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PRELIMINARY INTERPRETATIONS OF CERAMIC COMPOSITIONAL ANALYSIS FROM LATE CERAMIC AGE SITES IN ANGUILLA AND THE SALT RIVER SITE IN ST. CROIX

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Late Ceramic Age ceramic samples from five sites in Anguilla, British West Indies, and from the two most recent occupations at the Salt River Site, St. Croix, U.S. Virgin Islands, were analyzed by instrumental neutron activation analysis (INAA) at the University of Missouri Reactor Center (MURR). Compositional analysis of ceramic sherds from various archaeological contexts on these two islands help address issues related to ceramic production, interisland trade and exchange, and cultural affiliation.

Historically, ceramic research in the Caribbean has focused on establishing and refining typological and chronological sequences based on decorative style and vessel shape (cf. Rouse 1992). This necessary and essential work has formed the basis for reconstructions of pre-Columbian migration patterns and general spheres of cultural interaction. Unfortunately, due to the regional homogenization of ceramic form and decoration, style-based analyses cannot typically be used to discern specific patterns of intraisland and interisland ceramic trade and exchange. Compositional analysis of ceramics offers a complementary line of inquiry that helps address these issues with greater precision, allowing the identification and/or exclusion of possible production source areas, information that is vitally important for evaluating the role of ceramic

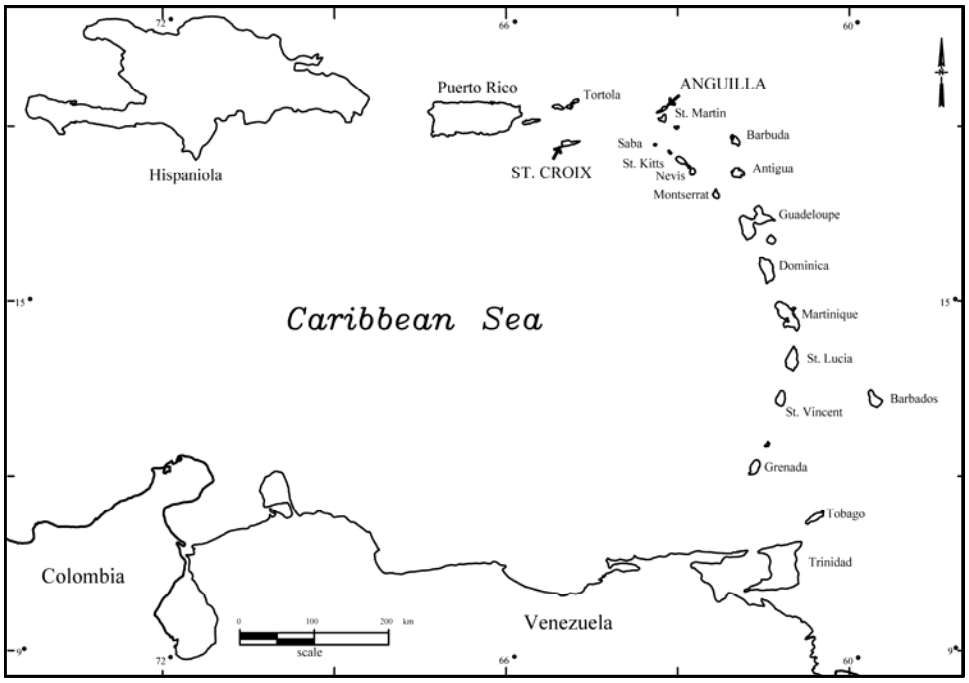

Figure 1. Map showing the location of Anguilla and St. Croix within the Caribbean Region.

vessels within a system of socioeconomic interaction.

In this paper, we report the preliminary results of INAA of ceramic sherds recovered from archaeological sites on the small Caribbean islands of Anguilla and St. Croix. Compositional analysis using INAA was undertaken to characterize and enumerate potential sources for the ceramics recovered from sites on these two islands. The results suggest that, during the Late Ceramic Age, ca. AD 600–1500, there were multiple manufacturing locales for the ceramics utilized at sites in Anguilla and St. Croix, and that, in many cases, production did not likely occur on the same island where the vessels ultimately were used and discarded. Though only preliminary, these data contribute to a better understanding of the dynamics of interisland interaction and the potential significance of ceramic trade and exchange in the development and maintenance of social organizations in the northern Lesser Antilles and Virgin Islands during the Late Ceramic Age.

Environmental Background

Anguilla is a relatively flat island with an area of only 102 square km and a maximum elevation of only 65 m. It is the northernmost of the outer, lower, islands in the Lesser Antillean chain (Figure 1) that are largely comprised of Oligocene limestones overlying a basal volcanic series and an intermediate series of feldspathic tuffs, conglomerates, and cherts (Earle 1923). Anguilla is made up of bedded white or cream-colored limestones with fossils that were laid down directly on top of an igneous basement. The underlying volcanic material is exposed only in a small area of the uplifted north coast (Earle 1923), below Crocus Hill, the island's highest point.

St. Croix is the southernmost of the Virgin Islands and is situated at the southeastern end

of the Greater Antilles, about 100 km southeast of Puerto Rico (see Figure 1). The closest of the Lesser Antilles are Anguilla, St. Martin and Saba, all of which are located on a north-south axis about 150 km to the east. Throughout the history of Caribbean archaeology, St. Croix always has been of great interest because of its somewhat isolated geographic location between the Greater and the Lesser Antilles, and its ethnohistoric position between the Classic Taino in the west and the Eastern Taino to the east (Rouse 1992; Morse 2004).

St. Croix is divisible into several geographical zones, the character of which undoubtedly had a considerable effect on prehistoric settlements. The two major physiographical areas include the late Cretaceous Oldland, underlain by rock of volcanic origin, and the Central Kingshill Plain, based on Tertiary marls and limestones, which divide the Oldland into a northwestern and an eastern part. The latter is partly covered by more recent alluvium (Cederstrom 1941, Nagle and Hubbard 1989). St. Croix has an area of about 220 square km and more than 50 known Amerindian sites that can be found in almost every sector of the island. Most sites are situated on or within 1 km of the coast, near sheltered bays or reefs, and the fewer inland sites are near waterways (Morse 2004).

Methods

The samples analyzed from Anguilla were obtained from 0.5 m by 0.5 m test pits systematically excavated at 25 m intervals across five different sites occupied during the Late Ceramic Age (ca. AD 600–1500). These include the Sandy Ground, Shoal Bay East, Barnes Bay, Sandy Hill and Forest North sites (Figure 2). Sandy Ground and Shoal Bay East have longer occupational histories with deposits that date between ca. AD 400/600–1500, whereas the other three date solely to more recent periods between ca. AD 900–1500. The 50 sherds studied were drawn from a larger grab sample of close to 300 sherds that were selected previously for basic temper analysis conducted by Crock and Petersen (Crock 2000). Two sherds were selected from each test pit excavated at each of the five sites, one randomly from an "upper" level and one randomly from a "lower" level in an effort to produce samples representative of earlier and later occupations at each site.

For the St. Croix sample, a total of 50 ceramic sherds from the two most recent Ceramic Age occupations at the Salt River site were analyzed. Previously, a basic temper analysis of these same sherds was conducted by Morse. The site is located on the island's northern shore at the base of Salt River point, which is a small, prominent, brush-covered peninsula stretching east towards the Salt River inlet. It was here that Columbus supposedly had an encounter with Amerindians on his second voyage in 1493. St.Croix's only ballcourt (*batey*) was also discovered at the site (Hatt 1924, Figure 3). The ballcourt is the easternmost known in the Caribbean and its construction is attributed to the last ceramic horizon (Taino). The Salt River site seems to have been the largest coastal settlement on the island at the European Contact, and the only one with continuous habitation throughout the Pre-Columbian Ceramic Age, which in the Virgin Islands, began shortly before AD 1 and lasted into the historic period. The site's chronology is known from two well-documented excavations, the results of which have been analyzed and compared with current research findings in St. Croix and nearby islands (Morse 1997). One of the excavations was

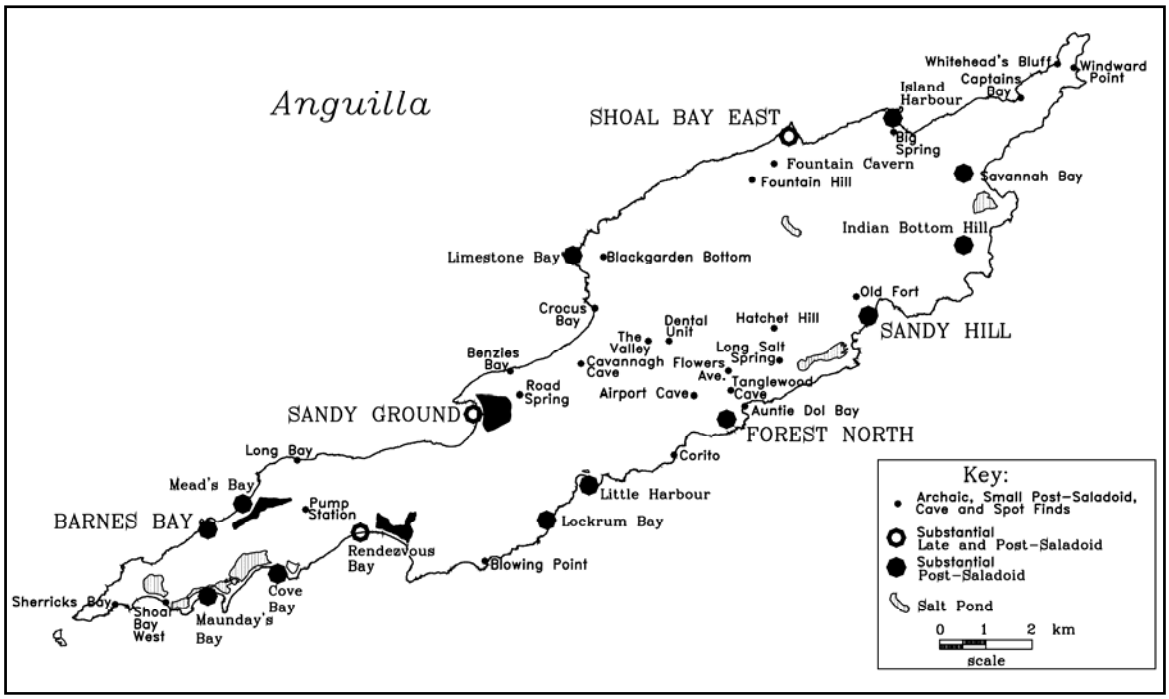

Figure 2. Map of Amerindian archaeological sites in Anguilla, B.W.I., with the five sites studied highlighted.

Figure 3. View of the Salt River site, St. Croix. Note petroglyph-lined ball court in foreground. Photo by Gudmund Hatt, 1923.

led by Gary Vescelius, whose comprehensive survey of the island in 1951 was carried out under the auspices of the St. Croix Museum Commission and the Yale Peabody Museum where his collections are presently housed.

Vescelius excavated 12 different units (pits) at the site, and the excavated ceramics proved essential to developing a ceramic seriation for St. Croix and the broader region (Vescelius 1951). For the present study, 10 sherds were selected from each of Vescelius' pits 1, 2, 4, 7 and 10. Five sherds from each of these excavation units were randomly selected from levels containing Elenan Ostionoid ceramics dating to between ca. AD 900–1200 (Figure 4), and five from shallower levels containing Chican Ostionoid ceramics dating to between ca. AD 1200–1500 (Figure 5). These two ceramic horizons represent the most recent Late Ceramic Age periods for the site, island, and region and are basically comparable to the temporal periods represented by the Anguilla materials.

Results

A previously conducted temper study found that 80% of Anguillian ceramics contain one or more volcanic minerals, the majority including rounded black sand grains (Crock 2000). Although Anguilla does have local clays that are suitable for the manufacture of ceramics, volcanic minerals, such as those visible with a low power microscope in sherds from Anguillian sites, do not occur naturally on the limestone island. Exposures of volcanic material do exist in deeper basement sections of the uplifted north coast. However, none has been readily identified as sources for the temper observed in any samples. These data have been used to suggest that more than half of the pottery found in Anguilla was manufactured on volcanic islands, including those with black sand beaches, and/or manufactured using local clays tempered with sand from these sources (Crock 2000). The closest islands to Anguilla with black sand beaches include St. Kitts, Nevis, Montserrat, and Antigua located approximately 80–160 km to the southeast. Finer grained, thin section petrography conducted by Donahue and others on samples from two Anguillian sites suggests the percentage of "exotic" ceramics is closer to 100%, with no sherds exhibiting exclusively carbonate temper (Donahue et al. 1990).

Principal components analysis conducted by Descantes and Glascock (2005a) on a subset of the same samples studied earlier by more conventional means indicates the five site samples are representative of three chemically distinct groups (Figure 6). A total of 10 of the 50 sherds (20%) fall within the range of Group 1, 27 (54%) fall within the range of Group 2, 6 (12%) fall within the range of Groups 3 and 7 (14%) could not be assigned to any of the three groups. Based on the earlier analysis of the temper used in the production of the same samples, all three groups identified in the compositional analysis likely represent off-island sources, or at least recipes containing off-island or "exotic" constituents. The identification of three distinct groups in the principal components analysis is surprising in that it excludes the possibility that all ceramics found in Anguilla derive from a single source of manufacture as well as the possibility that each village or household had its own unique ceramic recipe. Multiple sources for pottery vessels, like other commodities, is consistent with evidence that indicates Anguillian communities were major participants in an extensive interisland trade and exchange network during the Late Ceramic Age (Crock and Petersen 2004; Knippenberg 2006).

Figure 4. Elenan Ostionoid decorated ceramic sherds recovered by Gary Vescelius from the Salt River site in St. Croix. Yale Peabody Museum collection.

Figure 5. Chican Ostionoid decorated ceramic sherds recovered by Gary Vescelius from the Salt River site in St. Croix. Yale Peabody Museum collection.

In terms of possible site-based correlations, Group 1 is represented by samples from three of the five sites, Sandy Hill, Barnes Bay, and Forest North. Group 1 samples are enriched in the rare earth elements (REEs) and several transition metals (Co, Fe, Mn, V, etc.) relative to Groups 2 and 3. The latter groups are enriched in the alkali metals (K, Rb, Cs, and Ba) and in elements associated with quartz or sand temper such as Hf and Zr. The common trait shared by all of these sites is that they were occupied solely during post-Saladoid times, ca., after AD 900. The two sites without representation in Group 1—Sandy Ground and Shoal Bay East—have occupations that date to earlier periods. It is therefore possible that Group 1 may represent temporal patterns of ceramic production. That is, Group 1 may be associated with pottery production post-dating AD 900. However, given that the analyzed samples from all sites were derived from both earlier and later contexts (deeper and shallower), the absence of Group 1 ceramics from Sandy Ground and Shoal Bay East might be more related to social factors or simply a function of the small sample studied.

Group 2 comprises the majority of samples and includes pottery from all of the five sites studied. Relative to Groups 1 and 3, Group 2 is a core group and intermediate on most elemental concentrations. The lack of any statistically significant patterning within or between sites for Group 2 indicates that it

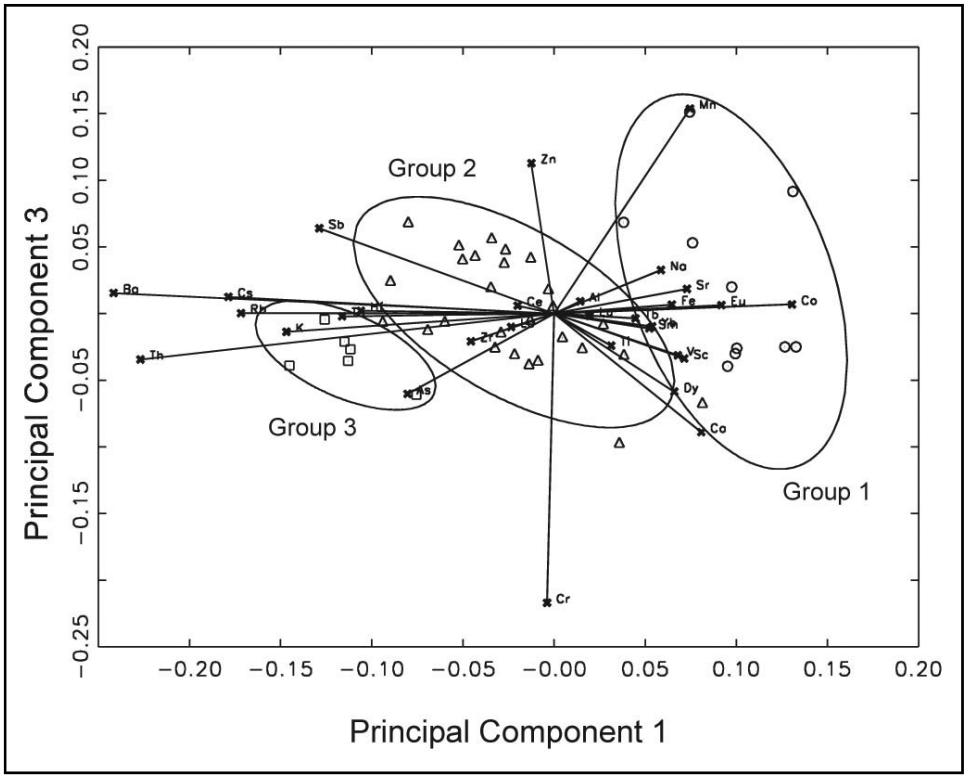

Figure 6. Biplot of principal components 1 and 3 displaying three compositional groups identified in the sample of ceramic sherds from five sites in Anguilla. Ellipses represent 90% confidence level for membership in groups. Vectors denote elemental influences on the ceramic data. Unassigned specimens are not shown (from Descantes and Glascock 2005a, Figure 1)

Figure 7. Broad-line incised rim sherd from the Barnes Bay Site in Anguilla. It was the only decorated sherd within the samples studied from Anguilla and a member of compositional Group 3

represents a consistent and enduring source for Anguillian ceramics, throughout the history of Amerindian occupation on the island. Based on simple falloff curve models of trade and exchange, the high proportion of ceramics exhibiting a variation of this particular "recipe" may represent a closer source than others, perhaps on the nearby island of St. Martin. St. Martin is the origin of a large proportion of the imported lithic materials, including greenstone used in the production of stone axes and calcirudite used to manufacture three-pointed zemis.

Group 3, the least represented of the three groups, is highly enriched in the alkali metals. It is worth noting that the three sites with samples assigned to Group 3 also are sites (Sandy Ground, Shoal Bay East and Barnes Bay) that exhibit a higher relative percentage of decorated sherds and other objects argued to be related to social status (Crock 2000). Of the two sites that did not contain pottery assigned to Group 3, one of them, Forest North, also happen to produce the lowest recorded estimated proportion of decorated sherds. Additionally, Group 3 included the only decorated sherd analyzed in the study of Anguilla ceramics, a slipped, broad-line incised sherd, possibly from a "pelican bowl" (Figure 7). Though very tentative due to sample size, this may suggest that there is a relationship between the provenance of Group 3 ceramics and the production of rarer decorated ceramics during the Late Ceramic Age, ca. AD 600–1500.

Three distinct groups were also identified in the ceramic samples from Salt River, St. Croix, based on principal components analysis of INAA results by Descantes and Glascock (2005b) (Figure 8). A total of 24

samples fall into Group 1 (48%), 20 in Group 2 (40%), and three in Group 3 (6%). Three specimens (6%) could not be assigned to any of the three groups identified. Relative to Group 1, Group 2 clearly has higher concentrations of the alkali metals and REEs, and is also enriched in zinc and antimony, when compared with compositional Group 1. Group 3 is enriched in thorium. The small member size in this group makes it difficult to test the probability of membership for samples in Group 3 relative to Groups 1 and 2 (Descantes and Glascock 2005b).

The identification of three separate groups of ceramics in the principal components analysis points to the use of at least three separate recipes in the production of the ceramics recovered from the two temporal components studied at the Salt River site. It is possible that all three groups represent ceramics that were manufactured on St. Croix from materials local to St. Croix. Alternatively, one or more of the compositional groups could represent off-island production locales.

Given the geologic characteristics of St. Croix with its two major physiographic areas, the sherds from compositional Groups 1 and 2, which are represented in both ceramic periods and date between AD 900–1500, may well represent locally manufactured ceramics utilizing clays from these two environments. Alternatively, these groups may also represent non-local sources, potentially

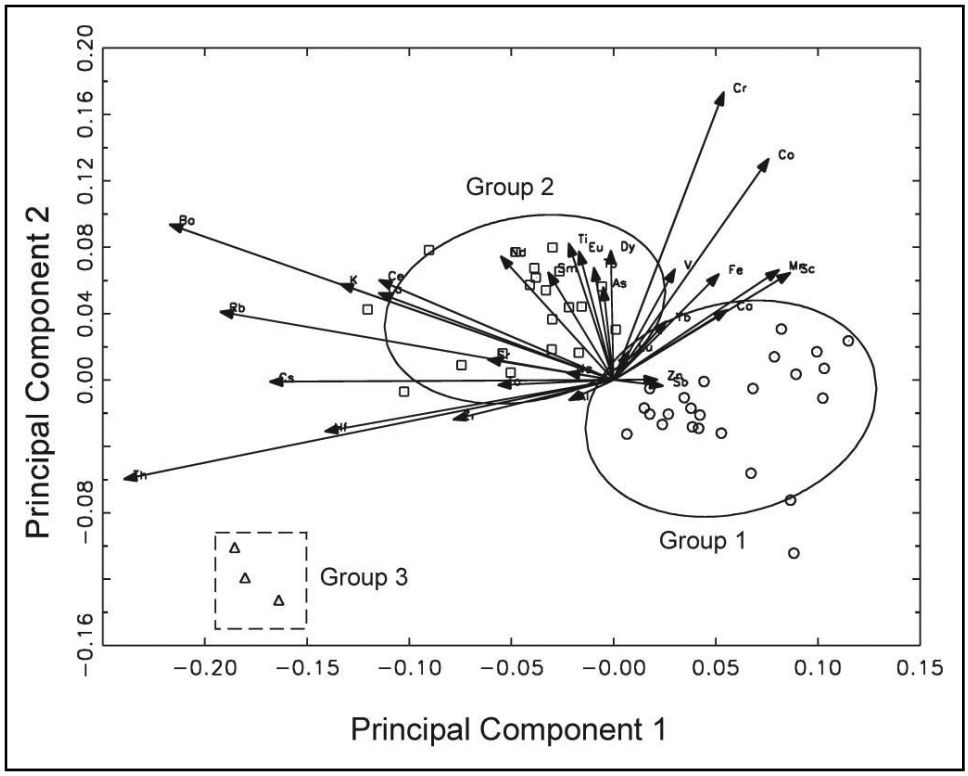

Figure 8. Biplot of principal components 1 and 2 displaying the three compositional groups identified in the sample of ceramic sherds from the Salt River site, St. Croix. Ellipses represent 90% confidence level for membership in the groups. Vectors denote elemental influences on the ceramic data. Unassigned specimens are not shown (from Descantes and Glascock 2005b, Figure 1).

including production locales on nearby islands such as Puerto Rico. Ceramics from sites in St. Croix and Puerto Rico are closely linked based on stylistic attributes and the geographic proximity of the two islands certainly would have favored cultural relatedness as well as trade and exchange. The Salt River Bay with its well-protected harbor, and the island's midway position between the Greater and the northern Lesser Antilles, were undoubtedly important factors in the site's settlement and position within a broader inter-island exchange network. When compositional data for St. Croix clay samples and for ceramics recovered from sites in Puerto Rico becomes available we will be able to better assess the relationship between the two islands in terms of ceramic production and consumption.

The three samples from the least well-represented group, Group 3, all derive from the latest ceramic period dating from AD 1200–1500. One of these samples exhibits a compositional affinity to samples of ceramics from the Dominican Republic (Descantes and Glascock 2005b). The one sherd from the Salt River site chemically resembles the Dominican Republic samples as a whole, which derived predominantly from the southeast side of Hispaniola in and around the ceremonial center of La Aleta. A possible compositional relationship between ceramic samples from Salt River and sites in southeastern Dominican Republic is not surprising based on the similarity between the two in terms of ceramic style and archaeological context (Hatt 1932). Though tentative, the potential relationship between ceramics found at a ceremonial site like Salt River and ceremonial sites in Hispaniola such as La Aleta, is intriguing. Based mainly on geographic distance, Salt River has long been more closely identified with Puerto Rico in terms of potential sociopolitical ties. Possible direct links with other ballcourt sites, like those known in Hispaniola, may help better identify and broaden the understanding of Salt River's position relative to broader issues of regional Taino sociopolitics.

Discussion

Compositional analysis presents an extremely valuable "new" perspective on regional interaction in the eastern Caribbean as indicated by the provocative results obtained in the pioneering analysis for two island contexts presented here. Clearly, we need to analyze samples of locally available clays, both in the context of Anguilla and St. Croix to identify/rule out potential clay source areas. As is always the case, analysis of additional ceramic samples from other sites will also further advance our understanding of ceramic production over time and help identify the potential number and variability of contemporaneous manufacturing locales.

Even at this early stage, however, we are able to discount the extremes when reconstructing the production and distribution of ceramics. As stylistic analysis already has long suggested, the results from Anguilla indicate that there were fewer ceramic "recipes" than households and sites and therefore, Late Ceramic Age vessels were more likely the products of some degree of specialized production at locations likely determined by the differential availability of suitable clays and tempering agents. The opposite extreme can also be discounted because of the compositional analysis. That is, that there was not a single-source manufacturing center for the Late Ceramic Age pottery used by the occupants of villages in Anguilla or for the pottery used by the people living at Salt River, St. Croix. Rather,

ceramic production was more likely dispersed. Based on the sites studied in Anguilla and its geology, the majority of the vessels were likely produced using a very limited number of recipes at a limited number of off-island locations. For the vessels used at Salt River, St. Croix, ceramic production was also seemingly limited to a handful of recipes from locations that were more likely to have been local to the site/island based on the local availability of constituent materials.

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