were drawn. Type or ware assignments were made where possible.

Several pieces of baked clay appeared to have basketry impressions. Femo® modeling clay was used to make positive impressions; none was sufficiently clear to enable identification of the kind of basketry,

only that individual stitch impressions were present. Ten sherds were selected for petrographic thin-section analysis. Unfortunately, clay samples were not collected during any of the five investigations, and comparisons to the local geology were restricted to the published literature.

Results

Typology

Archaeologists have long used ceramic types to assign geographic, temporal, and cultural ascriptions. Ceramic typologies are based on changes in ceramic manufacturing techniques, vessel forms, decorative techniques, and design elements. Typological schemas were especially useful in Southwestern archaeology where decorated ceramics are plentiful. Colton and Hargrave (1937) viewed ceramic traditions with a genetic model in mind. Ancestral types produced other types that were "genetically" related but increasingly different the farther they were removed in time or space from the ancestral type. According to their hierarchical classification, pottery can be assigned to a specific localized type within a regional series within the over-arching ware. Colton and Hargrave (1937:2) defined "type" as "a group of pottery vessels which are alike in every important characteristic except (possibly) form." These characteristics include surface color, method of handling the clay, texture of the core, chemical composition of the temper, chemical composition of the paint, and design styles in decorated pottery. According to Colton and Hargrave (1937:2–3), a series is "a group of pottery types within a single ware in which each type bears a genetic relationship to each other …," and a ware is "a group of pottery types which has a majority of (the above) characteristics in common but that differ in others."

The rules for naming types, series, and wares stipulated that names begin with a geographic term followed by a descriptive term (Kidder 1927; Gladwin and Gladwin 1930). A type might be named for a specific site or local area. A series is a regional designation, and a ware should refer to a large geographic area of ceramic types that share the same manufacturing technique and similarly colored clays (e.g., Lower Colorado Buff Ware). In practice, many of the ware designations are broad cultural/regional descriptions (e.g., Hohokam Buff Ware or Mogollon Red Ware), which introduces complications. Pottery traditions may be shared across linguistic and "cultural" boundaries.

There are four primary ceramic manufacturing techniques in the New World: (1) modeling; (2) coiling; (3) molding; and (4) slab building. Modeling involves pinching small bowls or other forms using the fingers to shape the vessel. Coiling begins with a flat pancake of clay for the vessel base on which coils of clay are added in a spiral fashion. Molding involves pouring clay slurry into a vessel mold. Slab building involves pinching the edges of flattened pieces of clay to build larger vessels. Modeling was used to make small bowls, pipes, and figurines, and such items are the earliest examples of baked clay forms in the Southwest and southern California (Griset 2008); they continue to be used to the present. Larger utilitarian pots, however, were built up by the coiling method wherein coils of clay are added to the base to build the walls; this allows for larger, stronger vessels. Two methods are used to shape and thin coiled vessel walls: (1) the excess clay is removed by scraping, hence "coil-and-scrape," or (2) the wall is thinned and shaped by placing a stone or ceramic anvil on the interior of the vessel and striking the exterior opposite the anvil with a wooden paddle, hence the name, "paddle-and-anvil." Puebloan, Owens Valley, and some Great Basin ceramic construction traditions are coil-and-scrape, while Hohokam and Patayan ceramics of western/southern Arizona and Baja California were made by paddle-and-anvil.

In addition to Hohokam Buff Ware of central and southern Arizona, two paddle-and-anvil wares have been identified for western Arizona and southern

California: (1) Tizon Brown Ware (Dobyns and Euler 1958), named for prehistoric ceramics from northwestern Arizona and later extended to include coastal southern California (Euler 1959), and (2) Lower Colorado Buff Ware (Schroeder 1952, 1958; Waters 1982a, 1982b, 1982c), from both sides of the lower part of the river and adjacent desert regions. Both are primarily undecorated plain wares, which makes it difficult to discriminate types and series within each ware.

Malcolm Rogers (1945a, 1945b) developed the first typology of plain wares from the Mojave Sink, the Colorado River, and adjacent desert areas in Arizona and California, but he did not publish his typology prior to his untimely death. His ceramic notes were used by others to publish subsequent typologies in ways that were not always in accord with Rogers' original schema (see Waters' disagreement [1982a:279] with Schroeder's Topoc Buff type). Rogers' (1945b) notes include as many as 75 types, which he was refining when he died.

Schroeder (1952) consulted Rogers' type collections and notes at the San Diego Museum of Man and published descriptions of 30 types of Lower Colorado Buff Ware within six regional series (Parker, La Paz, Palo Verde, Salton, Gila Bend, Lower Gila) (cf. Stein 1978a, 1978b). Schroeder (1958) added a seventh series (Barstow) and ultimately defined 31 types within Lower Colorado Buff Ware (LCBW) including three types previously published by Colton (1939a) (Topoc Buff, Needles Red-on-buff, and Pyramid Gray). Schroeder named a separate type for each surface treatment (e.g., undecorated, red slipped, stuccoed, red painted, and fugitive red wash).

May (1978) also examined Rogers' notes and published a typology for ceramics from southern California; it contained five series named within Tizon Brown Ware (Peninsular, Laguna, Gulf, Mohave, and Mission) and two series of Lower Colorado Buff Ware (Salton and Carrizo). May created separate types for undecorated and decorated ceramics within a series. Waters' (1982a, 1982b, 1982c) examination of Rogers' notes and type collections focused solely on the Lower Colorado Buff materials from the Lowland Patayan cultural area, which consists of the lower part of the river, the areas surrounding the Salton Sea shorelines, and an area only slightly eastward into western Arizona. He listed 17 types, generally a plain and a decorated type for each ceramic tradition, with stucco incorporated as a variant surface treatment on the plain types rather than segregated as another type. Waters did not identify series within his Lowland Patayan ceramic tradition, and he did not use three types listed in Rogers' (1945b) last list (El Rio, Blythe, and La Paz). The more dramatic difference between Schroeder's and Waters' reworking of Rogers' data occurs in the dating of individual types. As seen in Table 3, most are nearly reversed in their chronological placements; only Parker Buff is similar. Most recent ceramic analyses on either side of the Colorado River have used Waters' (1982a, 1982b, 1982c) typology for Lower Colorado Buff Ware (LCBW).

Lyneis (1988d) objected to extending Tizon Brown Ware to southern California without first documenting the ceramic types in the intervening areas between northern Arizona and cismontane southern California. Griset (1996) described the Southern California Brown Ware tradition without identifying specific types and noted earlier (Griset 1986:91) that sherds made from intermediary clays between the coastal mountains and the southern California desert were transitional in color between brown and buff.

Other analysts have begun adding new categories to these typologies, particularly for the transitional areas between the brown and buff burning clays of the California cismontane and desert, respectively. Unfortunately another source of confusion has been added by mixing typological layers in the process. Where Colton (1939a, 1939b) prescribed a hierarchical typology consisting of wares (e.g., Ware 15, Tizon Brown and Ware 16, Lower Colorado Buff), then regional

Table 3. Comparison of Lower Colorado Buff Ware Typologies.

Schroeder (1958)			Waters (1982a)		
Types	**Time Period**	**Griset Observations**	**Types**	**Time Period**	**Griset Observations**
Black Mesa Beige Red Polychrome	post AD 1150–?	Distinctive clay with clay pellets; same in both typologies	***Black Mesa*** Buff Red-on-buff (red wash)	AD 700–1000 Patayan I	–
Colorado Beige Red Red-on-beige	post AD 1150–Historic	Resembles a polished version of Parker	***Colorado*** Beige Red Red-on-beige	AD 700–1050 Patayan I	–
Pyramid Gray *(sample viewed at WACC)*	AD 900–1150	Clay similar to Black Mesa with added crushed granitics	–	–	–
Tumco Buff Red-on-buff Stucco	pre AD 900–post 1400?	–	***Tumco*** Buff (includes stucco) Red-on-buff	AD 1200–1400 Patayan II	Untempered; with crushed clay particles
–	–	–	***Salton*** Buff (& stucco) Red-on-buff	AD 1000–1500 Patayan II	–
Topoc Buff Red-on-buff Fugitive Red Stucco	post AD 1150–?	Erroneously listed as the only type within "Salton" series, contra Rogers	***Topoc*** Buff (stucco) Red-on-buff	AD 900–1150 Patayan II	= Oxidized version of Colton's Pyramid Gray; does not = Colton's Topoc Buff, but similar to Schroeder's samples
Palomas Buff Stucco	post AD 1150–?	–	***Palomas*** Buff (stucco) Red-on-buff	Patayan II & III	–
Parker Buff Buff; Red-on-buff Black-on-red Stucco	pre AD 900–post 1900	–	***Parker*** Buff (stucco) Red-on-buff	AD 1000–Historic Patayan II & III	–
–	–	–	***Colorado*** Buff (stucco) Red-on-buff (red wash, Red-on-red; Black-on-red; Black-on-buff)	AD 1500–Historic Patayan III	= Colton's Topoc Buff & Schroeders? Needles
Needles Buff Buff Red-on-buff Beige Red-on-beige Red Black-on-Red Stucco	AD 1150?– ?	–	–	–	–
Gila Bend Plain Plain Red Beige Stucco	post AD 1150– ?	–	–	–	–

series within each ware, then types within the series, Schaefer's (1995:IX–10) addition of Tahquitz Brown equates it with Salton Brown (a type) and Tizon Brown (a ware). Subsequently, Salton Brown has been proposed as a third ware based on its intermediary clays that are not purely residual or alluvial (Hildebrand et al. 2002). It is unfortunate that "Salton," a term already used to designate both a series and a type within Lower Colorado Buff, was selected to name a new ware.

Perhaps a more generic term that can include additional intermediate clays such as those observed in the Lovejoy ceramic assemblage would remove some of the typological confusion. For the purposes of this report, we have used a geographical/descriptive term, California Desert Intermediate Ware, to describe this tradition of local manufacture with clays that are between brown and buff. Tahquitz Brown and Salton Brown would fit as types or series (if there are multiple types described for each) within this overarching regional ware. Southern California Brown Ware is used to denote the brown ceramics of cismontane southern California formerly lumped under Tizon Brown Ware.

Additional controversy has raged over whether these wares reflect differences in manufacturing techniques, regional geology, or an associated cultural pattern. A pattern of mobile gathering of resources within territories of varying sizes was characteristic of the area in which these ceramics are found, and it is conceivable that the same people could have made both buff and brown ceramics depending on the resources at hand. The area also included multiple linguistic boundaries that are difficult to discern from the homogeneous archaeological pattern. However, there are clearly different vessel shapes in the early buff ceramics that are not found in the brown ceramics. Proposed evolutions of vessel form have not been verified with direct dates; in fact, recent data suggest these differences in shape may not have clear-cut chronologies (Hildebrand 2003). At present, the Yuman/Patayan/Hakatayan debate has evolved in favor of the neutral term, "Patayan," applied to lowland desert ceramics associated with the desert areas on both sides of the lower Colorado River, west to the Transverse Ranges, and east to Wellton, Arizona (Gladwin and Gladwin 1934; Colton 1939b, 1945; Rogers 1945a; Schroeder 1952, 1982; Waters 1982a).

How the Mojave Desert fits into the chronology remains to be discerned. The plain buff and brown ceramics associated with this area remain poorly dated and lack clear typological distinctions. Although the general cultural schema of Patayan I, II, and III (also known as Rogers' Yuman I, II, III) has been confirmed in various locales, few direct radiocarbon dates from deposits with ceramics have been added to the published literature. Cross-dating with intrusive Hohokam sherds has similarly been difficult, although significant gains have been made in narrowing the absolute dating for Hohokam ceramics in the Phoenix and Tucson basins. A gap remains between these southwestern dates and the time of introduction of exotic sherds to the western deserts. As more plain sherds have been dated, there has been some blurring of the formerly rigid divisions between rim/lip forms previously used to distinguish the three Patayan developmental periods (Bayman and Ryan 1988).

The Lovejoy Springs Ceramic Assemblage

The Lovejoy sherds (Table 4) were compared with published type descriptions (Schroeder 1958; Waters 1982a, 1982b, 1982c), Malcolm Rogers' unpublished notes on ceramics from the Mojave and Colorado deserts (Rogers 1945b), and May's (1978) publication of Rogers' notes. Sherd type collections at the Arizona State Museum and at the National Park Service's Western Archeological and Conservation Center in Tucson were consulted, as well as type collections lent by Michael Waters first to Mike Foster of SWCA, Inc. and then to the author. Archaeological ceramic

Table 4. Inventory of Lovejoy Springs Ceramics by Ware and Type.

Ware and Type	Number
Southern California Brown	58
California Desert Intermediate	14
Cronese Red-On-Brown	2
Lower Colorado Buff	3
Pyramid Gray	1
Colorado Beige	2
Colorado Red	3
Colorado Red-On-Buff	1
Parker Buff	15
Parker Stucco	4
Topoc Buff	8
Topoc Red-On-Buff	1
Tumco Buff	1
Hohokam Buff	–
Santa Cruz/Gila Bend Red-On-Buff	1
Total	114

collections from Lake Mead analyzed by Schroeder were also consulted.

Gross categories are discerned by considering combinations of differences in the following attributes:

Surface color:	Brown (containing more iron) versus buff (less iron)
Clay texture/sorting:	Residual (coarse) versus sedimentary (fine)
Nonplastics shape:	Angular versus rounded

Since these attributes can be misleading individually, their combinations must be taken into account. Finely textured sedimentary buff-colored clay may have crushed rock rather than sand added as temper; a brown residual clay may also have crushed rock as a result of grinding the rocky clay. Rogers (1945b) described two brown types specific to the Mojave Sink area (considered in this report under the California Desert Intermediate Ware category): Cronese Brown and Crucero Brown. The latter also has a red variant labeled Crucero Red. They are difficult to separate on the basis of Rogers' notes; Cronese has "residual (?) clay in appearance but due to its pink burning qualities and the fact that the spar with its inclusions are not decomposed, it decomposes easily." Rogers found no visible inclusions to 20 power, but he stated that the temper consists of crushed feldspar, mostly translucent white or pink, with strong biotite embedded in the spar, some hornblende, and traces of specular iron and magnetite. Cronese is usually brown in color but may also appear reddish brown, and it is probably of sedimentary origin.

Crucero Brown is a "rare type," with the same paste as Cronese, yet Rogers (1945b) stated that it burns to seal brown/greenish. Green spar is more common, and the temper is less micaceous and very finely ground. Rogers made no discrimination between naturally occurring nonplastics and purposely added temper, although it would appear that he considered both of these types to have added temper. He stated that Cronese Brown has more bronzite and less magnetite than Crucero, whereas Crucero Brown has a smoother floated surface, occasionally burnished, and there is a type with a burnished red slip. Rogers (1945b) found both types only in the Mojave Sink, with Crucero restricted to the southern portion of the sink. Flat rims occur in both types, which Rogers found difficult to explain since he placed both in the Yuman II period based on horizontal stratigraphy.

Given the paucity of substantive research on Mojave Desert ceramics in the intervening 60 years, seven of the 10 petrographic samples were selected from sherds identified as brown, micaceous brown, or a brown/grey ceramic intermediate between brown and buff; the remaining three sherds were considered to be "buff," but they were also problematic. Miksa (2009) performed the petrographic analysis using a point count technique perfected for ceramics from the

Tucson basin (Miksa and Heidke 2001). Griset's initial macroscopic descriptions and Miksa's petrographic analysis allowed for the division of the study sample into three compositional groups (Table 5).

Interestingly, the three compositional groups identified by point count analysis do not clearly follow the typological distinctions made during the macroscopic analysis. For example, SC1-1-19 (Table 5) was identified macroscopically as buff ware. Miksa (2009) noted that it contained the widest range of rocks as well as grog (ground potsherd), which signified a different manufacturing technique than was observed in the remaining nine sherds; nonetheless, its mineral content places it clearly within Group 1. The "intermediate" and grey sherds also fit into Group 1. In contrast, Group 2 includes a granitic brown as well as a sherd identified as a Topoc buff ware and a Parker buff stucco sherd.

Ideally, the point counts of rocks observed in the sherd thin sections would be compared to sand and rock samples collected from local petrofacies (distinct rock groupings) to identify potential raw material sources. Although we did not have any clay or rock samples from the Lovejoy Springs site nor from the surrounding area to compare to the sherds, the genetically related source materials for all 10 sherds were identified by Miksa (2009) as consistent with a granitic source, likely quartz monzonite. The published literature shows ample sources of quartz monzonite in the western Mojave Desert in an area that begins 80 km west of Lovejoy Buttes, extends 72 km to the northwest, 80 km to the north and northeast, 48 km to the east, and 16 km to the south, according to published geological mapping (Miksa 2009). Miksa concluded that:

> the source(s) cannot be in any of the mountain ranges with common metamorphic, sedimentary, or volcanic rocks. The sherds may be made from a sandy silty clay, or from a somewhat mafic silty clay to which granitic sand has been added. Sample TEU2-29-4 is a compositional outlier; even so, the textural features of its quartz and feldspar are much like the others. The remaining samples fall into two slightly different but related compositional groups. Sample SC1-1-19 is compositionally similar to the other samples but exhibits grog and other characteristics that

Table 5. Classifiation of Sherds Submitted for Petrographic Analysis.

Sample Provenience	Macro Identification	Petrographic Group	Petrographic Notes
4-SC1-1-19	Buff?	1	Widest range of rock, grog, less silt, sand; different manufacture
4-SC1-1-22	Brown	1	–
4-SC1-1-24	Brown	1	Increased mafic minerals
4-SC2-2-29	Brown – intermediate?	1	–
4-SC2-2-37	Cronese - residual, grainy, burnished high spots	1	Increased mafic minerals
5-31-2	Grey, residual, grainy	1	–
4-SC1-1-18	Parker Stucco	2	K feldspar more abundant than plagioclase
4-SC2-2-38	Topoc (pinkish, fine, clayey)	2	K feldspar more abundant than plagioclase
4-SC3-3-18	Tizon/So Cal Brown	2	K feldspar more abundant than plagioclase
11-TEU2-29-4	Brown micaceous?	3	Most abundant plagioclase; increased mafic minerals, volcanics; extremely silty

suggest a different or modified manufacturing technology [Miksa 2009:131–132].

Vessel Shapes and Functions

Six rim sherds, two neck sherds, and one probable basal fragment were identified in the ceramic assemblage, however only five vessel shapes were identified: one bowl, two wide-mouthed pots (ollas), and a medium-wide olla (Table 6; Figure 2). The shapes are reconstructed from rim profiles and diameters, and reconstructed shapes are based on comparison with whole vessels by ceramic types in museum collections. Two Parker Buff rims, both with direct, flat lips, were too small for projecting vessel shapes.

One of the Southern California Brown Ware rims had a wide mouth (34–36 cm); the other had a medium-wide diameter at the rim (10 cm) and carbon deposits on the exterior suggesting that it was likely a small cooking pot. Another medium-wide vessel is represented by the Topoc Buff rim which measures an estimated 20 cm diameter. The other wide-mouthed pot (36 cm diameter) and the only bowl (10 cm diameter) are Colorado Red vessels. The bowl was fairly shallow and small; the small size and the polished red-slipped interior suggest that it was probably used for serving or holding a small amount of food or other valued commodity. No narrow-mouthed ollas, such as might be expected to store or transport water or food, were recovered from the ceramic assemblage.

The two Colorado Red vessels were collected during the 1954 ASA investigation. Based on the curvature of the everted direct rim, the shallow bowl (Cat. No. 4-1-14) (Figure 2a) was probably no deeper than 5 cm. The rounded lip measures 4.5 mm thick, and the vessel wall thickness quickly increases to 10 mm at 4 cm below the rim. Polishing marks are vertical on the red-slipped interior and horizontal on the exterior surface. The exterior surface has a fire cloud (a black or gray area caused by exclusion of oxygen during firing or by incomplete oxidation of carbon particles deposited from smoke); the interior has manganese nodules deposited on the broken chip off the rim lip and a few on one of the edges.

The second Colorado Red vessel (Cat. No. 4-1-15) (Figure 2b) is a wide-mouthed pot, 36 cm in diameter at the rim, with a very slight recurve just below the rim, a rounded flat lip measuring 8.5 mm thick at the lip and 5.5 mm just below the neck. The smoothed surfaces have horizontal wiping marks at the rim and vertical marks on the exterior body. This rim has a mend hole, 3.5 mm in diameter, that was biconically drilled (9 mm in diameter on the exterior surface and 8.5 mm on the interior) located 2.2 cm below the rim and 1.0 cm from the broken vertical edge of the sherd.

Table 6. Vessels Recovered from Lovejoy Springs.

Cat. No.	Ceramic Type	Vessel Form	Rim Form	Lip Form	Rim Diameter (cm)	Chronological Period[1]
4-1-14	Colorado Red	Bowl	Direct	Rounded	10[2]	Patayan I (AD 700–1000)
4-1-15	Colorado Red	Wide-mouthed	Slight Recurve	Rounded/ Flat	36	Patayan I (AD 700–1000)
4-9-3	Southern California Brown	Wide-mouthed	Slight Recurve	Rounded/ Flat	34–36	–
6-1-10	Topoc Buff	Medium-wide	Direct	Rounded/ Flat; Incised	20[2]	Patayan II (AD 1000–1400)
11-5-5	Southern California Brown	Medium-wide (cook pot)	Direct	Rounded/ Flat	10[2]	–

1. Waters 1982a; Bayman and Ryan 1988.
2. Depending on orientation of rim.

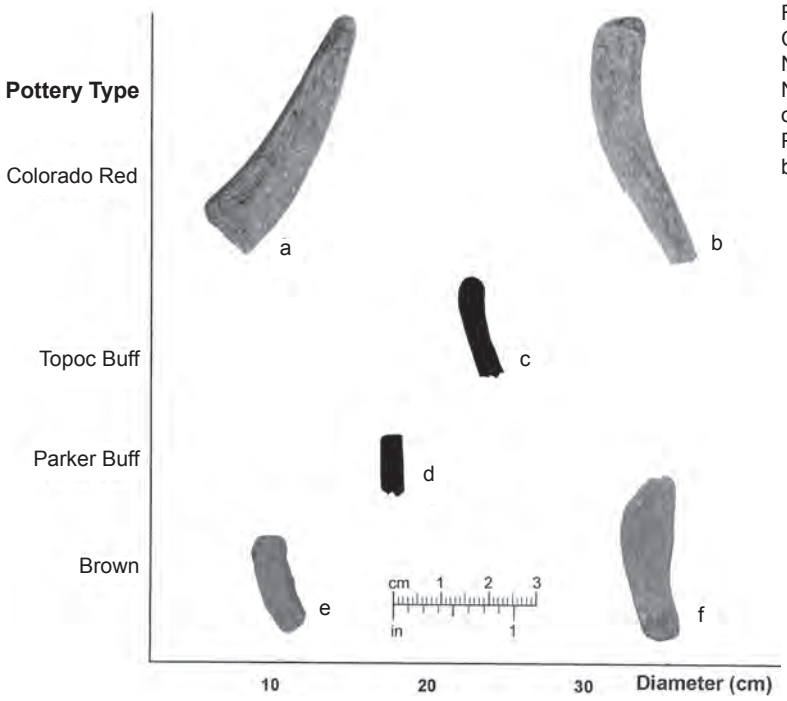

Figure 2. Lovejoy Springs rim profiles: (a) Cat. No. 4-1-14; (b) Cat. No. 4-1-15; (c) Cat. No. 6-1-10; (d) Cat. No. 4-3-22; (e) Cat. No. 4-9-3; and (f) Cat. No. 11-15-5. Sherds oriented with exterior surface to the right. Photographs by Lynn Meckstroth; drawings by Rusty van Rossmann.

The adjacent sherd likely had a similar hole used to lace the crack to hold it together. There is no evidence of any mastic having been applied to the crack, so one may assume that the jar continued to serve as a storage vessel for dry materials rather than liquids.

Two vessel shapes were observed among the five sherds in the UCLA surface collection: one Topoc Buff jar (Cat. No. 6-1-10) (Figure 2c), 20 cm in diameter, with a direct rim, rounded flat lip measuring 7.0 mm. The vessel wall thickness quickly decreases to 5.5 mm below the rim. The exterior surface is smoothed but uneven; the interior has horizontal wiping marks just below the rim, but otherwise it too is smoothed. The lip has been decorated with three small incised tick marks, made when the clay was wet. They average 3 mm in length, run down the middle of the lip, parallel to the vessel surfaces, and are spaced 3–5 mm apart. The other vessel shape observed in the UCLA collection is projected from a Southern California Brown Ware neck sherd (Cat. No. 6-1-20) which suggests a recurved form, typical of an olla or jar. Both surfaces of the sherd are wind-scoured, which has exposed the nonplastics.

Two Parker Buff rim sherds were recovered from ASA units; both are too small to estimate original vessel diameter accurately, and so they are not included in the table. Available data are included here for each rim. Specimen 4-3-22 (Figure 2d) was recovered from ASA unit SC3. It has a direct rim and a flat lip measuring 5.5 mm thick. There is no observable change in the wall shape or thickness for the entire 18 mm below the rim. Two small indentations were created on the exterior wall when it was still plastic; the larger indentation is 8 mm below the rim and ca. 4.5 mm wide, and the other is 11 mm below the rim, slightly below and left of the first, and is smaller in size (ca. 3 mm) and different in shape. Neither is round, nor were they necessarily made by the same implement. They may not have been intentionally created, yet none of the other sherds have similar marks. The second Parker Buff rim (not illustrated) was found in ASA unit SC8. The lip is rounded flat,

8 mm wide, and quickly decreases to 5.5 mm just 18 mm below the rim, at the slight neck restriction. Faint horizontal wiping marks are visible on the exterior near the rim, but otherwise the surface is smoothed, with occasional vugs and rough areas.

One Southern California Brown vessel, a wide-mouthed olla (Cat. No. 4-9-3) (Figure 2e) from ASA Unit SC9, has an estimated diameter of 34–36 cm, a slightly recurved rim, and a rounded flat lip projecting to the exterior and measuring 7 mm at the lip. The vessel surface was smoothed but is generally rough and has horizontal wiping marks on both surfaces. There are tiny manganese nodules on the exterior surface. The other Southern California Brown vessel is a micaceous brown cooking pot (Cat. No. 11-5-5) (Figure 2f) recovered from TEU1 in the AE 2004 excavation. The jar was 10 cm in diameter at the mouth, with an incurving, direct rim, and a rounded flat lip, 6 mm thick. Horizontal wiping marks are visible on both surfaces, and nonplastics, including mica, are visible on the exterior surface. Carbon deposits on the exterior suggest that it was a cooking pot or olla. All the sherds from this unit appear to be from this vessel. A different sherd (Cat. No. 11-5-6) from the same level (40–50 cm below surface) of TEU1 was submitted for thin-sectioning.

Vessel Wall Thickness

Vessel wall thickness was measured for 107 sherds with intact surfaces. The measurements were rounded to the nearest millimeter (Table 7). Seventy-five percent of the sherds measured between 4–6 mm thick, with a thickness of 5 mm accounting for 38 percent of the total. The 13 mm sherd was identified as a fragment of a rounded vessel base due to the thick wall, pronounced wall curvature, and the pattern of carbon on the exterior surface. The 10 mm example is the basal end of a shallow bowl rim sherd. The 3 mm sherds were all found in the ASA collection, from SC3, TP1A and TP1B, and all are buff.

Residues

Of the 107 intact sherds, over half (59 sherds; 55 percent of total) had some degree of carbon deposit on one or more surfaces (Table 8). Fire clouds were recorded separately from carbon deposits. Nearly one-third of the assemblage (31; 29 percent) had extensive carbon, mostly on the exterior. Nearly 10 percent had carbon on both surfaces. It is uncertain whether the carbon was deposited through use of the vessel on or near a fire or was the result of post-depositional activities; clearly, many of the ceramic vessels found at Lovejoy Springs were used for culinary purposes. Carbonate deposits, often thought to result from using ceramics to hold/transport water or to boil liquids, were found on six sherds (6 percent). Two sherds had salts on the exterior surface; two had salts on the interior, and one had salts on both surfaces. Considering that one of the foremost features of the Lovejoy site is the presence of potable water, this number is surprisingly low.

Two sherds from ASA Unit SC1 had manganese nodules deposited on broken edges (specimen 4-1-15, the Colorado Red bowl [Figure 2b] and specimen 4-1-17,

Table 7. Sherd Wall Thickness.

Thickness (mm)	Number of sherds
3	8
4	19
5	41
6	21
7	11
8	3
9	1
10	1
11	–
12	1
13	1

Table 8. Location of Carbon Deposits on Sherd Surfaces.

Residue	Exterior Surface	Interior Surface	Both Surfaces
Carbon	20	1	10
Carbon trace	13	2	3

a Colorado Red-on-buff sherd [Figure 3b]). The growth of manganese dendrites on ceramics, similar to its growth on rock (desert varnish), has been viewed as a sign of antiquity; the more nodules there are, the greater the passage of time. Recent work by O'Grady (2005) indicates that manganese dioxide dendrites on ceramics may form in as few as 40 years, depending on the porosity of the ceramic substrate, the amount of manganese (in the buried substrate, in the environment, or in the painted decorations), and the presence of a standing liquid.

Significantly, both Lovejoy examples of manganese nodules are on Colorado Red sherds and not on any other buff or brown type. This may indicate that this particular sedimentary clay fosters manganese dioxide formation or that a manganese-rich mineral was used to color the clay slip or the painted decoration or that these sherds were exposed for some period of time in a different environment and transported to Lovejoy Springs with the manganese nodules already formed. Some combination of these factors may explain the observations.

Vessel Decoration

Several decorative techniques were observed on different ceramic types from Lovejoy Springs: four instances of burnished red slipped surfaces on Colorado Red bowls, jars and ground disks; one red-on-buff and two red-on-brown painted linear designs typical of the Colorado River area and a single example of a painted Hohokam-like red-on-buff design; a faintly incised chain motif, typical of Southern California Brown vessels, on a shoulder sherd; a series of small incised tick marks on the lip of a Topoc buff rim; and a possible punctate design on a Parker buff rim exterior.

Specimen 4-1-16 has a distinctively Hohokam design typical of Santa Cruz Red-on-buff pottery (Figure 3a). If it had been found in the Tucson Basin or Phoenix Basin, it would undoubtedly have been typed as such and dated at AD 850–950/975. Miksa (2009) examined the sherd with a hand lens and thought that the inclusions (crushed angular grains of gabbro diorite) were atypical of the Tucson Basin, although they might have derived from further west along the Santa Cruz River. The temper is similar to that attributed to Gila Bend Red-on-buff; Waters also reported Gila Bend sherds with Santa Cruz designs (Waters 1982a, 1982b, 982c). This sherd is probably from a jar, since only the exterior is decorated (see Heckman et al. 2000:Figure 52c for a similar vessel pattern). Specimen 4-1-17 (Figure 3b) is very similar in appearance. It too has an orange cast and a red-on-buff design; however, it has crushed angular clear quartz as well as grains with intertwined quartz/feldspar/hornblende, and appears to fall within the type description for Parker Red-on-buff, which Waters (1982a, 1982b, 1982c) dated to AD 1000 onward. Two additional sherds (Cat. No. 4-2-47 and Cat. No. 4-2-48) from ASA Unit SC2 (Figure 3c and Figure 3d), are from the same vessel but do not conjoin; they have broad red lines that are somewhat obscured by a faint deposit of carbon on the exterior surface. They fit Rogers' (1945b) description of Cronese Brown in that they appear to be brown upon first glance, but the paste is pinkish. Rogers (1945b) reported finding only one example with a "crude red line."

A small Parker buff rim sherd (Cat. No. 4-3-22) has two indentations on the exterior that may be part of a punctate design (Figure 3e). A Topoc buff rim (Cat. No. 6-1-10) has small incised tick marks spaced about 5 mm apart in the center of the rounded flat lip, parallel to the interior and exterior walls. A Southern California Brown sherd (Cat. No. 4-3-8) with rough surfaces and crushed quartz/feldspar/ hornblende (but without the pink burning clay) may have an incised design on the exterior surface. Alternatively, this may be particularly deep mop marks (incisions left from wiping and smoothing the wet clay surface with a plant fiber "mop"); however, the clay texture is very grainy (it does not have a floated smooth surface), and resists incising (Figure 3f).

Worked Sherd Disks

Ceramic disks are reported from sites throughout the Great Basin, Southwest, and southern California and are attributed to a variety of functions. Some served as lids for storage vessels; these often exhibit residues of pitch or wax around the edges where they were sealed into the mouth of an olla. Central perforations (usually drilled into an existing sherd, rather than formed when the clay was wet) may have enabled a hide or plant fiber strap to be inserted, knotted on one side to secure it, then used as a handle to lift the lid out of the olla. Other perforated sherds are identified as spindle whorls, particularly in Southwestern sites where woven textiles were common. They may also have been used as toys, ornaments, or game markers, or as disks that were on game strings (see Koerper 1988). No functional evidence is apparent on any of the Lovejoy disks. Five sherds were reshaped into disks by edge grinding (Figure 4). None of these sherds were broken during analysis to reveal a fresh face of the paste, and so paste observations were restricted to surface observations.

Three of the five disks were centrally perforated using a stone drill; one was drilled conically from the interior of the original sherd, while the other two were drilled biconically. The disks are similar to the wide range of sizes, both perforated and unperforated, reported for Tahquitz Canyon (Schaefer 1995:Figures IX.12 and IX.13). None corresponds in diameter to the vessel rims in the Lovejoy collections.

Specimen 7-1-11 (Figure 4a), surface collected by Wubben in 1920, is nearly half of an estimated 3.0 cm disk created from a California Desert Intermediate Ware sherd. The central perforation was drilled from the interior surface only and is ca. 4 mm in diameter. The exterior surface was smoothed, although nonplastics are visible through the light carbon deposit. Nonplastics are much more visible on the interior surface which is much rougher than the exterior and has copious vugs from nonplastics that popped out when this surface was ground down to the current 5 mm thickness. Nonplastics comprise more than 75 percent of the clay body and are primarily quartz. No fresh break was made on this tool, and so it is impossible to determine macroscopically whether the sub-rounded shape of the quartz and feldspar is due to grinding during manufacture of the disk or to the original state of the nonplastics. One small chip had flaked off the interior edge, perhaps through use of the disk. There are four ground facies, flat areas on the otherwise curved edge of the disk (Figure 4a).

Specimen 4-3-24 (Figure 4b) is a perforated disk made from a Colorado Red potsherd. It had an estimated diameter of 4.0 cm, and it was biconically drilled with an opening estimated at 4.5 mm. The exterior surface has a smooth, burnished red slip; the interior is rough and may have been purposely ground so that the interior surface slants to meet the exterior at the narrow 2.5 mm thick edge. Vugs remain where the nonplastics were popped out during the grinding. The third perforated disk, specimen 4-7-2 (Figure 4c), represented by half of the disk, had an original diameter estimated at 2.6 cm, and it is 5 mm thick at the ground edge. It was biconically drilled with a 3 mm diameter central

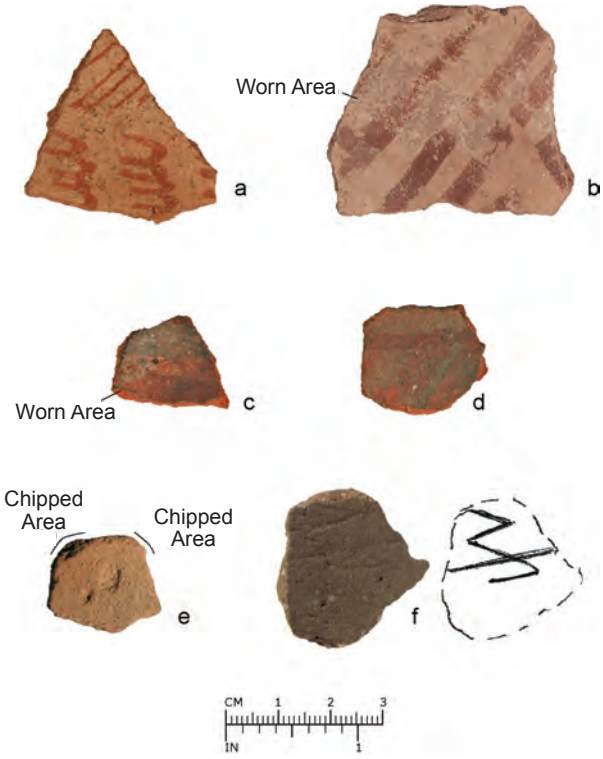

Figure 3. Decorated sherds from Lovejoy Springs: (a) Cat. No. 4-1-16; (b) Cat. No. 4-1-17; (c) Cat. No. 4-2-47; (d) Cat. No. 4-2-48; (e) Cat. No. 4-3-22; and (f) Cat. No. 4-3-8 with pencil drawing. By Lynn Meckstroth.

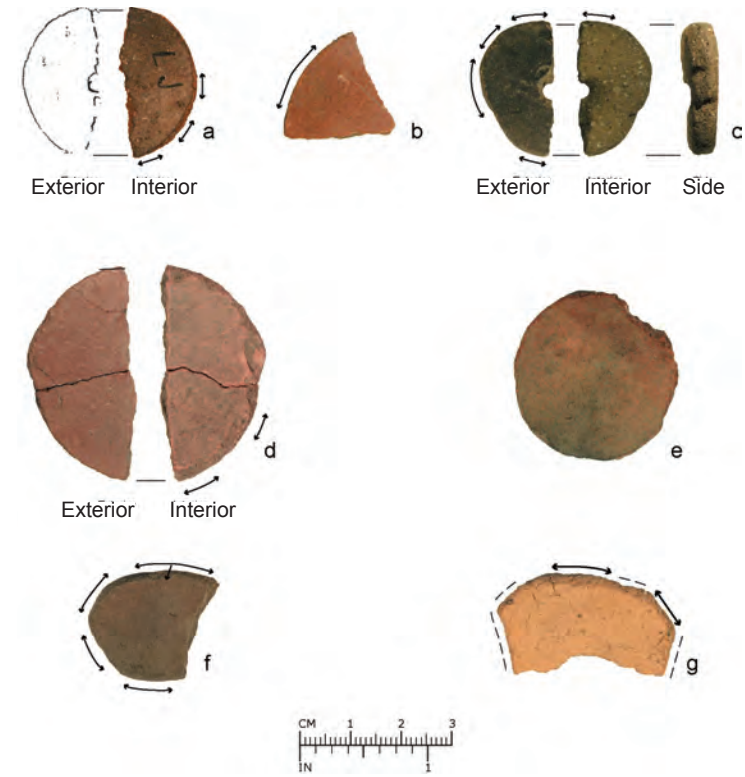

Figure 4. Decorated and worked sherds from Lovejoy Springs: (a) Cat. No. 7-1-11; (b) Cat. No. 4-3-24; (c) Cat. No. 4-7-2; (d) Cat. No. 4-15-3; (e) Cat. No. 4-9-5; (f) Cat. No. 4-3-23; and (g) Cat. No. 4-8-1. By Lynn Meckstroth.

hole. There are four ground facies on the edge. This disk differs from all others in that it has two grooves cut across the exterior edge, one perpendicular to the edge, the other oblique. Both grooves are cut into the interior surface of the sherd as well as the edge; only the oblique groove extends to the exterior surface as well, having been cut deeper. These cuts were made after the sherd was ground into its disk shape and are probably the result of rubbing that edge against a sharp string or other object. This sherd is also identified as California Desert Intermediate Ware, based on the abundant (75 percent) rounded quartz inclusions (again, no new fresh break was made on the disk). Disk 4-7-2 and disk 7-1-11 are similar in size and paste; the paste is finely ground clay, and nonplastics consisted of sub-angular to sub-rounded quartz and feldspar. It was fired in a reducing atmosphere.

One unperforated disk (Cat. No. 4-15-3) (Figure 4d) is represented by two sherds that conjoin to form approximately half of a disk, 4.2 cm in diameter, with an average thickness of 4 mm. The disk had been ground on the rounded edge, yet it also exhibits chips all along the interior surface of the original sherd and two ground facies on the edge. It is nearly round which leads one to believe that the chips resulted from use wear rather than chipping to create the circular shape. The exterior surface is burnished but not slipped; the interior is smoothed but uneven and does not appear to have been ground.

The other unperforated disk (Figure 4e) (Cat. No. 4-9-5) is a slightly elongated round form, complete except for a fragment missing on one edge. It could be a disk preform that has not been ground smooth on the edges (only two small facies are smoothly ground on opposing edges). It has a diameter of 3.2–3.3 cm and an edge thickness of 4.5–5.0 mm, and faint wiping impressions appear on both sides but in opposite directions, perhaps a result of wiping the original vessel. The interior surface has a consistent carbon deposit; the exterior has a firing cloud, typical of Tizon Brown Ware. The sub-angular granitic nonplastics are also consistent with that type.

Worked Sherd Tools

Two sherds were altered by grinding the edges into amorphous shapes with multiple facies that could be used as scraping or grinding tools. The two examples are dissimilar in outline. Specimen 4-3-23 (Figure 4f) is approximately half of a roughly elliptical sherd ground on the edge in four distinct facies, one of which also exhibits grinding on the interior perpendicular to the edge. Both surfaces have random scratch marks, and tiny mica flecks are visible; one surface has faint red traces that may be paint. It has been identified as a California Desert Intermediate Ware due to the finely ground paste and abundant sub-angular/sub-rounded quartz and feldspar exposed on the old break.

Specimen 4-8-1 (Figure 4g) was originally cataloged as a rimsherd, but the angle of the "rim" is not correctly aligned. It is probably a neck or shoulder fragment that had been reshaped to use as a grinding tool. Three sides are broken; one edge has been partially rounded by rubbing it back and forth perpendicular to the edge. That same edge also exhibits tiny chips, especially on each end of the "rounded" portion. The interior surface is a crackled orange color with nonplastics visible and faint anvil marks; the exterior was smoothed more in the original vessel, though it too has uneven areas. A hairline crack begins at the rounded edge and runs diagonally across the interior surface, suggesting the sherd was stressed by some force, possibly when used as an edge scraper.

Chronology

The buff ceramics from Lovejoy Springs span the entire Lower Colorado Buff Ware ceramic period, from Patayan I through Patayan III (AD 700 to the historic period). Patayan I is represented by the three Colorado Red sherds (2 rims and 1 disk) as well as direct rims

with rounded lips (see Waters 1982a:Fig. 7.1). None of the rim sherds have a marked recurve, a form reputed to begin in Patayan II, but Patayan II/Patayan III types (Parker Buff, Colorado Red-on-buff, Cronese Brown) are also present in the assemblage. According to Waters (1982a, 1982b, 1982c), stucco exterior treatments are restricted to Patayan II and III (AD 1000 onward); conversely, Schroeder (1958) dated Parker Stucco as early as "pre AD 200? to at least 1840." The Santa Cruz/Gila Bend Red-on-Buff sherd dates no earlier than AD 850 in the Phoenix Basin and Gila Basin. It is impossible to say when it was brought to the Lovejoy Springs site or whether it was from an intact vessel or was simply curated.

No Owens Valley Brown Ware or Great Basin Brown Ware sherds were identified in the ceramic sample. Both of these wares were manufactured using the coil-and-scrape technique to shape the pots and have distinctive wiped surfaces. Eerkins' (2003:20) studies of Owens Valley Brown Ware suggested that ceramics may have been present in the valley as early as AD 1300, and widespread local manufacture occurred at the individual or family level by ca. AD 1450.

The Lovejoy Springs sherds identified as Southern California Brown Ware due to their surface treatment and paste characteristics also have anvil marks on some interiors, as do several of the Parker Buff sherds. Southern California Brown Ware has been dated in the Transverse Ranges to as early as AD 600–799, in coastal southern California villages to ca. AD 1000, and throughout San Diego County to ca. AD 1450 (Griset 1996).

The only ceramics associated with a radiocarbon assay at Lovejoy Springs are fragments of a Southern California Brown cooking jar that were distributed principally between 40 and 50 cm below surface in TEU1, with three tiny sherds found lower than 80 cm. A charcoal sample (#212904) taken from Feature 1a (100–110 cmbs) and 20 cm below the deepest fragments of the cooking jar produced a calibrated range of AD 1450–1650, suggesting that the cooking jar was deposited after that time. None of these California Desert Brown sherds had anvil marks, although they were extremely small compared to the other sherds. Perhaps they were more friable.

Unfortunately, there is no vertical or horizontal stratigraphy that can be used to date the ceramics at the Lovejoy Springs archaeological site. All chronological estimates are based on cross-dating with sherds from other areas, and in some cases these are themselves cross-dated using decorated Anasazi or Hohokam sherds. Clearly, dating plainware ceramics will remain problematic until a larger body of directly dated sherds from desert contexts becomes available.

Comparisons

Lyneis (1988a, 1988b, 1988c, 1989, 1990) reported a group of sherds from Fort Irwin ca. 240 km northeast of Lovejoy Springs that are comparable to specimens in the Lovejoy Springs collection. The Fort Irwin sherds exhibit a paste texture that intergraded with both the grainier (brown) and the non-granular (buff) textures observed in the Lovejoy Spring ceramics. Lyneis' Intermediate Brown was easily distinguished from any potential Owens Valley Brown Ware or Great Basin Brown sherds that may have been transported into the Mojave Desert, especially as those wares were finished by scraping, rather than paddling, and both often have distinctive wiping marks in opposing directions on the interior and exterior surfaces. Lyneis concluded that the Desert Intermediate paste's tendency to intergrade "is likely a reflection of the dominance of ceramics made from clays available along the Mojave River Valley and its environs," although she cautioned that there were insufficient data to rule out the presence of fine clean sedimentary clay deposits in the uplands of Fort Irwin or the adjacent Mojave River Valley. She noted that Drover (1979:140, Table 13, cited in Lyneis 1988b:E3)

found a deep bed of fine clay near the center of East Cronese Lake.

Interpretations

Examination of ceramics collected from Lovejoy Springs over the past 90 years indicates that this water hole attracted people passing through or using areas of the Mojave Desert for 900 years prior to the twentieth century. In all probability an even greater diversity of ceramic types existed at the Lovejoy Springs site before visitors began to remove them, beginning 125 years ago. Given the paucity of exotic sherds, many of which represented but a single vessel, it is most likely that at least some of these exotics were surface collected elsewhere by Native peoples and brought to Lovejoy Springs prehistorically.

The diversity of ceramics at Lovejoy Springs likely reflects a diversity of people visiting or residing in the area. In addition to people traveling the historically recorded east-west Mojave trading corridor between the Colorado River and the Pacific Coast, people transporting ceramics possibly came from other areas to the Mojave region. Malcolm Rogers' surveys of the Mojave Sink convinced him that early turquoise miners brought Southwestern ceramics (Deadman's Gray, Lino Gray, and their decorated varieties) in the early ninth century and that Mojave Desert residents traded Pacific shells for Prescott Gray pottery. Rogers (1945a:175) added that "during these pre-ceramic times, all the Prescott Gray Ware types were traded for and are now found surficially associated to some extent with the first importations of early Yuman types from the Lower Colorado focus."

Rogers identified two ceramic types produced in the Mojave Sink, Cronese Brown and a rare variant, Crucero Brown. The petrographic evidence from sherds found at Lovejoy Springs confirms Lyneis' (1988c) "Margaret's Principle" that the brown wares in the central Mojave Desert were locally produced. The thin-sectioned California Desert Intermediate sherds from Lovejoy derive from clay sources found in a region that potentially extends 80 km west of Lovejoy Buttes, northwest 72 km, north and northeastward 80 km, 48 km east, and 16 km south. Further petrographic examination of clays and nonplastics from this area may refine the ceramic materials procurement zone considerably.

Unfortunately, there are no associated or direct dates for these sherds. Rogers (1945a:176) concluded that "settled occupation" of the Mojave River region ceased around AD 1400 as dated by the presence of Jeddito Black-on-yellow sherds on Mojave Sink sites. He added that, "it is probable that small parties from the Colorado River continued to visit it occasionally for some time, but the increasing aridity and the expanding Shoshonean and southern Paiute bands soon after made the Colorado valley a more favorable and a decidedly more hospitable habitat." Schroeder (1952:56) postulated an even earlier abandonment of the area beginning ca. AD 1150.

Drover's (1979) excavations in the Cronise Basin and Jenkins' (1989) comparisons of ceramics from Afton Canyon on the lower Mojave River with those from Fort Irwin provide ample evidence that the area was not abandoned. Ceramics continued to be deposited throughout the eastern Mojave Desert, but the ceramic assemblages are amalgamations of buff, brown, and gray wares. Also, there are sherds that do not quite fit existing typologies. Joint use of the region by multiple, ceramic producing historic groups (Desert Serrano, Mohave, and [after 1840] Chemehuevi-Southern Paiute) has left evidence of multiple potential sources for the prehistoric ceramics found in the Mojave Desert region (David Earle, personal communication 2006). Sutton (1989) suggested that the Antelope Valley was abandoned in the Late Prehistoric period (AD 1250–1750) because of the drying climate and was only sparsely populated during the protohistoric (see also Earle 2005:9–10).

The Lovejoy Springs assemblage reflects multiple sources of ceramics but does not provide any direct dating that would address the question of whether the site was abandoned for any period of time. It is not known who occupied it at any given time. The Patayan II/Patayan III Lower Colorado Buff Ware traits and types at the site span the full length of the combined periods (AD 1000–historic). The Colorado Red-on-buff sherd is a Patayan III type, but it is a single sherd that could have been transported by Mohave traders who continued to use the Mojave trade route into the late nineteenth century. The Intermediate Brown Desert ceramics, most likely made from local clays, are not associated with a particular cultural group, and it is currently impossible to determine whether they were made by Serrano, Chemehuevi, or some other tribe.

Significantly, there are no examples of Owens Valley Brown Ware among the Lovejoy Springs collection, suggesting that there was not extensive contact or trade beyond a certain point northward. This supports Sutton's proposed boundary between Numic to the north and Patayan (Takic) to the south (Sutton 1989; David Earle, personal communication 2006). The petrographic data suggest a potential resource procurement zone for local ceramic materials that runs 160 km east-west and ca. 96 km north-south and is centered about 32 km north of Lovejoy Springs.

Ceramics used at the site include wide-mouthed and medium wide-mouthed vessels, probably ollas and deep bowls, and one small shallow serving bowl. One of the medium wide-mouthed vessels was used for cooking. Interestingly, narrow-mouthed ollas suitable for transporting water or stashing food for long-term storage are missing from the assemblage.

Sherds were recycled as tools, either as disks of unknown function or as amorphously shaped sherds used to grind or scrape. All the disks are smaller than the rim diameters of the vessels, so they were probably used for purposes other than pot lids. It is also possible that the absence of narrow-mouthed vessels, for which these disks might have been lids, is due to their having been carried away from the site or cached offsite in rock crevices. If the buff rim sherds were derived from intact vessels at Lovejoy Springs, not just transported rim sherds, then considerable effort was expended to transport large vessels from the Colorado River area to the western Mojave Desert. Rogers (1945a, 1945b) suggested that pottery was being traded for shell; a complete Lower Colorado Buff Ware narrow-mouthed olla found at an archaeological site on the Santa Barbara coast (now curated at the Santa Ynez Historical Society Museum) attests to long-distance trade and these vessels' values.

Future Research

Three areas for future research on Mojave Desert ceramics are the following: (1) expansion of petrographic analysis of sherds, clays, and mineral samples; (2) direct dating of carbon deposits on suitable sherds; and (3) a comparison of Mojave brown sherds with those from known Serrano and Chemehuevi sites. Ethnographic data concerning Serrano pottery is limited to brief statements by Benedict (1924) that mountain clays were collected, dried, sifted to remove large nonplastics, aged for 24 hours, and then shaped into pots for cooking and ollas for storing mesquite and piñon flour. It would be useful to compile petrographic data on clays and sherds from throughout the Serrano area to provide a baseline for comparison with brown sherds found at the northern base of the mountains and on the floor of the Mojave River Valley.

At present, brown ware ceramics are dated by horizontal association with exotic ceramic types or other dated materials. In an area where ceramics were being transported long distances and site deposits are generally surficial, sites such as Lovejoy Springs that have subsurface midden deposits are exceedingly rare and valuable. Hopefully, intact midden yet remains at the site, and areas of future ground disturbance will be sampled with these objectives in mind.

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