

***PRE-COLUMBIAN POTTERY IN THE WEST INDIES:
COMPOSITIONAL CHANGE IN CONTEXT***

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Raw material selection in the production of pottery was examined in the context of site location, developing settlement hierarchies, and evolving institutional inequality in pre-Columbian Puerto Rico. Distinctive sherds ranging in age from 200 BC to AD 1200 were selected from various contexts in the Maisabel site. This time frame spans occupations of the earliest single-village egalitarian communities (Hacienda Grande and Cuevas complexes) through the development of multi-village territorial polities (Monserrate and Santa Elena complexes). Sherds were also selected from Site HU-7, occupied during the transition between two late prehistoric complexes, ca. AD 1000. All sherds were subjected to instrumental neutron activation analysis to characterize compositional variability regionally and through time.

Pottery was of fundamental importance to pre-Columbian cultures in the Caribbean. Broad similarities in surface decorations, vessel morphologies, and technology within and across many islands of the archipelago hint at social networks, through which ideas and perhaps pots were exchanged. Dramatic social and political changes occurred from

the early to late ceramic age in some parts of the Caribbean, documented archaeologically in site distributions; settlement organization; and such domains of material culture as ceramic styles, rock art, and iconography. The degree to which raw materials or finished products flowed through exchange networks and within and across settlement systems or

politics is poorly understood. In the present study, raw-material selection in the production of pottery is examined in relation to site location, developing settlement hierarchies, and emergent social inequality in Puerto Rico. Selected sherds from two pre-Columbian sites were subjected to neutron activation analysis to assess compositional variability geographically and through time.

The paper is divided into six sections. First, background is provided into Saladoid and post-Saladoid (Ostionoid) social and political organization in the West Indies; second, we present the problem and hypotheses addressed in this study; third, a brief review of the methods used in the study are discussed; results are detailed in the fourth section, followed by a discussion section; the paper closes with avenues for additional research.

Social and Political Context of Pre-Columbian Cultures in the Caribbean

The earliest ceramic-age colonists to the West Indies departed from northeastern South America approximately 2,500 years ago. These people were horticulturalists, who relied extensively on fishing and the collecting of marine and terrestrial faunal resources (deFrance 1989, 1990; deFrance et al. 1996; deFrance and Newsom 2005; Newsom and Wing 2004; Siegel 1991a, 1991b). They produced thin-walled elaborately painted, incised, and modeled ceramic vessels and figurines; fine groundstone celts, adzes, beads, and amulets; carved and ground shell, bone, and coral objects; in addition to many everyday items fabricated from stone, bone, shell, clay, coral, wood, cloth, and feathers (Rouse 1992). Similarities in material culture across sites and through time provide the basis for assigning the groups to a single series of

Saladoid cultures, named after the Saladero type site excavated by Irving Rouse and José Cruxent (1963). It is generally agreed that Saladoid peoples displaced pre-existing Archaic groups who were already occupying the Caribbean archipelago. However, the extent and nature of interactions between the ceramic and lithic-age groups in the Caribbean are poorly understood, and recently have become the topic of considerable interest (Rodríguez Ramos 2005; Siegel 1989; Siegel et al. 2005).

The earliest Saladoid colonists arrived to Puerto Rico by approximately 200 to 300 BC. For the next six to seven centuries (ca. 300/200 BC–AD 400), early Saladoid (Hacienda Grande complex) groups occupied sizable villages located in coastal to near-coastal settings. It is likely that Saladoid newcomers came to landscapes already modified by the previous Archaic residents. Well-developed Archaic occupations have been documented in the southern portions of the Caribbean (Allaire and Mattioni 1983; Boomert 2000; Harris 1973; Williams 2003). Emily Lundberg (1980:135) observed long ago that “the first pottery-making people to migrate into the West Indies did not move into a vacuum. Archaic groups (or at least people who made no use of pottery) were living all along their pathway.” In addition, ceramic-age colonists brought with them established ideas for how to make a living, how to organize their villages, and how the universe was structured. Ceramic iconography and village organization are vivid expressions of the Saladoid connection to the South American tropical rainforest (de Hostos 1919; Moravetz 2005; Roe 1989; Siegel 1995, 1996, 1999).

Settlement patterns and burials indicate that early-Saladoid social structure was based on

Table 1. Ceramic-age chronology for Puerto Rico.

Period	Date Range	Cultural Complex	Cultural Series
IIa	ca. 200 BC–AD 400	Hacienda Grande	Saladoid
IIb	AD 400–600/700	Cuevas	Saladoid
IIIa	AD 600/700–900	Monserate	Ostionoid
IIIb	AD 900–1200	Santa Elena	Ostionoid
IV	AD 1200–1500	Esperanza/Boca Chica	Ostionoid/protohistoric

an egalitarian ethic. Institutional social inequality was not a feature of early-Saladoid society (Rodríguez López 1990; Siegel 1993, 1995, 1996; Versteeg 1989). By about AD 400, we see an increase in the number of sites and habitats occupied compared to previous occupations. The late-Saladoid period (AD 400-600/700) was associated with continued habitation of coastal areas, in addition to substantial occupations in interior valley settings (Curet et al. 2004; Rodríguez López 1990; Siegel 2004).

The post-Saladoid occupations of the island are associated with an explosion in the frequency of sites and site types. At this time, formal civic-ceremonial plazas were constructed in a number of settlements. Combining lines of evidence from site locations, relative site sizes, architectural and structural organization, and mortuary patterns there appear to have been fundamental transformations in social relations beginning around AD 700 (Curet and Oliver 1998; Oliver 1998; Siegel 1996, 1999, 2004). Given the rather coarse chronology that we currently work with, where our finest degree of control is no better than two to three hundred years, the underlying shift in social organization was probably more gradual than it appears to us archaeologically (Table 1). Over the span of about seven centuries, from ca. AD 700 to AD 1400, the cultural

landscape of Puerto Rico progressed through a series of gradual but dramatic shifts. Tracking the locations of civic-ceremonial centers, as a proxy for mapping the political geography of the island, we see power initially broadly dispersed in the south and, through time, increasingly concentrated in the high interior mountains (Curet et al. 2004; Siegel 1999; Torres 2005). This trend was “associated with [the establishment] of well-defined group territories, increased solidarity among group members, and notions of exclusive rights over resources, land, and people” (Siegel 2004:93). Ethnohistoric documents reveal tensions between groups, ranging from low-level rivalries to casual feuding to out-and-out warfare and military campaigns of conquest (Siegel 2004:89–90). Numbers of sites in general, and ball courts/ceremonial plazas in particular, increased to their greatest levels by the Esperanza (protohistoric) period. From demographic trends apparent in the regional archaeological database, we might infer that population increases within the geographically circumscribed border of the Puerto Rico coastline combined with emergent and aspiring leaders in post-Saladoid times were responsible for changes in sociopolitical organization.

The Problem

In this context of institutional inequality fundamental questions are raised regarding the circulation of materials and loci of production. Unambiguous ceramic-style changes have been documented with the shift from single-village communities to multi-village polities (e.g., Roe 1989; Rouse 1992). Assemblages from early-Saladoid sites suggest a strong local focus on food supplies, combined with systematic long-distance exchange for semi-precious stones used in craft production (Cody 1991; deFrance and Newsom 2005). In the post-Saladoid world, settlement patterns evince a linked and hierarchical system of villages and camps that eventually formed into territorial chiefly polities (*cacicazgos*), well described in the sixteenth-century Spanish accounts.

The trajectory of ceramic-style shifts are well documented over approximately 2,000 years in the Caribbean, from about 500 BC to AD 1500 (Petersen et al. 2004; Rainey 1940; Roe 1989; Rouse 1992). In short, the early-Saladoid series of styles include elaborately decorated and technically sophisticated vessels in a variety of forms, ranging from bottles with multiple carinations, open bowls, and restricted flying-saucer shaped bowls. In contrast, the later Ostionoid series of styles are characterized by less complexly decorated and simpler vessel forms. The best explanation that I've heard for this "devolutionary" shift relates to concomitant changes in social organization: egalitarian to institutionalized inequality (Roe 1989, 2005). That is, with social and political changes there were distinctive material transformations in how power and prestige were expressed and displayed. In Saladoid communities, where power was of the achieved variety, the locus of prestige was in

the small personal-presentation realm of material culture (Roe 1989, 2005). We find exquisitely carved and polished stone and shell artifacts and fine pottery. At the scale of small and portable, these diminutive objects were designed to be admired up close and personal. During the following Ostionoid periods, in the context of developing chiefly polities, the locus of power shifted from the achievements of individuals to corporate groups, where people were born into positions of power and high status. Materializations of this group power are seen in the large easily visible and not-easily-movable petroglyphs and ceremonial plazas.

It is in this context of shifting power relations, developing settlement hierarchies, and evolving institutional inequality that we will address the production of pottery. Maisabel is a large ceramic-age site located on the north-central coast of Puerto Rico. It was intensively occupied from about 200 BC to AD 1200, spanning the full range of the Saladoid period and much of the Ostionoid period. Importantly, this occupational history spans the transition from tribal egalitarian communities to chiefdoms in Puerto Rico. Maisabel was a highly structured village, with a cemetery/plaza, series of mounded middens, and residential area (Siegel 1992, 1995, 1996, 1999). Sherds were selected distinctive of the Hacienda Grande, Cuevas, Monserrate, Santa Elena, and Esperanza styles from well-controlled contexts in the site.

Site HU-7 is a small Ostionoid village or camp located on the east coast of Puerto Rico (Figure 1). The site contains a buried sealed deposit of pottery that is stylistically transitional between Monserrate and Santa Elena (Siegel 2002). Sherds were selected from several vessel types in the site to assess



Figure 1. Map of Puerto Rico showing the locations of the Maisabel and HU-7 sites.

variability in pottery composition during this period of polity formation and integrated settlement hierarchies.

With the development of multi-village polities and regional settlement hierarchies, there is an expectation for the systematic movement of goods within and across settlement systems. The flow of tribute and trade and exchange were important aspects of Taíno chiefly polities, especially in negotiating alliances (Wilson 1990). With the increasing importance of trade and tribute in emerging and competitive polities we might expect to find artifacts laden with symbols and iconography to be moving through exchange networks. Saladoid and Ostionoid decorated pottery constitutes one class of symbolically charged easily movable artifacts and thus are uniquely appropriate to address the flow of materials through and across emergent polities (Roe 1989, 2005). Goals of

the research were to identify distinctive compositional signatures in the fabrics of sherds from the various time periods. Two hypotheses guided this study:

H₁: Pottery vessels from early periods exhibit a narrow range of compositional variability compared to those from later periods. Shifts in compositional variability through time relate to changes in settlement patterns, from single-village communities to large multi-village polities and the attendant development of regional social networks, through which pottery circulated.

H₀: There is no discernible compositional variability in sherds from the various periods, suggesting that pottery did not circulate through regional social networks.

H₂: The production, use, and ultimate

disposal of ceramic vessels were tethered to individual villages or communities, regardless of time period and degree of social complexity.

H₀. Pottery was manufactured in places different from where it was used and eventually discarded.

Other relevant studies have been conducted in the Lesser Antilles. In their petrographic analysis of Saladoid and post-Saladoid pottery from sites on Barbuda, Montserrat, Anguilla, and St. Martin (northern Lesser Antilles), Donahue et al. (1990) found generally distinct temper associations on the different islands. Saladoid and post-Saladoid sherds from the Sufferers site on Barbuda were compositionally/mineralogically similar, leading them to conclude “that virtually identical temper agents were being used in the two periods,” unless some sherds were misidentified as to temporal placement (Donahue et al. 1990:251). Viewing all sherds as a group, they observed that post-Saladoid pottery was more diverse in temper associations than Saladoid pottery (Donahue et al. 1990:252).

Based on her compositional analysis of La Hueca and Hacienda Grande-style sherds from the Hope Estate site on St. Martin, Corinne Hofman (1999:184) concluded that “although both styles are distinct in decorative motifs, the composition of the paste is often identical and that on this basis the La Hueca pottery should indeed be classified as a member of the Saladoid series, rather than as a separate series.” This conclusion is consistent with Carini’s (1991) compositional analysis of early Saladoid pottery. Although we are in agreement with the conclusion that La Hueca pottery is of the Saladoid series, we would only suggest that it is entirely conceivable that potters of

different cultural series could have made pots using similar, if not identical clay recipes, especially if source materials were derived from the same locales.

Methods

Fifty-three sherds from the Maisabel and HU-7 sites were submitted to the University of Missouri Research Reactor Center (MURR) for instrumental neutron activation analysis (INAA). Of these, 40 were collected from Maisabel and 13 from Site HU-7. Discussions of INAA, analytical procedures, and sample preparations are presented by Descantes and Glascock (2005) and Descantes et al. (this volume).

The INAA produced concentration values for 33 elements in most of the specimens (Descantes and Glascock 2005:3). These data were standardized to base-10 logarithms to compensate for differences of magnitude between major and trace elements and to approximate normal distributions, especially for the trace elements. Calcium levels for most of the sherds were found to be quite high, ranging from concentrations of 1 percent to values exceeding 25 percent (approximate mean of 3%). This is not surprising given the calcareous sediments and rocks and karst topography that characterize much of the coastal plains in Puerto Rico. Calcium values were corrected using MURR’s UNSHELL program (Cogswell et al. 1998). In their studies of the Maisabel and HU-7 sherds, MURR staff employed elemental plots to identify subgroups in the compositional data (compositionally homogeneous groups within the analytical database). Three compositional groups ranged in size from 5 to 21 members, with 8 sherds not assigned to any group.

Geological and Pedological Contexts of the Maisabel and HU-7 Sites

Puerto Rico is the smallest and most easterly of the Greater Antilles. It is 3,421 square miles in area and is included in the Greater Antilles Geologic Province. Puerto Rico is surrounded by the Atlantic Ocean to the north, Mona Passage to the west, the Caribbean Sea to the south, and Vieques Sound to the east. Approximately 75 percent of the island is characterized by rugged steeply sloped mountains. These mountains form the Cordillera Central, the Sierra de Luquillo, and the Sierra de Cayey. Much of the island's periphery consists of a coastal plain that averages approximately 5 km in width. Although the climate of Puerto Rico in general may be classified as humid subtropic, considerable variation exists within the island, from the mountains to the coast and from the island's northern shore to its more arid southwestern coastal plain.

Puerto Rico is divided into seven physiographic regions: Mountain Uplands, St. John Peneplain, Caguana Peneplain, Foothill Zone, Interior Lowlands, Belted North Coastal Zone, and Playas and Alluvial Plains (Beinroth 1969; Mitchell 1954). The Maisabel and HU-7 sites are located within portions of the Playas and Alluvial Plains physiographic region. Although most sections of this region are situated along the north and south coasts, sizable pockets of playas and alluvial plains are found on the east and west coasts. In general, the playas and alluvial plains are flat and mostly sandy and located along the mouths of larger streams. The playas and alluvial plains date to the Holocene and Pleistocene ages (Beinroth 1969:11).

The Maisabel site landscape encompasses both beachfront and inland positions, each

with attendant geology, soil types, and formation processes. An expansive mangrove swamp at the mouth of the Río Cibuco is located about a half kilometer southeast of the site. An assortment of calcareous sediments and rocks occur in the north-central coast region. These range from Tertiary limestone in the higher uplands well south of the coast to various Pleistocene and Holocene terrace and beach deposits along the coast itself (Beinroth 1969; Guillou and Glass 1957). In the immediate vicinity of the site the main geologic materials are recognized simply as marine-terrace deposits as well as eolian sands, typical for nearly any low-lying coastline location.

Soil variability in the vicinity of Maisabel is related to soil parent material type and landscape position. Three main parent material or deposit types occur within and around the site. These consist of eolian sand concentrated mainly between the shoreline and the crest of an interfluvial ridge, sandy residual limestone comprising nearly all of the upland landscapes south of the ridge, and alluvial and peat deposits associated with the Río Cibuco and associated karst features. Sizable deposits of clay are associated with the Río Cibuco and adjacent mangrove swamp within 1 km of Maisabel.

Site HU-7 is located on the east-central coast of the island, just south of the Río Antón Ruíz (Figure 1). The site is positioned on sandy near-shore Holocene sediments, approximately 300 meters from the beach. A large area of tidal-marsh soils occurs west of the site along with smaller pockets of salt marsh. Portions of the tidal-marsh soils developed on alluvium. The upland area backing the site contains soils formed on volcanic rocks. Deposits of clay and gravelly

clay loam are located in close proximity to the site (Boccheciamp 1977).

Results

Thirty-three elements were measured in 53 sherds selected from the Maisabel and HU-7 sites located on the north and east coasts of Puerto Rico, respectively. Nickel was subsequently deleted because of its absence in most specimens (Descantes and Glascock 2005:5). The log-transformed dataset was divided into two groups for an initial round of analysis: Maisabel vs. HU-7 sherds.

Maisabel contains pre-Columbian occupations spanning approximately 14 centuries, from ca. 200 BC to AD 1200. These occupations are represented by the Hacienda Grande, Cuevas, Monserrate, Santa Elena, and Esperanza cultural complexes, each associated with distinctive ceramic styles. The test hypothesis states that potters

from each of the five cultural complexes selected unique recipes in their manufacture of ceramic vessels. If true, then the compositional dataset should sort into five groups of sherds, each representing a distinct cultural complex or ceramic style. The null hypothesis states that potters through time did not create clay recipes distinctive of each ceramic style.

Elemental plots and Mahalanobis distance calculations using a subset of the principal components were performed to define compositionally homogeneous groups of sherds (Descantes and Glascock 2005; Ferguson 2007). Three compositional groups were identified in the Maisabel sample of sherds (Table 2, Figure 2). Group B, with 21 members, consisted of 9 Hacienda Grande-style sherds, 3 or 4 Cuevas, 3 or 4 Monserrate, 2 Santa Elena, 2 Esperanza, and 1 undifferentiated Ostionoid (Table 2;

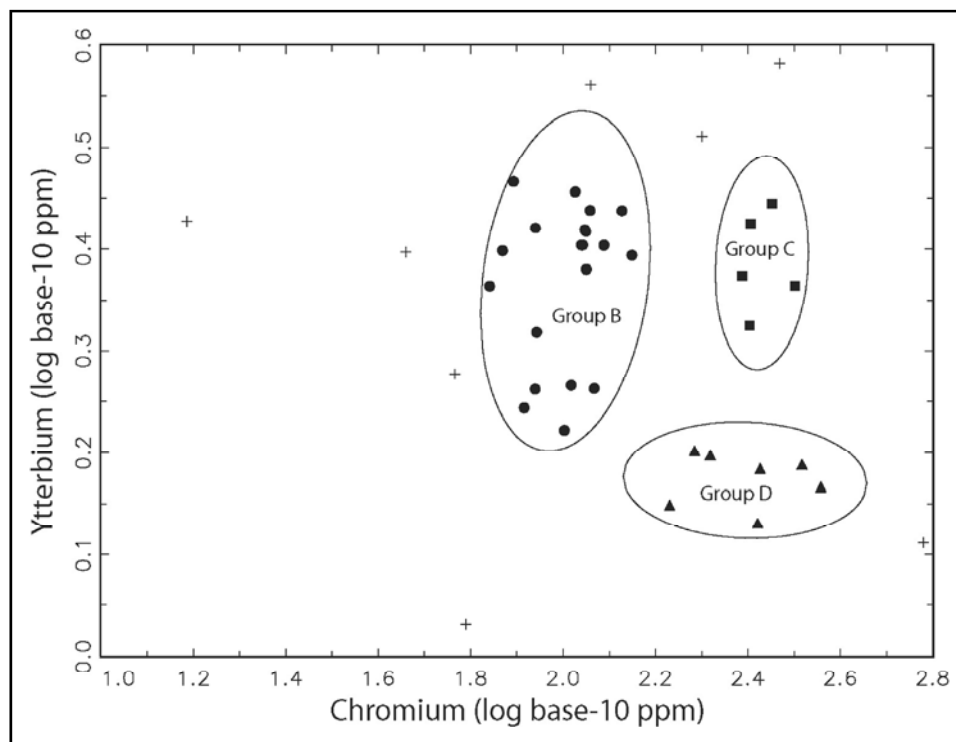


Figure 2. Compositional groups of Maisabel sherds. Unassigned samples shown (+).

Table 2. Compositional groups of the Maisabel sherds.

Group							
B		C		D		Unassigned	
<i>PUR No.</i>	<i>Cultural Affiliation</i>	<i>PUR No.</i>	<i>Cultural Affiliation</i>	<i>PUR No.</i>	<i>Cultural Affiliation</i>	<i>PUR No.</i>	<i>Cultural Affiliation</i>
2	SE	16	HG	3	Cu	1	HG
4	HG	18	Ost	7	Cu	2	Se
5	HG	19	Ost	13	HG (ZIC)	8	Esp
6	HG	27	SE	14	HG (ZIC)	24	SE
9	HG	35	Mon	22	Mon	25	Esp
10	Mon			33	Mon	28	SE
11	HG (ZIC)			36	Mon	28	SE
12	HG (ZIC)					39	Ost
15	HG						
17	Ost						
20	Cu						
21	Esp						
23	Mon						
26	Cu/Mon						
29	Esp						
30	Cu						
31	Mon						
32	SE						
37	HG						
38	Cu						
40	HG						

HG: Hacienda Grande complex

HG (ZIC): Hacienda Grande complex, zoned-incised cross-hatched

Cu: Cuevas complex

Mon: Monserrate complex

SE: Santa Elena complex

Esp: Esperanza complex

Ost: Ostionoid series

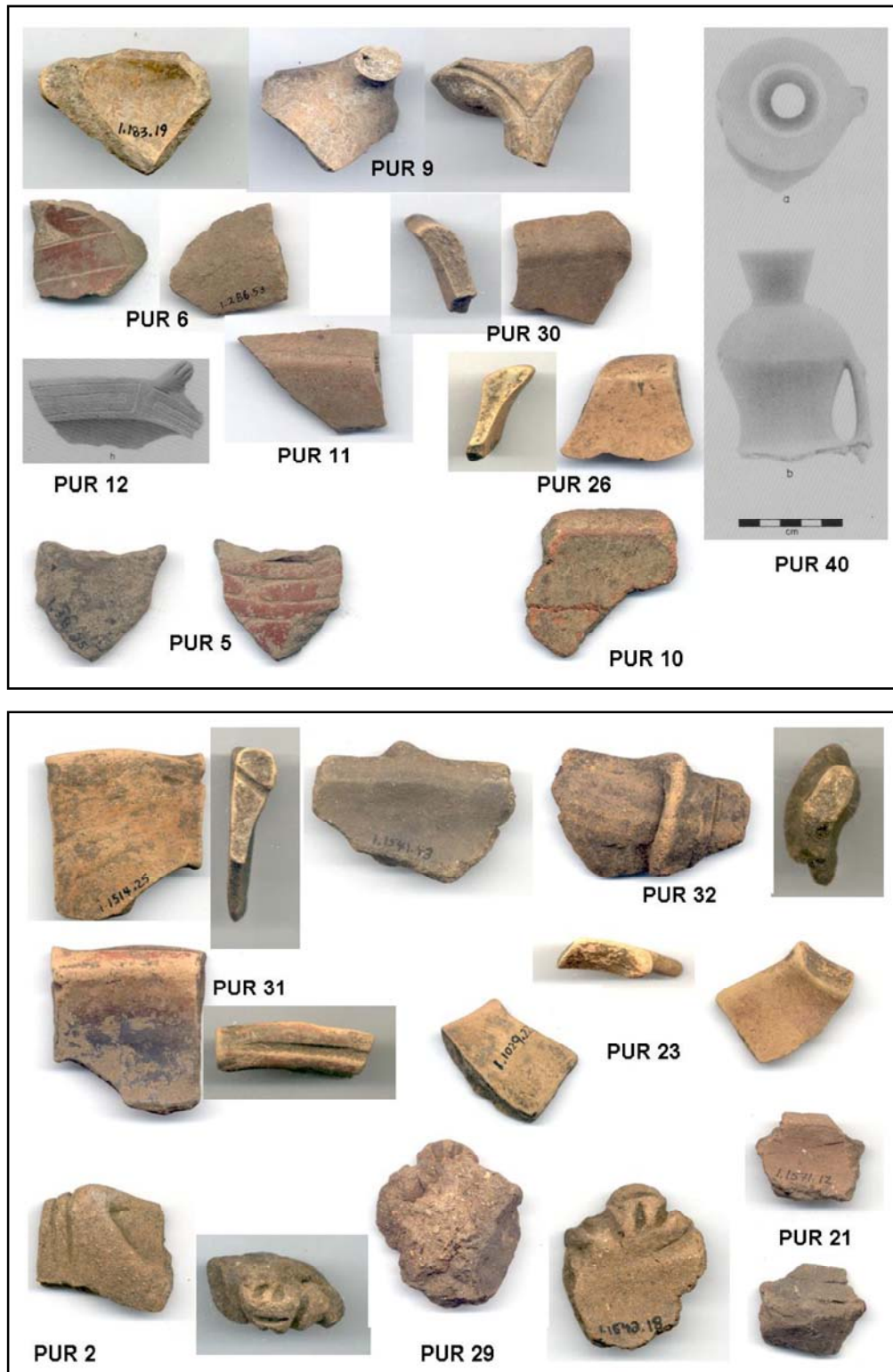


Figure 3. Sample of sherds from Maisabel Compositional Group B.

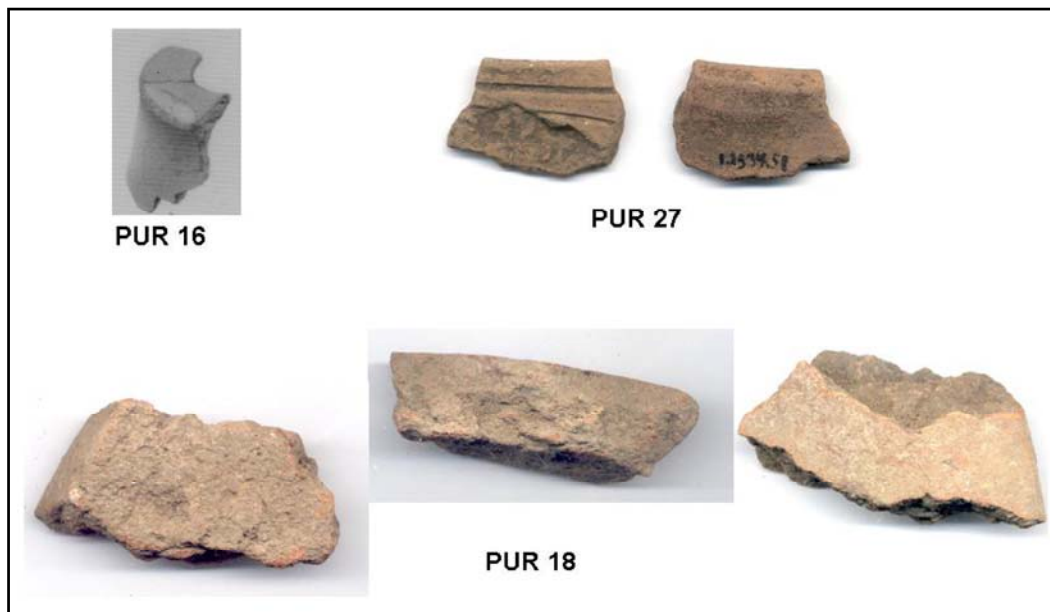


Figure 4. Sample of sherds from Maisabel Compositional Group C.

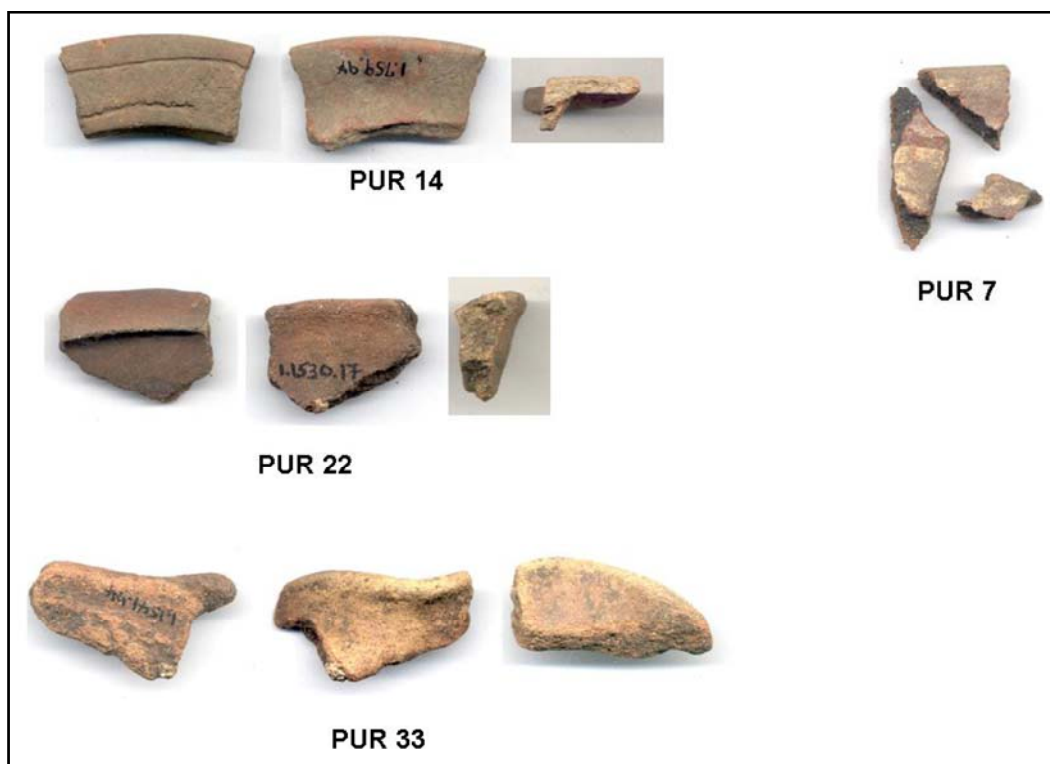


Figure 5. Sample of sherds from Maisabel Compositional Group D.

Figure 3). Group C contained 1 sherd each of the Hacienda Grande, Monserrate, and Santa Elena styles and 2 of undifferentiated Ostionoid (Figure 4). Group D consisted of 2 sherds each of Hacienda Grande, Cuevas, and Monserrate and 1 of undifferentiated Ostionoid (Figure 5). Eight sherds were unassigned to any group and consisted of 1 Hacienda Grande, 1 Monserrate, 3 Santa Elena, 2 Esperanza, and 1 undifferentiated Ostionoid (Table 2; Figure 6). Based on elemental compositions, there do not appear to be unique recipes, by cultural complex, in the production of ceramic vessels at Maisabel. The null hypothesis is accepted in this test.

A second hypothesis was posed to test for geographic distinctions in ceramic production: there are unique recipes in the production of ceramic vessels based on settlement locations. The null hypothesis states that settlement location does not bear

on the compositional makeup of vessels. The compositional databases of the Maisabel and HU-7 sherds were combined to test the hypothesis that pottery production is linked to settlement location.

Four compositionally discrete groups and one subgroup were identified (Figure 7). Again, all ceramic styles in the assemblage are represented in Groups B, C, and D. Groups A and A2 consist exclusively of Site HU-7 sherds. Two HU-7 sherds were placed in Group D, along with 7 Maisabel specimens. One HU-7 sherd was not assigned to any group. Based on these data, the null hypothesis is rejected. Regardless of time period, geographic location of a settlement is important in determining the compositional makeup of the associated pottery.

Discussion

This pilot study resulted in unexpected findings. Sherds were carefully selected from

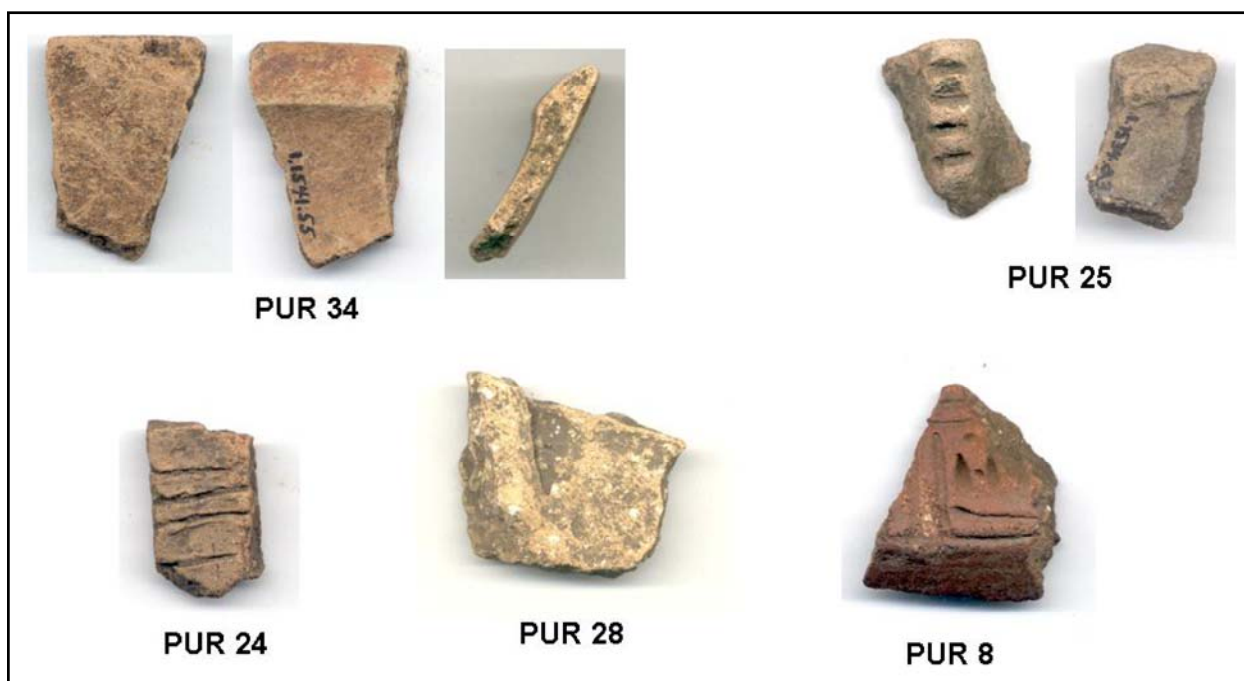


Figure 6. Sample of Maisabel sherds unassigned to any compositional group.

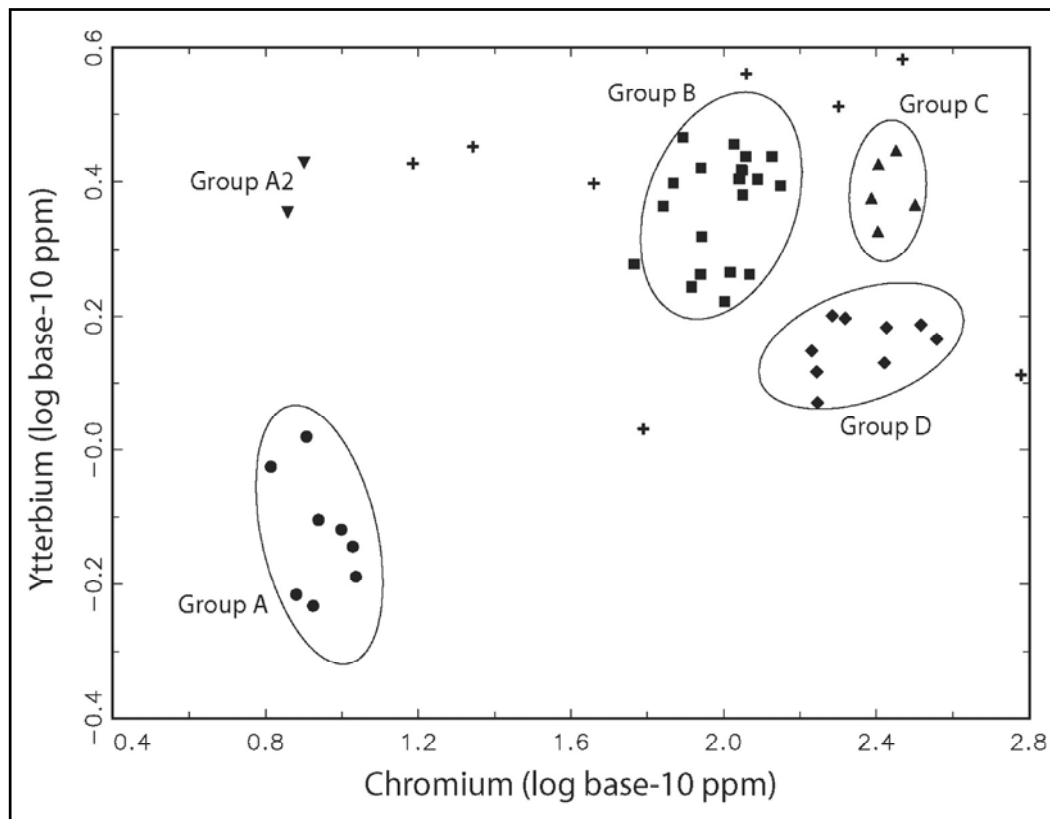


Figure 7. Compositional groups of Maisabel and HU-7 sherds combined. Unassigned samples shown (+).

well-documented contexts in the Maisabel site to investigate ceramic compositional variability through approximately 14 centuries of pre-Columbian occupations, spanning the Hacienda Grande, Cuevas, Monserrate, Santa Elena, and Esperanza cultural complexes. Current understanding of ceramic-age settlement patterns and political organization for Puerto Rico suggests that the earliest (Saladoid) occupations (Hacienda Grande [ca. 200 BC–AD 400] and to some extent Cuevas [AD 400–600/700]) consisted of egalitarian single-village communities. Villages tended to be large and widely spaced around the island in coastal to near-coastal settings. The earliest formally constructed ball courts on the island date to approximately AD 700 (Monserrate

complex). During the post-Saladoid occupations (Monserrate [AD 600/700–900], Santa Elena [AD 900–1200], Esperanza/Boca Chica [AD 1200–1500]), we see an explosive increase in the number of sites and site types and the development of settlement hierarchies. Post-Saladoid settlement patterns relate to the formation of and, through time, increasingly competitive chiefly polities (Siegel 2004).

Viewing for the moment the long trajectory of the ceramic age from the perspective of the terminal endpoints (Hacienda Grande vs. Esperanza), we expected that ceramic compositional variability would be lower at the older single-village community terminus (Hacienda Grande) than at the later integrated-settlement hierarchy end

(Esperanza/protohistoric). This expectation relates to the presumed systematic movement of materials through the post-Saladoid polities, especially in the context of tributary relations (Moscoso 1986).

Results of the current study suggest that the production and circulation of ceramic vessels remained at the local domestic level, regardless of the larger social and political context. Individual groups of sherds from Maisabel, produced by similarities in elemental compositions, contained specimens from all cultural complexes. Based on this analysis of 40 sherds from Maisabel, we conclude that the occupants of the settlement procured clays and temper materials from the local area throughout the ceramic age. Importantly, ceramic vessels found in the site apparently were not transported from other places. When elemental compositions of the Maisabel and HU-7 sherds were combined into a single analysis, there was nearly perfect segregation of the sherds, by site, further support for the emphasis on the local area in the production, use, and final disposition of pottery throughout the pre-Columbian occupations of Puerto Rico.

When multi-village polities formed during post-Saladoid times some villages may have maintained a certain degree of autonomy. For example, Maisabel, and perhaps other large Saladoid villages, continued to thrive as relatively autonomous villages even as networks of integrated settlements developed across the post-Saladoid landscape of Puerto Rico. Continuity of village autonomy would explain the lack of differentiation in paste content of ceramic vessels produced at Maisabel from early to late ceramic times. John Hoopes (2005:10) suggested a similar phenomenon in the early formation of chiefdoms for the Chibchan world of southern Central America and northern Colombia:

“Although there are some indications of settlement hierarchies, it remains to be demonstrated that some centers exercised political control over others and that some villages lost autonomy as they were incorporated into multivillage polities.”

Future Research

This pilot study leads to three lines of additional research that will help to clarify the use of ceramic vessels during the ceramic age: (1) clay sourcing, (2) functional variability within ceramic assemblages, and (3) regional variability in ceramic assemblages.

Clay Sourcing

Results of the current study suggest that settlement occupants relied on local sources of clay in the production of pottery. In Maisabel, ceramic vessels produced by artisans of all the major ceramic-age complexes shared common elemental compositional distributions. Except for two sherds, the Maisabel and HU-7 samples sorted into two distinct ceramic clusters.

It will be important to clarify raw material sources in ceramic production by conducting systematic soil surveys in relation to each archaeological site. In particular, clay samples need to be collected, analyzed for elemental distributions, and compared to the database created for the current study. Published soil surveys may be used to guide this fieldwork (Table 3; Acevedo [1982]; Boccheciamp [1977]). The soils map for the Maisabel setting shows sizable patches of clay within 1 km and especially within 3 km of the site (Table 4).

Functional Variability within Ceramic Assemblages.

Sherds selected for the current study generally targeted good examples of distinctive styles recognized for Puerto Rico

Table 3. Potential sources for clay for pre-Columbian pottery production in the vicinity of the Maisabel and HU-7 sites.

Maisabel		HU-7	
Bajura clay	Deep, nearly level, and poorly drained. Located on floodplains. Permeability is slow and available water capacity is high. Organic matter content is high	Caguabo clay loam	Shallow, well drained, and moderately permeable. Formed from partly weathered volcanic rocks. Moderate available water capacity
Jareales clay	Deep, nearly level, and poorly drained. Located in coastal lowlands. Permeability is very slow and available water capacity is high. Organic matter content is high	Coloso silty clay loam	Deep, nearly level, somewhat poorly drained. Located on floodplains and occasionally flooded. Permeability is slow. High available water capacity.
Santa Clara clay	Moderately deep, gently sloping to sloping, and well drained. Located on foot slopes and small hills. Permeability and available water capacity are moderate	Fortuna clay	Nearly level on river floodplains. Permeability is slow. High available water capacity.
		Junquitos gravelly clay loam	Moderately deep and well drained and moderately slowly permeable. Located on foot slopes in humid volcanic uplands. Formed in alluvial and colluvial sediment derived from extrusive volcanic rocks. High available water capacity.
		Pinones silty clay	Deep, poorly drained, and very slowly permeable. Located on coastal lowlands. High available water capacity.

and neighboring islands. This selection necessarily was weighted to decorated vessels and thus undoubtedly limited the analysis to a narrow range of functionally specific wares. An important follow-up study will be to systematically select a cross section of vessel types, defined on the basis of morphology and technology, from each of the cultural complexes. Functionally specific wares may be associated with distinct clusters of elemental concentrations, which also may be linked to specific clay sources identified in the soil surveys.

Regional Variability in Ceramic Assemblages

A large follow-up study will entail the systematic collection of sherds from other sites in the vicinity of Maisabel and HU-7. Maisabel is located in the Cibuco valley, where there are numerous documented late Saladoid and post-Saladoid sites. We have good evidence for the gradual development of settlement hierarchies and increasingly integrated polities after the Hacienda Grande period (Siegel 2004). In particular, it will be important to analyze samples of pottery from

Table 4. Distribution of potential clay sources in the vicinity of Maisabel.

Catchment Distance (km)	Bajura clay (m ²)	Jareales clay (m ²)	Santa Clara clay (m ²)
0.5			65,800
1.0			290,700
2.0	7700		96,700
3.0	973,400	403,300	93,000
Total	981,100	403,300	546,200

the large Paso del Indio site located a short paddle ride up the Río Cibuco from Maisabel (Walker 2005) and samples from some of the many smaller hinterland sites documented for the valley (Siegel and Joseph 1993).

Site HU-7 represents a small household settlement that was occupied for approximately 10–20 years during the transition between Periods IIIa and IIIb (Monserrate to Santa Elena periods). The site is located within the largest remaining mangrove swamp on Puerto Rico. Based on location, we can reasonably assume that the inhabitants of Site HU-7 took advantage of the bountiful resources surrounding them. Further, the small settlement was undoubtedly linked to a larger network of settlements across the post-Saladoid landscape. By Period IIIb, a site with a small ceremonial plaza was located in Sabana Arriba, approximately 22 km to the northwest of Site HU-7 (Rodríguez López and Rivera 1983). Assuming that ball court/plaza sites served as political or administrative centers then Sabana Arriba may have included the east-central coast within its jurisdiction during Period IIIb (Siegel 1999: Figure 6). Social and economic relations revolving

around tribute may have been established by Period IIIa, associated with the earliest evidence for institutionalized social inequality on Puerto Rico. As such, small household-based camps dating to the post-Saladoid occupations on the island must be viewed as potential resource-extraction places in the primary production of tribute. In this regard, it will be important to compare elemental distributions of pottery from sites within and across polities.

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Notes

¹Twenty-one sherds contained nickel; all except for one came from Maisabel. The Maisabel sherds with nickel spanned all of the cultural complexes.