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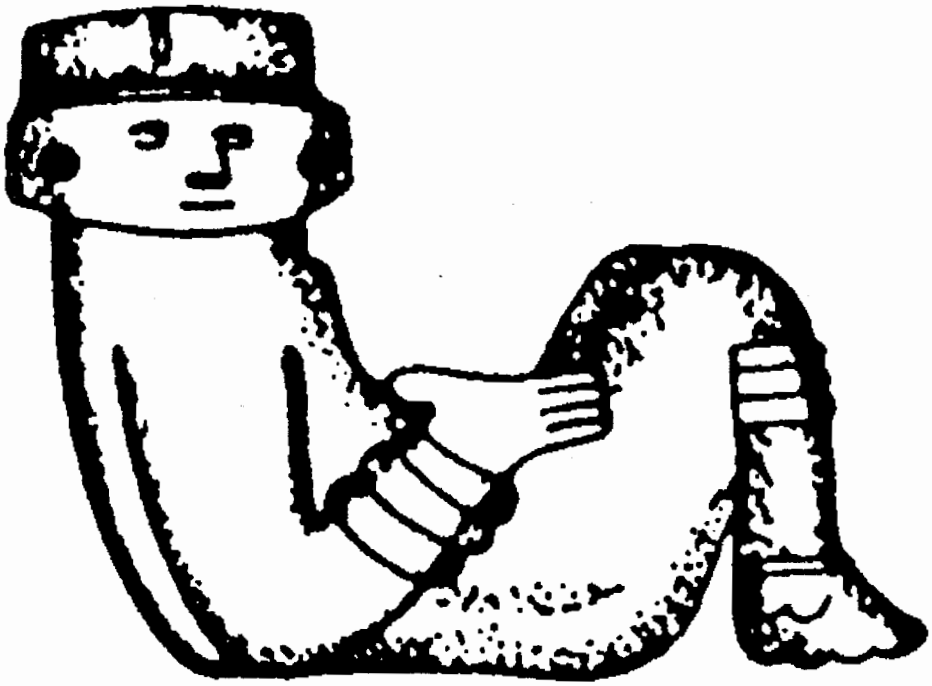

CHACMOOL

Editors: Roman Harrison, Milan Gillespie, Meaghan Peuramaki-Brown

THE ARCHAEOLOGICAL ASSOCIATION OF THE UNIVERSITY OF CALGARY

EARLY CERAMICS IN SOUTHEASTERN ARIZONA: TECHNOLOGY, ICONOGRAPHY, AND FUNCTION

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In the Sonoran Desert, the first fired clay containers were produced in farming settlements occupied at the end of the Archaic period (ca. 400 B.C. to A.D. 150). Potters selected a raw material, untempered alluvial clay, that they were already familiar with from the earlier production of figurines, while they drew upon the Western Archaic rock art tradition for decorative motifs. Most of these plain ware vessels are small bowls, and a large percentage have been recovered from ritual or ceremonial contexts. Raw material selection, vessel form, and function all show dramatic changes by A.D. 150-550. Vessel forms focused on jars with simple contours. Multiple lines of evidence indicate that these vessels were used principally for storage. Potters began to produce red wares as well as plain wares by A.D. 550-650/700. The increase in the diversity of vessel forms that also occurs at this time indicates that ceramic containers finally began to fulfill the range of tasks usually associated with the prehistoric Southwest.

Pottery has attracted archaeologists to the American Southwest for as long as the region has held archaeological interest. The field of Southwestern archaeological ceramic research has pioneered numerous innovative methods and analytical techniques for understanding ceramic variability. Yet for all of the attention devoted to archaeological ceramics in the Southwest, surprisingly little work has concentrated on the earliest ceramic technologies across the region. Previous archaeological work in the Mogollon highlands (e.g., Haury and Sayles 1947; Martin 1940; Sayles 1945; Wheat 1955) suggested early dates for the adoption of a ceramic container technology. However, until quite recently, questions regarding the origins of agriculture have consistently eclipsed those regarding early ceramic innovation (but see LeBlanc 1982).

Abundant research across the American Southwest now suggests that fired clay technology, including the manufacture of figurines, beads, and containers, was familiar to prehistoric Southwestern peoples by 1000 B.C. to A.D. 500 (see review in Stark 1995). An early ceramic horizon, first identified by a previous generation of archaeologists (e.g., Hayden 1970; Rodgers 1936:4; Wendorf 1953:165), was established from the southern deserts to the Colorado Plateau by A.D. 1-300. These early potters utilized simple manufacturing techniques and produced a narrow range of vessel forms. A growing number of archaeologists have begun to investigate the causes and motivations that stimulated technological innovations _ and pottery making _ in different regions of the prehistoric Southwest at this early time (Crown and Wills 1995; Wilson and Blinman 1993). Our paper investigates processes involved in the adoption of a ceramic container technology in the Sonoran Desert of the southern Southwest.

We explore the inception and widespread adoption of the potter's craft in the Middle and Lower Santa Cruz River Valley of southern Arizona. The earliest ceramics discussed have been recovered from deposits that are securely dated between ca. 400 B.C. - A.D. 150 (the Late Archaic period's late Cienega phase, see Gregory 1996). The collections that we describe are currently the earliest well-dated ceramics from the American Southwest. We structure much of our discussion in terms of the operational tasks involved in the production sequence of hand-made pottery (following Rye 1981) to examine technological aspects of this early pottery. We also suggest ideas regarding the social and cultural context of this technological innovation. Our study concludes by reviewing the changing role of early pottery in the Sonoran Desert.

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R. Harrison, R. M. Gillespie (editors)

POTTERY IN THE SOUTHWESTERN LATE ARCHAIC PERIOD

Until quite recently, Archaic period sites in the American Southwest have been defined by their lack of pottery and the presence of specific projectile point styles (Schroeder 1982:7; Bayham 1986:6), and, in the Hohokam area, the relationship between sedentism, agriculture, and ceramics remained undefined (Fish 1989:25). We now know that the occupation of settlements that contained multiple pithouses, large storage pits, thick trash middens, burials, and other types of features generally thought to represent some degree of sedentism correlates with the introduction of agriculture in the Southwest (Mabry 1996b).

In southeastern Arizona, the first ceramic containers are found in agricultural settlements, but they were preceded by ceramic figurine production. The earliest maize and ceramic figurines in the Tucson Basin have been recovered from San Pedro phase contexts, ca. 1500-800 B.C. (Huckell et al. 1995), whereas ceramic containers were not produced until the late Cienega phase (ca. 400 B.C. - A.D. 150). Although archaeologists have traditionally associated pottery production with a sedentary way of life, numerous recent studies have suggested that mobile and semi-nomadic peoples also use ceramics (Rice 1996:154).

In the Tucson Basin, many Cienega phase sites are located on lowland alluvial landforms that were suitable for flood water farming during the summer monsoons (B. Huckell 1996). Macrobotanical data indicate that these sites were occupied from at least the early spring through late fall (L. Huckell 1996). One of the most striking aspects of Cienega phase pithouses is the large number and volume of floor pits that they contained. Lisa Huckell (1996) has suggested that, although there are no winter-indicator plant resources in the Sonoran Desert, the presence of maize remains in these storage pits can be considered a possible indicator for winter occupation.

LATE CIENEGA PHASE POTTERY: THE INCEPTION OF A RITUAL CERAMIC CONTAINER TECHNOLOGY

The earliest dated ceramics in our sample are plain wares. Given the fact that this plain ware technology characterizes the beginning of the regional ceramic sequence, and the fact that they do not resemble later Tucson Basin Hohokam plain wares (Kelly 1978), we propose that the term "incipient plain ware" be used to refer to them. We have distinguished four varieties based on differences in primary forming technique and surface treatment: coiled, bumpy, incised, and impressed.

Review of Late Cienega Phase Pottery Technology

So far, portions of 84 incipient plain ware vessels have been recovered from five late Cienega phase sites (Clearwater, Coffee Camp, Los Pozos, Santa Cruz Bend, and Wetlands), whereas other late Cienega phase sites (such as the Donaldson Site and Stone Pipe) have not produced ceramics. A "bumpy" exterior surface variety has been recovered from all five ceramic-bearing sites, whereas a "coiled" variety was recovered from only two of them, an "impressed" variety from one of them, and an "incised" variety from two of them. Most of the vessels are represented by body sherds, rather than rim sherds, a fact that limits our understanding of vessel forms and sizes (Table 1).

Based on our compositional research, we believe that late Cienega phase potters used "untempered" clays; production of pottery from "untempered" clay is restricted to this earliest portion of the regional ceramic sequence. It is interesting to note, however, that "self-tempered" alluvial clays were used in the subsequent Agua Caliente phase (Heidke et al. 1996) but not thereafter. Throughout the rest of the prehistoric sequence, potters in the Sonoran Desert added sand or crushed micaceous rock tempers to their clay. Taken together, the late Cienega phase and Agua Caliente phase data suggest that it took potters many generations to gain familiarity with the various resources available in the region, and to develop mixtures of plastic and nonplastic materials that would produce workable clay bodies.

Two methods of primary forming were utilized: pinching and coiling. Pinched vessels have either bumpy, hand-smoothed surfaces or incised surfaces. Vessels exhibiting animal fur or plant fiber impressions may also have been formed by pinching, or the impressions may have resulted from molding the clay body over another object.

The vessel shape represented by most sherds could not be determined, but we offer inferences based on thirteen rim sherds. Most are small bowls, whose orifice diameter ranges from 1.5-13.0 cm and an average diameter of 7.4 cm. These are unusually small vessels relative to those produced throughout the rest of the Tucson Basin's prehistory. Like the bowls, the jars are unusually small vessels, with an average aperture diameter of 3.0 cm. A single jar vessel form has been documented _ the neckless "seed jar." That vessel form dominates the potters' output in the subsequent Agua Caliente phase. However, Agua Caliente phase seed jars are much larger (Heidke et al. 1996), and their average aperture diameter is 14.3 cm.

The Origin, Iconography, Recovery Context, and Function of Late Cienega Phase Pottery

If we believe Braun's (1983:107) now famous dictum that pots are "tools," we must search for the functions that these early ceramic containers served. One hypothesis is that pottery was invented in order to detoxify foods and make them more palatable, whereas another set of hypotheses proposes that early pottery functioned as a prestige good, particularly in the context of competitive feasting (Hoopes and Barnett 1995:3). The orifice diameter measurements reviewed above have shown that the incipient plain wares are very small vessels; many, in fact, would be considered miniature vessels. It seems unlikely that these small vessels would have been of much use in food processing or competitive feasting. Aspects of their (incised) iconography and their recovery contexts, reviewed below, suggest that they may have been "ritual" goods. However, before we review that data, we would like to look at possible origins of the technology.

Origins

Childe (1951:93) has suggested that the earliest pots were imitations of containers made from natural materials, such as gourds, bladders, skins, baskets, and even human skulls, and that early forms of decoration helped to reinforce the connection between ceramic vessels and earlier materials. Similarly, Clark and Gosser (1995:219) have argued that the earliest Mesoamerican ceramic containers copied the forms of some perishable vessels already in use. We feel that the replacement of a perishable container technology, basketry, with a ceramic technology is a particularly satisfying explanation for the coiled variety of incipient plain ware which looks like nothing so much as a "clay basket." The other incipient plain ware varieties are more problematic. However, we think that a case can be made that the bumpy and incised varieties replaced another type of perishable container _ those made of gourds _ given their size and type of decoration.

In southern Arizona, squash or wild gourd remains have been recovered from two late Cienega phase sites (Los Pozos [D. Gregory, personal communication] and Los Ojitos [Huckell 1995]). Therefore, we know early occupants of the Tucson Basin used cucurbits. Three species of wild gourds occur in Arizona, the most common and widely distributed of which are the buffalo gourd and fingerleaf gourd. These species produce round, baseball-sized fruits (L. Huckell 1996). The average orifice diameter of the bumpy and incised bowls is 6.3 cm, slightly smaller than the diameter of a baseball. Finally, the thin rinds of buffalo gourds could be used as containers, but do not lend themselves to use as tools because they are easily broken (L. Huckell 1996). A ceramic container would, therefore, have made a less fragile substitute.

Iconography

Cross-culturally, burnishing and incising are two common techniques used to decorate gourds (Lathrap 1977, cited in Clark and Gosser 1995:216). A review of data in Barnett and Hoopes (1995) suggests that incising may be the most common decorative technique used by early potters throughout the world. Therefore, it is not surprising to find that some of the earliest ceramics in southeastern Arizona were incised. These straight, curved, wavy, and parallel line incised motifs present on incipient plain wares are shared with the Western Archaic rock art tradition (Wallace and Holmlund 1986:Figure D-3). This iconography started ca. 8000 B.C. and continued until A.D. 800 (Wallace 1995:34). It is possible that these design elements may also have been used to decorate less durable media, such as gourds.

Recovery Contexts

Almost one-half (43%) of these early ceramics were recovered from features that have been interpreted as having a ceremonial, ritual, or integrative function _ rather than a domestic function _ based on criteria other than the presence of ceramics. Foremost among these are the "Big Houses" found at some of the late Cienega phase sites. The term "Big House" has been applied to structures that are up to three times larger than other structures at a site (Mabry 1996a). Three of the five ceramic-bearing late Cienega phase sites contain at least one "Big House" in the investigated part of the site, and ceramics have been recovered from the fill (and in some cases the floor pits) of at least one "Big House" at each of these three sites. The "Big Houses," or in the case of Los Pozos a pithouse with a ceremonial cache on its floor, contain greater quantities of these early ceramics than do other pithouses that were investigated at these and other late Cienega phase sites.

Overall, the integrative and ceremonial structures contain approximately 16 times more incipient plain wares than the other structures.1 This value appears meaningful even when we consider that the "Big Houses" are up to three times larger than (and, therefore, approximately nine times the volume of) other structures, a concern expressed by Schiffer (1983) with regard to Lightfoot and Feinman's (1982) arguments regarding early Mogollon integrative structures. When a volumetric approach is taken, the integrative and ceremonial structures are found to contain approximately 1.75 times more incipient plain wares than other structures.

Function

Given their small size, their iconography, and their association with non-domestic contexts, we suggest two ritual functions that this early pottery may have served. The small bowls that make up the majority of incipient plain ware vessels are well suited to the task of serving individual portions of a liquid or holding offerings. Their low numbers and small size make competitive feasting an unlikely explanation, despite its plausibility in many other early pottery traditions (Hoopes and Barnett 1995:3). However, ritual uses of small containers recur in ethnographic descriptions of Sonoran peoples and groups who live in northern Mesoamerica.

The Tohono O'odham of the Sonoran Desert (Underhill 1938:21-41) used gourd cups in their saguaro wine ceremony; this ceremony marked the onset of the summer rainy season and the beginning of the agricultural cycle. The saguaro wine was first served at the community's "rain house" (Underhill 1938:24) from "great watertight willow baskets" (Underhill 1938:35). Afterword, each household returned home to its own jar of wine which had been left buried to ferment in the even warmth of the earth (Underhill 1938:39). As each household's wine reached the peak of fermentation it was shared with other members of the village using gourd cups.

Support for this hypothesis requires a linkage between agricultural origins and the inception of a container technology. Not only do we see the introduction of ceramic container technology during the late Cienega phase, we also see an increased reliance on maize agriculture (Adams 1996; L. Huckell 1996). Thus, the Mesoamerican sacred linkage of clouds, rain, and corn and its Sonoran Desert manifestation could have been forged at this early time, and the roots of a saguaro wine ceremony established. Saguaro fruit was clearly important to the late Cienega phase occupants of the Middle and Lower Santa Cruz River Valley. Saguaro seeds were recovered from all five of the sites that have produced incipient plain wares (L. Huckell 1996; Hutira 1993:337-339), and saguaro pulp and seeds are themselves important byproducts of wine making (Underhill 1938:23). Thus, the incipient plain wares may have served a function similar to the gourd cups used historically in the Tohono O'odham saguaro wine ceremony.

An alternative function is suggested by the Huichol Indians' use of small gourd bowls to hold offerings to various deities (Negrín 1975:19-20). Such bowls are kept in the local or family god house. In terms of their size and material culture, Huichol god houses and community temples (Myerhoff 1974:108-110) show a remarkable resemblance to late Cienega phase "Big Houses" (Halbirt et al. 1993:87, 90).2 Based on those similarities, we suggest that incipient plain wares may have been used like the Huichol prayer-bowls _ as a medium to convey prayers to the spirit world of ancestors and gods.

AGUA CALIENTE PHASE POTTERY: THE ADOPTION OF A UTILITARIAN CERAMIC CONTAINER TECHNOLOGY

Although we cannot discern the specific uses to which the earliest pottery was put, ritual _ rather than secular _ motivations seem to underlie the inception of this technology. Following the late Cienega phase, we see the adoption of a utilitarian ceramic container technology in the Agua Caliente phase (ca. A.D. 150-550). In a recent article discussing the beginnings of pottery manufacture and use as an economic process, Brown (1989:213, 220-221) lists a number of expectations derived from his position that pottery container technology was adopted to meet a growing need for watertight, fire-resistant containers. First, there should be an experimental period of pottery production that could last for several centuries. Second, expedient manufacturing techniques should appear in the earliest phases of pottery production. Third, early periods should contain evidence of alternative technologies that decline in frequency after pottery use takes hold.

Recent excavations at four Agua Caliente phase sites _ El Arbolito, Houghton Road, Square Hearth, and Stone Pipe _ have provided large samples of plain ware pottery from well-dated contexts. The Agua Caliente phase evidence supports Brown's (1989) thesis of an expedient pottery manufacturing technology model when resource selection, vessel shape, vessel wall thickness, and ceramic flow rate data are considered.

Analysis of compositional data from these four Agua Caliente phase sites has shown that plain wares were produced with raw materials available in six distinct portions of the Tucson Basin. Temper composition and texture data indicate that Agua Caliente phase potters followed two different materials procurement strategies. One of these strategies involved a single production step: the procurement of "self-tempered" alluvial clays. The other strategy involved three production steps: the procurement of untempered clay, the procurement of sand temper, and the combination of these two resources into a workable body.

In this phase, simple vessel shapes were produced by coiling, pinching, hand smoothing, smearing, scraping, and polishing. Vessel walls are thin, although variability related to production source was noted: plain wares produced from self-tempered clay had thinner vessel walls than those that were produced from clay and sand mixtures. Although five bowl vessel forms and three jar vessel forms have been documented, the dominant vessel form of Agua Caliente phase plain wares is the neckless "seed jar."

Crown and Wills (1995:245) and Wilson et al. (1992:13-14) have argued that the paste formulations, simple profiles, and thin vessel walls of early pottery are most appropriate for vessels used over a fire. Although these are desirable cooking pot characteristics, it is our contention that Agua Caliente phase pottery was produced by an expedient manufacturing technology and that the pots produced by that technology display many characteristics that are also desirable in cooking pots. It is important to realize that similarities between Agua Caliente phase pottery and later bowl forms may reflect a common solution associated with the desire to reduce thermal stress rather than a common function (i.e., cooking). As Rice (1987:363) notes, "The thermal behavior of a ceramic is of concern in two situations: in the initial firing of the clay and in use of the fired vessel with heat." The fact that pottery with simple profiles and thin vessel walls continued to be produced in later bowl vessel forms does not necessarily indicate a cooking function for the Agua Caliente phase seed jars. We believe that the results of a discriminant analysis of the proportions of vessels of known function (reported in Heidke and Stark 1996), the recovery of jar lids and vessels with abrasion at their lips, and the focus of the collection on a single vessel form, the seed jar, provide definitive proof that storage was the function for which the majority of Agua Caliente phase ceramics were best suited.

Estimating an Agua Caliente phase potter's annual output provides an important insight as to why we believe an expedient ceramic technology was employed. On average, the typical Agua Caliente phase household assemblage contained only five pots. How long did the five pots in the typical household assemblage last before they required replacement? An assemblage uselife value weighted by vessel function was calculated by multiplying the average uselife of storage vessels (using data from Mills 1989) by the percentage of storage vessels in the collection (documented in the rim sherds and reconstructible vessels), multiplying the average uselife of cooking/serving vessels by the percentage of cooking/serving vessels in the collection, and then adding the two figures together:

(Storage vessel uselife (Storage vessel fraction of collection) + (Cooking/serving vessel uselife (Cooking/ storage vessel fraction of collection) = (5.375 years (0.8914) + (1.85 years (0.1083) = 4.99 years.

Therefore, on average, the typical Agua Caliente phase household assemblage would have needed replacement every five years. The production of just one or two vessels each year would have met this need. If production rates were that low, then a simple, or expedient, technique may have had the dual advantages of being relatively easy to remember (from year to year) and likely to yield a successful outcome.

This review of Tucson Basin ceramics thus meets two of Brown's (1989) expectations for the adoption of a ceramic container technology: a low frequency of what might be termed "experimental" ceramics recovered from numerous late Cienega phase sites prior to the adoption of an expedient manufacturing technology in the Agua Caliente phase. Ceramics themselves cannot provide the evidence necessary for assessing his third expectation _ that early periods should contain evidence of alternative technologies that decline in frequency after pottery use takes hold. However, a decline in the volume of house floor storage pits between the late Cienega phase and the Agua Caliente phase has been documented (Mabry 1996a), and we interpret this pattern as evidence for a decline in one type of alternative container technology. Differential preservation precludes us from assessing the relative importance of baskets and other containers made of perishable materials. With regard to the model per se, the Tucson Basin evidence does not indicate a strong need for fire-resistant containers, which we interpret to mean cooking vessels, at this early time. It is not until the following Tortolita phase (ca. A.D. 550 to 650/700) that a large proportion of the pottery was well-designed for cooking (Heidke 1996).

Potters began to produce red wares as well as plain wares by the Tortolita phase. Adams (1996) has suggested that the introduction of the floury Maiz de Ocho at about this time stimulated design changes that led to the development of the trough metate and longer manos, both of which were specialized for efficient flour production. The increased diversity of ceramic vessel forms that also occurs by this time indicates that pottery containers finally began to fulfill the range of food preparation, cooking, serving, and storage functions that are usually associated with the prehistoric Southwest. In fact, Heidke and Stark (1996) have suggested that the first appearance of red-slipped vessels may have denoted the relationship between new (ceramic) food processing technologies and the life-giving force of the foods cooked and served in them. The model of economic intensification, and its effect on women's labor, proposed by Crown and Wills (1995) fits the Tortolita phase botanical, groundstone, and ceramic data nicely, but it does not explain the origins of Southwestern ceramic technology as they propose. The evidence from southeastern Arizona suggests that pottery origins in the southern Southwest may lie in ritual, and shows that it took somewhere between 400-1,000 years of ceramic production before Southwestern peoples became dependent on pottery for daily use.

FOOTNOTES:

1 _ This fact is easily demonstrated by calculating an odds ratio (Blalock 1979:311-312) comparing the number of incipient plain ware sherds recovered from the five ceremonial/integrative structures with the number recovered from the other structures. Odds ratio = (14 incipient plain ware sherds (5 excavated ceremonial/integrative structures) ((25 incipient plain ware sherds (140 other excavated structures) = 2.8 (0.178 = 15.68.

2 _ Compare Myerhoff's (1974) description of Huichol religious buildings, and their size and material culture with that of the "Big House" at the late Cienega phase site of Coffee Camp (Feature 315).

The Huichols erect two types of religious buildings _ the small oratories, xíriki, (local or family god houses) and the tuki (community temple). The xíriki resembles an ordinary Huichol house, and there may be one or more on each rancho. Here offerings are made and the souls of deceased relatives who have returned as rock crystals are kept; here one finds the gourds of sacred water, offerings, deer horns and tails, musical instruments, staffs of civil officials, and the like. . . . The tuki is constructed along the same lines as the xíriki but is generally much larger, typically thirty to forty feet in diameter. . . . On top of the tuki and xíriki are deer horns of Kauyumari (Sacred Deer Person). The mara'akame (shaman-priest) chanting inside the structure communicates with the deities by means of these horns (Myerhoff 1974:108-110).

Two complete deer antler racks were recovered atop several charred beams and the roof fall stratum of Coffee Camp Feature 315 (Halbirt et al. 1993:87), while the floor contained a phyllite baton/wand, four pieces of worked shell, a bone tube, a piece of malachite, and a figurine fragment in addition to a mano, a handstone, and seven chipped stone flakes (Halbirt et al. 1993:87, 90).

TABLE 1. Summary of late Cienega, Agua Caliente, and Tortolita phase production sequence attribute data.

ATTRIBUTE	Late Cienega Phase	Agua Caliente Phase	Tortolita Phase
No. Sites (*Sites listed in italics are included in the attribute data reported below*)	5 (*Clearwater, Coffee Camp, Los Pozos, Santa Cruz Bend, Wetlands*)	4 (El Arbolito, Houghton Road, *Square Hearth, Stone Pipe*)	5 (*Hodges, Lonetree*, Rabid Ruin, *Romero, Valencia*)
No. ^{14}C dates (Ceramic-bearing contexts only)	8	12	10
Probable date range (calibrated)	400 B.C. - A.D. 150	A.D. 150 - 550	A.D. 550 - 650/700
No. plain ware rim sherds/ reconstructible vessels	16	105	270
No. red ware rim sherds/ reconstructible vessels	0	0	111
Ceramic body	Untempered alluvial clay (<10% silt- to fine sand-sized nonplastics and variable, small amounts of organic nonplastics)	Self-tempered alluvial clays; mixtures of sand and clay	Mixtures of sand and clay; mixtures of crushed, micaceous rocks (+/- sand) and clay
Primary forming technique	Coiling; pinching	Coiling? Slab Building? Pinching	Unknown
Secondary forming technique	Scraping	Scraping	Beating (paddle-and-anvil)
No. vessel forms documented per site	1 - 4	4 - 7	10 - 17
Percentage bowls	85	11	65
Percentage seed jars	15	83	2
Percentage other jars	0	6	33
Sherd thickness (range)	3.0 - 7.5 mm	3.5 - 9.0 mm	3.5 - 10.0 mm
Sherd thickness (mean)	4.7 mm	5.7 mm	5.7 mm
Bowl orifice diameter (range)	1.5 - 13.0 cm	14.0 - 29.0 cm	12.0 - 34.0 cm
Bowl orifice diameter (mean)	7.4 cm	22.2 cm	21.9 cm
Jar aperture diameter (range)	2.0 - 4.0 cm	5.5 - 28.0 cm	9.0 - 41.0 cm
Jar aperture diameter (mean)	3.0 cm	14.4 cm	19.1 cm
Surface modification	Hand-smoothing; scraping; polishing; incising; impressing	Hand-smoothing; wiping or scraping; burnishing	Hand-smoothing; wiping; burnishing; polishing
Perishable container technologies copied	Basketry; gourds	None	None

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