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COMPOSITIONAL ANALYSIS OF FRENCH COLONIAL CERAMICS: IMPLICATIONS FOR UNDERSTANDING TRADE AND EXCHANGE

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There is a considerable literature that explores the significance of low-fired earthenware production as a component of African Diaspora identity creation and maintenance both in the West Indies and in the American Southeast. Yet very little analysis has gone into understanding the role of industrially-produced, low-fired, earthenware ceramics in the Caribbean. We believe that these ceramics may be an overlooked archaeological resource. Although they do not typically reflect the fairly rapid changes in style that make European ceramics useful for chronology building, and whereas they do not usually exhibit stylistic and morphological variations that enable clear identification of their origin, they were produced in great quantity and transported around the West Indies to serve a wide variety of uses. We suggest that industrially-produced, low-fired, earthenwares may provide us with more information than simply their functional purpose. They may also prove useful as a key aspect of material culture to aid in the reconstruction of trade and interaction patterns, dependant, of course on being able to identify the place of origin of these ceramics. This article discusses compositional analysis of archaeological ceramics and wasters (poorly fired ceramics) recovered from historic kiln sites on the islands of Martinique and the Guadeloupe Archipelago. Compositional data from kiln sites are then compared to ceramic sherds from excavated domestic contexts elsewhere on these islands to begin to reconstruct trade and exchange patterns during the French Colonial period. The results from these analyses not only point to expected routes of trade, but also routes which contravened colonial boundaries.

Historical archaeologists, ethnoarchaeologists, and ethnographers of material culture have documented the presence and persistence of low-fired earthenware traditions on many islands of the West Indies. Present day earthenware production is known from islands with colonial histories as diverse as St. Lucia, Martinique, Nevis, St. Kitts, and Jamaica (Beuze 1990; Ebanks 1984, 2000; England 1994; Heath 1988; Hoffman and Bright 2004). Low-fired earthenware also is known archaeologically from these islands, as well as Antigua, St. Croix, Montserrat, and St. Martin (Gartley 1979; Handler 1963, 1964; Heath 1990; Petersen et al. 1999). These low-fired earthenwares have been studied by a number of scholars who have viewed their production and use as aspects of identity creation and resistance throughout African Diaspora related sites in the West Indies and the Southeast United States (e.g., Crane 1993; Ebanks 1984; England 1994; Ferguson 1992; Hauser and Armstrong 1999; Hauser and DeCorse 2003; Heath 1988; Mathewson 1972; Mouer et al. 1999; Petersen et al. 1999;). However, an extensive (indeed probably outnumbering hand-built ceramics) and potentially very important subset of low-fired earthenware production has generally been overlooked in archaeological investigations of the plantation-era West Indies. These wares, produced industrially in the Caribbean, include sugar cones, drip pots, and other "industrial" ceramics used in the plantation economies, as well as other forms, and are typically seen as evidence of the production of sugar. This stands in contrast to hand-built wares that are usually seen as a product of African inspired cultural resilience and creativity. In this article we explore how these industrially produced low-fired ceramics may be able to yield evidence of their origin through compositional analysis that will allow archaeologists to use them to address anthropological questions of trade and interaction rather than mere function.

This project originated as one of us (Kelly) was recovering large quantities of low-fired, but apparently industrially produced wares (wheel-thrown, controlled firing, etc.) from excavations at two plantation sites on Guadeloupe (Kelly and Gibson 2005). The sherds are similar to those observed on the surface at two known pottery production sites on the island. However, it was impossible to ascertain their origin because they lacked any distinguishing characteristics. We later discussed this problem, and developed a research plan to attempt sourcing sherds through petrographic analysis of thin sections. We were subsequently approached by Christophe Descantes and invited to participate in a region-wide survey of ceramics using instrumental neutron activation analysis (INAA) which was supported by the University of Missouri Research Reactor Center (MURR). This allowed us to expand our samples and begin addressing broader questions regarding provenience and manufacture of ceramics.

In 2004, we began this study of ceramic production in the French West Indies by collecting ceramic sherds from as many historic pottery production sites as we could find on the islands of Guadeloupe and Martinique. Although some sites were little more than large waster heaps associated with historically documented pottery production sites, others were very impressive with substantial standing remains. Of these, the Fidelin kiln on Terre de Bas, Les Saintes (a small island in the southern portion of the Guadeloupe archipelago, between Guadeloupe and Dominica) where there is a

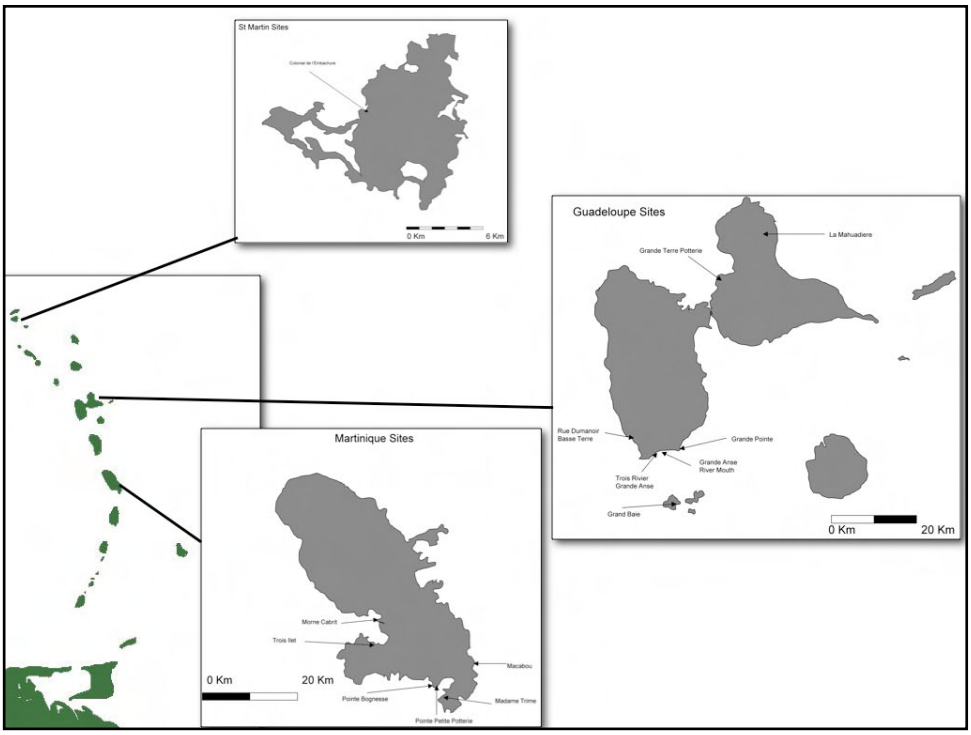

Figure 1. Sampled sites in Martinique, Guadeloupe, and St Martin.

double-chamber kiln, each chamber of which measures about 4 m square, and the still-active pottery at Trois Ilets, Martinique, are most notable. The sherds collected from eight production sites (three on Guadeloupe, five on Martinique) were augmented by sherds excavated from two plantation sites on Guadeloupe, an urban site in Basse Terre, Guadeloupe, a surface collection from the island of St. Martin, and sherds of modern production in St. Anne, Martinique (Figure 1). In most cases these sherds were remains of industrial pottery vessels such as sugar drip jars and sugar cones, although some domestic wares such as cooking and serving vessels and pitchers were included as well. These samples were analyzed by INAA and optical thin-section petrography to identify chemical, mineralogical, and physical composition properties.

Context

Although locally- and regionally-produced ceramics in the Caribbean have been studied by a number of scholars (see Crane 1993; Ebanks 1984, 2002; Handler 1963; 1964; Hauser and Armstrong 1999; Hauser and DeCorse 2003; Heath 1988; Mathewson 1972; McCusick 1960; Petersen et al. 1999; Vérin 1963), few have systematically catalogued and completed compositional studies of these wares. During the eighteenth and nineteenth centuries, local earthenwares were manufactured at scales of both craft and industrial production as utilitarian household wares for use by enslaved laborers and others, and industrially as vessels used in the processing and storing of sugar in the plantation industries. Among the few compositional studies that have been undertaken of either hand-built or wheel-

thrown earthenwares are those of Brian Crane (1993), who analyzed a set of *Criollo* wares recovered from San Juan, Puerto Rico using INAA in 1992; Mark Hauser (2001) who completed petrographic analysis on similar ceramics called *Yabbas* in Jamaica in 2001; and James Petersen and David Watters (1988; see also Watters 1997) who petrographically analyzed ceramics from Barbuda and Montserrat. However, none of these studies have been integrated to consider regional interaction spheres between neighboring islands.

Excavations from the French West Indies (see Figure 1) have also produced a series of local coarse earthenware. In Martinique, Suzannah England (1994) completed a dissertation on a ceramic production site near Trois Ilets at Habitation Vatable, in which she used formal characteristics to define wares. In Guadeloupe, Isabelle Gabriel (2003) conducted test excavations at the Fidelin kiln site at Grande Baie on the island of Terre de Bas, Les Saintes (Figure 2). Gabriel's (2003) excavations produced a large number of ceramic sherds, but they have not been analyzed in any detailed or systematic fashion. Hauser (2001) and Mathew Reeves (1997) have both inferred that evidence of glazing on earthenware ceramics recovered from Jamaica indicates the use of kilns in their manufacture, but the production sites themselves remain unknown. Therefore, the identification of the kiln sites on Guadeloupe and Martinique used to produce utilitarian wares is archaeologically unique in the historic Caribbean, but remains understudied in the French Antilles. We hope that analysis of the ceramics from this French industry can be used to help understand distribution systems and compositional characteristics of local earthenware production in the Caribbean.

Figure 2. Fidelin Kiln, Grande Baie, Les Saintes, Guadeloupe, 2005.

Figure 3. Industrial ceramics used in sugar processing. Diderot Vol 18, Oeconomie rustique, Sucrerie.

The Ceramics

Here, we examine three types of ceramics recovered from the surface collections at kiln sites and from excavations on Guadeloupe and Martinique. The first ceramic type is related to the industrial processing of sugar and is shown in this contemporary illustration (Figure 3). These ceramics (Figure 4) are a thick-walled, wheel-thrown earthenware. The paste is coarse, orange-red, and contains large grog, limestone, and detrital inclusions. The surfaces are untreated. These ceramics are found in forms that include drip jars (Figure 3, lower ceramic) and sugar cones (Figure 3, upper ceramic).

The second type of ceramic (Figure 5) is a utilitarian ware associated with household cooking and serving. They also appear to be wheel-thrown and are thin-walled. The paste is coarse, reddish brown and contains felspathic detrital inclusions and limestone. These ceramics are smoothed and treated with a red slip, and cores indicative of an oxidizing environment are present on the majority of this type. With both types there appears to be variation in the texture of the paste and the nature of the visible inclusions dependent upon from which kiln the surface collection was obtained. These ceramics have also been recovered in archaeological excavations at La Mahaudière and Grande Pointe by one of the authors (Kelly) and also salvaged from construction sites in Basse Terre and St. Martin by Antoine Chancerel and Christian Stouvenot (pers. comm. 2005).

The third ceramic type is a hand-built ceramic similar to those described by Lyn-Rose Beuze (1990) in her ethnographic description of the potter Madame Trime in the Commune of Sainte Anne in Martinique (Figure 6). This is a coil-made, thick-walled ceramic. The surfaces are evened and

smoothed using a scraper and a rag (Beuze 1990). The highly variable cores in the ceramic paste, and the surface clouding indicate that the ceramics were fired in an oxidizing and relatively uncontrolled environment, probably fired in an open pit (Rye 1981:116). The ceramics are both slipped and burnished. Seven forms of this type are identified by Vérin (1960) using créole nomenclature including “Terrine”, “Canari”, “Tesson”, “Kastol”, “le Leshwit”, “Krish”, “Jé”, “Shodie”, “Plate” and “Potaflé”. An eighth form described by Madame Trime is the Coco Nèg’ (Beuze 1990:42–43; pers. comm. 2005). We collected several wasters from Madame Trimes' house yard in Ste. Anne. Archaeological examples of this kind of pottery were collected from La Mahaudière and Grande Pointe in Guadeloupe, and surface collections in Martinique.

Methods

The ceramic sherds from Guadeloupe and Martinique used for the study included surface collections from known or hypothesized kiln sites, sherds excavated from sugar plantation slave village contexts, material from urban salvage excavations, and waster sherds from the last remaining traditional earthenware maker in Martinique. These samples were augmented by surface-collected sherds from St. Martin, a French island and dependency, 250 km to the north of Guadeloupe. We also selected samples from a diverse array of geological environments, ranging from southern Martinique to Les Saintes, Guadeloupe, and

Figure 4. Sugar cone recovered from River Mouth Grand Anse, Basse Terre, Guadeloupe. Note the “F” on the base of the cone, which represents the Fidelin Kiln.

Figure 5. Wheel-thrown utilitarian ceramics recovered from Grande Pointe, Basse Terre, Guadeloupe.

Figure 6. Ethnographic examples of hand-built utilitarian ceramics manufactured by Madame M. Trime, Ste. Anne, Martinique, 2007.

St. Martin. The specific context of each collection is discussed below.

Surface Collections

Guadeloupe Kiln Sites

Fidelin Kiln, Grande Baie, Terre de Bas, Les Saintes. These sherds were collected from the surface of a very large industrial-scale operation active on Terre de Bas during the eighteenth and nineteenth centuries (Gabriel 2003). The sherds were primarily from forms that are associated with sugar production (e.g., sugar cones, drip jars), but also included some forms that were probably produced for domestic use (open pots of various sizes).

Kiln site, Grande Anse, Trois Rivières, Guadeloupe. These sherds were collected on the surface from what remains of a large waster heap that is now eroding into the sea and partially destroyed by the modern coastal road. The waster heap is the only visible portion of the production site; any kiln remains are either gone or hidden by vegetation in private lands that were not accessible. The site dates to the eighteenth and possibly the nineteenth century. It is located approximately 100 m west of the Grande Anse beach parking lot.

Kiln site, River mouth, Pointe de la Grande Anse, Trois Rivières, Guadeloupe. These sherds were collected on the surface from an extensive waster deposit surrounding the ruins of a single chamber kiln about 20 m west of the Rivière de la Grande Anse, and about 150 m from the ocean near the parking area for the municipal swimming pool. This site probably dates to the eighteenth and nineteenth century.

Martinique Kiln Sites

Kiln site, Morne Cabrit, Lamentin, Martinique. These sherds were collected on the surface from a waster deposit adjacent to the kiln chamber ruins at the south end of Morne Cabrit, a small rocky island in the mangrove swamps of the east end of the Baie de Fort de France. The island, currently used as a yacht club, contains the ruins of a large eighteenth century house on the north end which may have been the owner's house. The site is noted as a *Habitation Poterie* (pottery production estate) on the *Carte de Moreau du Temple* map (Bousquet-Bressolier et al. 1998), dating to the 1760s.

Habitation La Poterie, Trois Ilets, Martinique. These sherds were collected on the surface from the area surrounding the slave village of the Habitation La Poterie, a large pottery production estate. The sherds date to the eighteenth and nineteenth century. The kiln area is no longer present, as modern production has completely eradicated the earlier kilns. The site is noted as a *Habitation Poterie* on the *Carte de Moreau du Temple* (Bousquet-Bressolier et al. 1998), dating to the 1760s.

Pointe Borgnesse, Le Marin, Martinique. These sherds were collected on the surface from waster accumulations adjacent to the kiln chamber of this large pottery production complex. The complex is on the coast and literally built on beach sand. The site is noted as a *Habitation Poterie* on the *Carte de Moreau du Temple* (Bousquet-Bressolier et al. 1998) map, dating to the 1760s.

Pointe Petite Poterie, Le Marin, Martinique. These samples were collected adjacent to the ruins of the kiln structure, approximately 100 m from the sea. The site is described as an *Habitation Poterie* on the *Carte de Moreau du Temple* (Bousquet-

Bressolier et al. 1998) map, dating to the 1760s.

Macabou, Le Vauclin, Martinique. These sherds were collected from the surface of a site at the mouth of the bay among the mangroves. The site has Amerindian material on the surface, including faunal remains, so it is possible that it was not used to produce historic era pottery. The sherds from this site were distinct due to the presence of shell temper and were included based upon suggestion of the then-Conservator of Archaeology for Martinique, Olivier Kayser, because there may have been a kiln site there. Furthermore, we felt that if the sherds were Amerindian, they would provide a useful alternate sample for the petrography and the INAA because of different production techniques and inclusions, such as shell temper.

Excavated or Non-Production Samples

Habitation La Mahaudière, Anse Bertrand, Guadeloupe. These sherds came from excavated contexts dating to the late eighteenth and nineteenth century slave and laborer village site associated with a large sugar plantation.

Habitation Grande Pointe, Trois Rivières, Guadeloupe. These sherds were excavated from the late eighteenth to mid nineteenth century slave village site associated with a sugar plantation.

Rue Dumanoir, Basse Terre, Guadeloupe. These sherds were part of two nearly complete pitchers or carafes and a globular pot salvaged by Antoine Chancerel, then Conservator for Archaeology in Guadeloupe, from a pipeline excavation along Rue Dumanoir in the historic (seventeenth to nineteenth centuries) center of the city of Basse Terre, administrative capital of Guadeloupe. This sample was included because it resembled some very small fragments found at La Mahaudière and Grande Pointe and because they bore a strong morphological resemblance to water carafes traditionally produced in Martinique and visible on display in the Ecomusée de la Martinique, Rivière Pilote.

Colonial de l'Embachure, Saint Martin, Guadeloupe. These sherds were obtained from an assemblage of between four to six nearly complete large pots that were found cached under a rock shelter on the side of one of the principle hills of the French portion of St. Martin. Other artifacts recorded with the earthenware pots suggested a late eighteenth or early nineteenth century date to the assemblage. The site has no known association with any recorded historic habitation and may represent an intentionally hidden place of refuge. The sherds were included because they were the only samples available from the island of St. Martin, a dependency of Guadeloupe.

Château Dubuc, La Trinité, Martinique. These sherds were surface collected from the eighteenth to mid-nineteenth century sugar plantation.

Ethnographic Collection

Madame Trime, St. Anne, Martinique. These sherds were donated to our project by Madame Trime, a potter active in St. Anne. Madame Trime is believed to be the last potter working in Martinique who continues to use traditional methods, including hand building and open firing to produce earthenwares.

INAA and Petrographic Methods

As Mason and Keal (1988) have pointed out in south Yemen and Jordan and Schrire and Miller (1999) have demonstrated in South Africa, ceramic petrography can detail

the economic relationship between imported ceramics and local pottery traditions. We employed both petrography and INAA on a sample of archaeological and ethnographic ceramic sherds recovered from the above-mentioned sites in order to discern the relative homogeneity and heterogeneity of recipes employed by potters in the production of pottery in the eighteenth century. In this analysis we were interested in assessing both the compositional similarity of ceramic materials from different proveniences as well as discerning any differences in processes associated with manufacture. INAA has a long history of successfully utilizing these analytical means to characterize and identify the provenance of archaeologically recovered materials (e.g., Hegmon et al. 1997; Hoard et al. 1993; Steponaitis et al. 1996). Thin-section petrography is a widely used technique to assess the compositional heterogeneity of detrital inclusions, added temper and the paste within the matrix of a ceramic vessel (e.g., Jordan et al. 1999; Mason and Keal 1988; Stoltman 1989). In tandem, these techniques enable researchers to develop a recipe of ceramic sherds and gain better understanding of the source materials used in manufacturing pottery including the weathering and petrogenesis of clay and tempering materials (e.g., Hegmon et al. 1997:455; Hill et al. 2004; Mandal 1997).

Our study comprised 56 ceramic sherds which were analyzed petrographically. These included samples that were hand-built utilitarian ceramics (n=17), wheel-thrown utilitarian ceramics (n=20), industrial ceramics (n=18), and pre-Columbian ceramic (n=1). We subjected fifty of these sherds to INAA (See Table 1). Initial sample preparation occurred at the Field Museum of Natural History, Island Archaeology Lab. Sherds were cut along the vertical axis of the pottery using a slow saw.

Fifty six samples were sent for sample preparation to Arizona Quality Thin Sections in Tucson, Arizona. Following standard techniques of sample preparation in ceramic petrography, these samples were vacuum impregnated with epoxy, mounted on a 46 mm slide and finished to a 30 micron thickness. All thin sections were analyzed using Brunell XP-201 polarizing light microscope and mechanical stage. Relative abundance of constituent materials was established by employing an areal count technique discussed by Velde and Druc (1999:232) using a 10 mm counting reticule under 40x magnification. Although Chayes has argued that this technique enables a fairly accurate measure of constituent materials (Chayes 1956, 1955 cited in Stoltman 1989:146), the size of larger inclusions exceeded the 0.5 mm grid of the counting reticule. We therefore took the estimations to be only semi-quantitative. We paid specific attention to identifying mineral inclusions within the clay matrix noting size, angularity, relationship with other mineral inclusions, chemical, and mechanical alteration. The relative abundance of specific minerals and their texture provide some indication of the potential geological maturity of the source materials. Fifty of the sampled sherds were sent to MURR and prepared for INAA under the direction of Michael D. Glascock and Christophe Descantes according to a standard set of procedures (Glascock 1992). By use of two irradiations and three measurements, a total of 33 elements were measured by INAA. Descantes conducted the data reduction and employed principle components analysis to identify compositional clusters.

Results

Instrumental Neutron Activation Analysis

Before identifying compositional groups, exploratory data analyses were conducted on the thirty-three elemental abundance measurements. The elemental concentration of nickel (Ni) was dropped from subsequent analyses because many of the samples were below the detection limits. In addition two specimens, GUA037 and GUA045, were excluded from further analyses because of unusually high concentrations of metal that likely result from contamination of the samples. Specimen GUA037 had excessive concentrations in calcium, cesium, nickel, and the rare earth elements; specimen GUA045 exhibited an uncharacteristically high concentration of arsenic.

A three-group structure was identified among the ceramic specimens: Group 1 (n = 19), Group 2 (n = 16), and Group 3 (n = 4). The compositional groups can be graphically represented in principal component space (Figures 7 and 8) and in elemental space (Figure 9). Statistical tests based on Mahalanobis distance-derived probabilities using nine principal components (that is 90.5% of the cumulative variance) support the graphical representation illustrating the group structure. A cut-off of 1% was generally used to refine the membership of Groups 1 and 2; however, exceptions were made because of the low numbers of samples in each of the compositional groups. The small membership size of compositional Group 3 precluded a robust statistical test of its validity. We therefore tested the probability of its samples having membership in Groups 1 and 2. The elevated statistical probability that specimen GUA019 has membership in Group 2 is anomalous and is partly due to the heterogeneous nature of compositional Group 2. Upon closer inspection (e.g., Figure 9), we decided to identify GUA019 as an unassigned sample. Nine specimens (19%) could not be assigned to any of the three compositional groups (Figures 8–9).

The chemical characteristics describing the compositional groups are the following (see Figure 7): Group 1, in relation to Groups 2 and 3 has elevated concentrations of manganese, rubidium, and the rare earth elements. Group 2, on the other hand, is enriched in the transition metals chromium, iron, antimony, scandium, titanium, and vanadium, relative to the other compositional groups. Compositional Group 3 is enriched in the transition metal element of cobalt and the alkali earth metal element of strontium. Finally, Group 1 is chemically more homogenous, whereas Groups 2 and 3 are somewhat more diverse. It is possible that analyses of additional samples would allow us to identify subgroups within the three compositional groups or assign more of the unknown specimens to one of the established groups.

Tendencies and patterns can be found when comparing the archaeological attributes of the data belonging in the three compositional groups. Sampling issues aside, the ceramic specimens from six of the thirteen sites (River Mouth Grande Anse, Trois Rivières Grande Anse, Grande Baie, La Mahaudière, Grande Pointe, and Rue Dumanoir), have membership in a single compositional group (Group 1). All but one sample of industrial ceramics collected from Guadeloupe belonged to compositional Group 1. The same pattern exists for the wheel thrown utilitarian ceramic. Only one hand-built pot belongs to this group. Ceramic specimens from six sites (Pointe Petite Poterie, Point

Table 1. Samples analyzed

Site	Site Type	Hand-Built Utilitarian Ceramics		Wheel-Thrown Utilitarian Ceramics		Industrial Pottery		Amerindian		Grand Total	
		Petrog.	INAA	Petrog.	INAA	Petrog.	INAA	Petrog.	INAA	Petrog.	INAA
Château Dubuc	Plantation	1	—	1	—	—	—	—	—	2	—
Colonial de l`Embachure	Refuge?	2	2	—	—	—	—	—	—	2	2
Grande Baie	Kiln	—	—	—	1	1	3	—	—	1	4
Grande Terre Poterie	Kiln	—	—	1	—	3	1	—	—	4	1
Grande Pointe	Plantation	1	1	1	1	1	1	—	—	3	3
La Mahaudière	Plantation	—	—	2	2	2	2	—	—	4	4
Macabou	Midden	2	2	—	—	1	1	1	1	4	4
Madame Trime	Ethnographic	4	—	—	—	—	—	—	—	4	—
Morne Cabrit	Kiln	2	2	3	3	1	1	—	—	6	6
Pointe Petite Poterie	Kiln	2	2	2	2	—	—	—	—	4	4
Pointe Borgnesse	Kiln	—	—	3	3	2	2	—	—	5	5
River Mouth Grande Anse	Kiln	—	—	3	3	2	2	—	—	5	5
Rue Dumanoir	Urban excavation	2	2	1	1	—	—	—	—	3	3
Trois Ilets	Kiln	—	—	1	1	3	3	—	—	4	4
Trois Rivières Grande Anse	Kiln	1	1	2	2	2	2	—	—	5	5
	Grand Total	**17**	**12**	**20**	**19**	**18**	**18**	**1**	**1**	**56**	**50**

Table 2. Chemical membership. HB=handbuilt, WT=wheel thrown, IC=industrial ceramic, ph=presumed prehistoric

Site	Island	Group1			Group 2			Group 3			Unassigned			Excluded			Total
		HB	WT	IC	HB	WT	IC	HB	WT	IC	HB	WT	IC	HB	WT	IC	
River Mouth Grande Anse	Basse Terre, Guadeloupe	—	3	2	—	—	—	—	—	—	—	—	—	—	—	—	*5*
Grande Baie	Les Sainte, Guadeloupe	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	*4*
La Mahaudiere	Grande Terre, Guadeloupe	—	1	2	—	—	—	—	—	—	—	—	1	—	—	—	*4*
Troi Rivieres Grand Anse	Basse Terre, Guadeloupe	1	2	1	—	—	—	—	—	—	—	—	1	—	—	—	*5*
Grand Pointe	Basse Terre, Guadeloupe	—	1	1	—	1	—	—	—	—	—	—	—	—	—	—	*3*
Rue Dumanoir	Basse Terre, Guadeloupe	—	1	—	—	—	—	—	—	—	2	—	—	—	—	—	*3*
Morne Babrit	Martinique	—	—	—	2	3	1	—	—	—	—	—	—	—	—	—	*6*
Pointe Petite Poterie	Martinique	—	—	—	2	2	—	—	—	—	—	—	—	—	—	—	*4*
Trois Ilet	Martinique	—	—	—	—	1	3	—	—	—	—	—	—	—	—	—	*4*
Pointe Borgnesse	Martinique	—	—	—	—	2	2	—	—	—	—	1	—	—	—	—	*5*
Macabou	Martinique	—	—	—	1	—	—	1	—	—	1	—	—	—	—	1	*4*
Colonial de l'Embachure	St. Martin	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	*2*
Grande Terre Poterie	Grande Terre, Guadeloupe	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	*1*
	Grand Total	**1**	**9**	**9**	**5**	**9**	**6**	**1**	**0**	**0**	**5**	**1**	**3**	**0**	**0**	**1**	**50**

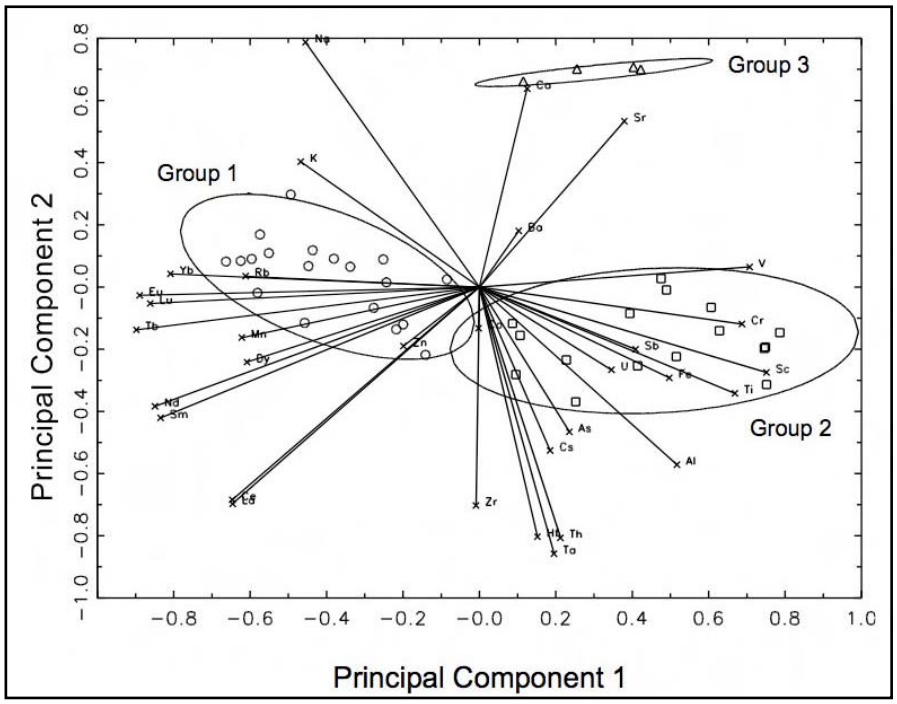

Figure 7. Bivariate plot of principal components 1 and 2 displaying three compositional groups. Ellipses represent 90% confidence level for membership in the groups. Vectors denote elemental influences on the ceramic data. Unassigned specimens are not shown.

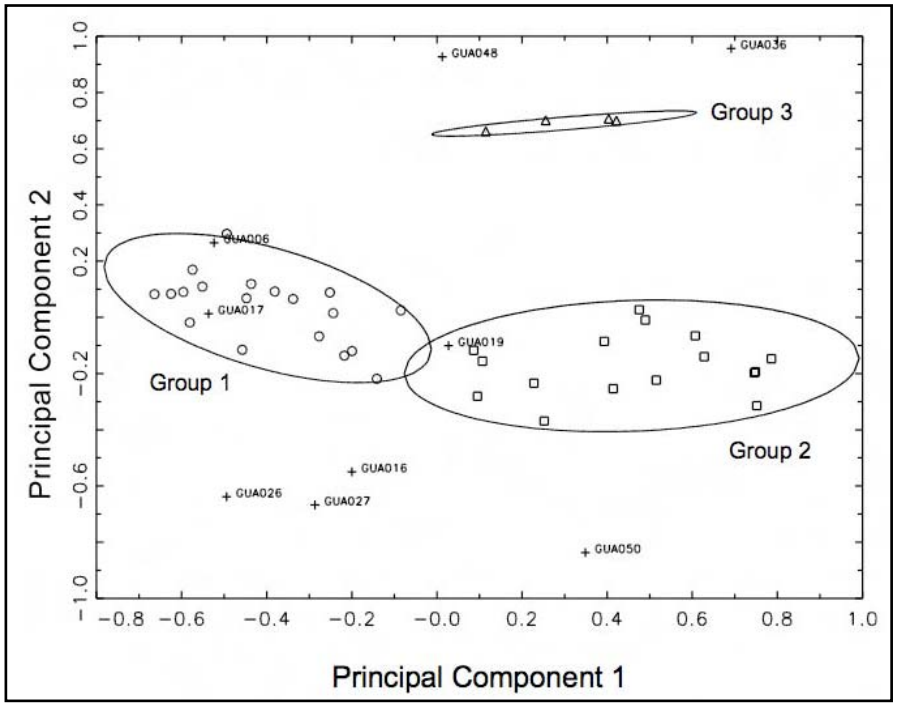

Figure 8. Bivariate plot of principal components 1 and 2 displaying the three compositional groups and labeled unassigned specimens (+). Ellipses represent 90% confidence level for membership in the groups.

Borgnesse, Morne Cabrit, Trois Ilets, Macabou, and Grande Pointe) belong to Group 2. Three of the six industrial ceramics recovered from Martinique belong to this group. Seven of the nine wheel-thrown utilitarian vessels recovered from Martinique belong to this group. In this group, five of the six ceramics that were hand-built were recovered from Martinique. Only one was recovered from Guadeloupe. Lastly, ceramics from plantation proveniences tend to have membership in compositional Group 1.

INAA identified three compositional clusters interpreted to be chemically similar (n=39) and several outliers (n=2) and unassigned samples from presumably unknown provenances (n=9) (Table 2). Among the industrial ceramics and wheel-thrown utilitarian wares the compositional groups correlate well with the island from which they were excavated. Among the hand-built domestic ceramics one sample was assigned to Group 1 (Guadeloupe); six samples were assigned to Group 2 (five from Martinique and one from Guadeloupe); three samples were assigned to Group 3 (two from St. Martin and one from Guadeloupe); and two were left unassigned. This would seem to indicate a degree of trafficking in pottery between islands, or rather probably what was inside the pottery.

Ceramic Petrography

Temper-to-matrix ratios in the ceramic samples ranged from 1:3 to 1:7. The most

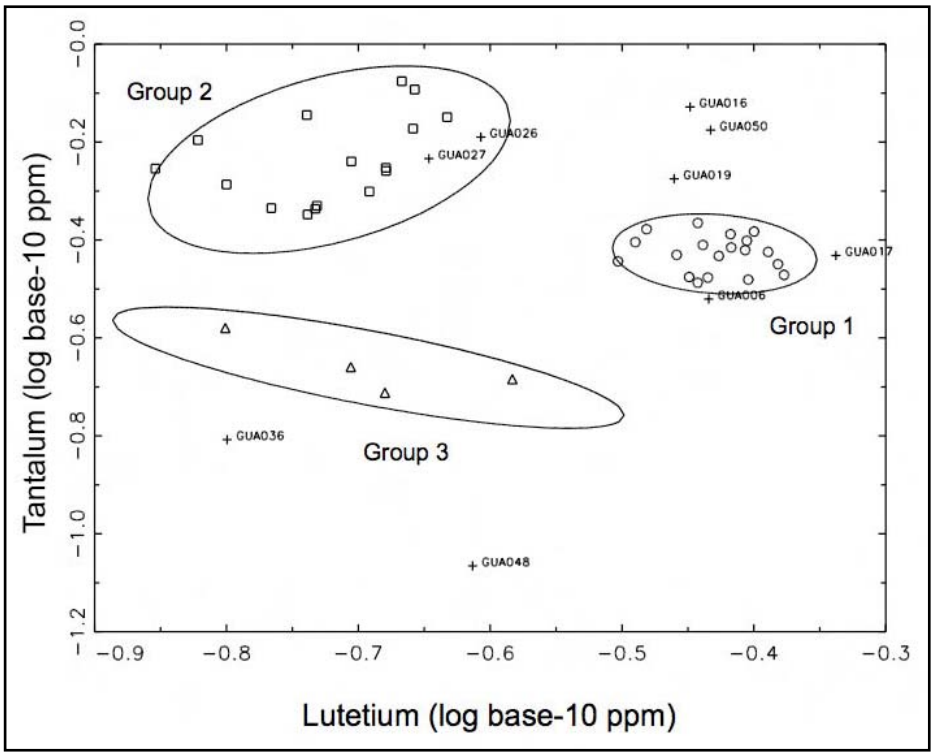

Figure 9. Bivariate plot of base-10 logged lutetium and tantalum concentrations showing the chemical distinctiveness of the three compositional groups. Ellipses represent 90% confidence level for membership in the groups. Unclassified samples (+) are labeled.

commonly observed mineral inclusions were volcanic rock fragments, monomineral plagioclase feldspars, quartz, hornblende, and biotite. For the most part, the ceramic petrography results were concordant with the INAA, but also served to identify additional mineralogical variation within the defined chemical groups.

Petrographically, Group 1 appears to be a tightly clustered group of ceramics and includes wheel-thrown domestic pottery (n=10), and industrial ceramics (n=9). The sites represented in this group include Grande Pointe, Grande Anse River Mouth, Grande Anse, Grande Baie, and La Mahaudière, all in Guadeloupe. Petrographically, members of this group are relatively similar, and diagnostic inclusions within the clay matrix are volcanic clasts (0.5 to 0.75mm), quartz fragments with undulatory (0.05mm) extinction and plagioclase feldspar (0.05 to 0.1 mm), (Figure 10). There is some variation in the clastic inclusions, including one variant that contained fine-grained clasts with large feldspar inclusions. These inclusions are identified as rhyolite. These ceramics include industrial ceramics (n=5), and domestic wheel thrown ceramics (n=3) from La Mahaudière, Grande Anse, and Trois Rivières. The second variant contains more coarse grained clasts within a poikalitic texture with volcanic glass (approx. 1 mm), plagioclase feldspar (0.1 to 0.2 mm). There are also accessory pyroxenes in the clay matrix. These samples include wheel thrown domestic ceramics (n=4) and industrial ceramics (n=7) from La Mahaudière, Grande Anse, and Grande Pointe.

Ceramics identified as Group 2 contain domestic hand-built pottery (n=6), domestic wheel-thrown pottery (n=7), and industrial ceramics (n=3) from Grande Pointe, Guadeloupe (n=1), Macabou (n=1), Morne Cabrit (n=6), Pointe Petite Poterie (n=4), Trois Ilets (n=2) and Pointe Borgnesse (n=2). Petrographically, this cluster of ceramics is defined by the large presence of amphiboles identified as hornblende, plagioclase, quartz with undulatory extinction, orthopyroxenes, augite, and the accessory minerals of calcite, magnetite, and garnets (Figure 11). The mineral assemblage of these ceramics is consistent with the geology of Martinique, as well as pre-Columbian ceramics previously described by Walters (1991) and England (1994). Samples identified as unassigned by MURR are included in this group, specifically three from Pointe Borgnesse (GUA 16, 17, 19), one from Trois Ilets (GUA 27), and one from Rue Dumanoir.

We recorded three variants in this cluster of ceramics through petrography. The first variant includes industrial ceramics from Morne Cabrit and Trois Ilets (n=3) in Martinique. This variant contains large hornblende inclusions that comprise 15% of the counted inclusions. Samples also contain quartz (approx. 50%) and plagioclase feldspar inclusions (approx. 25%). The hornblende shows signs of hemical deformations and range in size from 0.25 to 1 mm. The quartz is simple angular and exhibits undulatory extinction. The plagioclase feldspar exhibits deformed carlsbad twinning indicating regional metamorphism.

The second variant is dominated by domestic wheel-thrown ceramics from Trois Ilets (n=1), Morne Cabrit (n=3), Pointe Petite Poterie (n=2), and Pointe Borgnesse (n=3), (all from Martinique). This group contains quartz (approx. 50%), plagioclase feldspar (approx 20%), and biotite (approx. 10%). The quartz is between 0.25 and 0.5 mm and

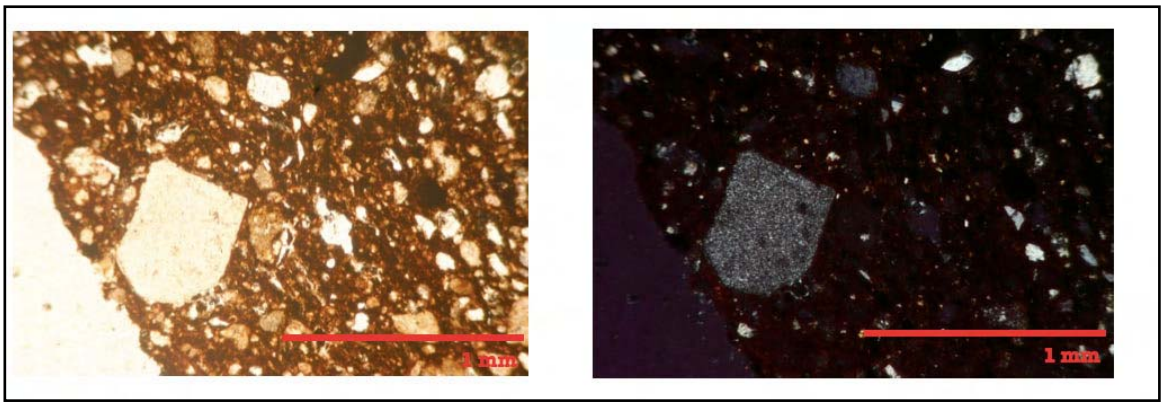

Figure 10. Petrographic Group 1 (40x ppl and 40x xpl). Dominated by microlithic lithic fragments, plagioclase feldspar and quartz.

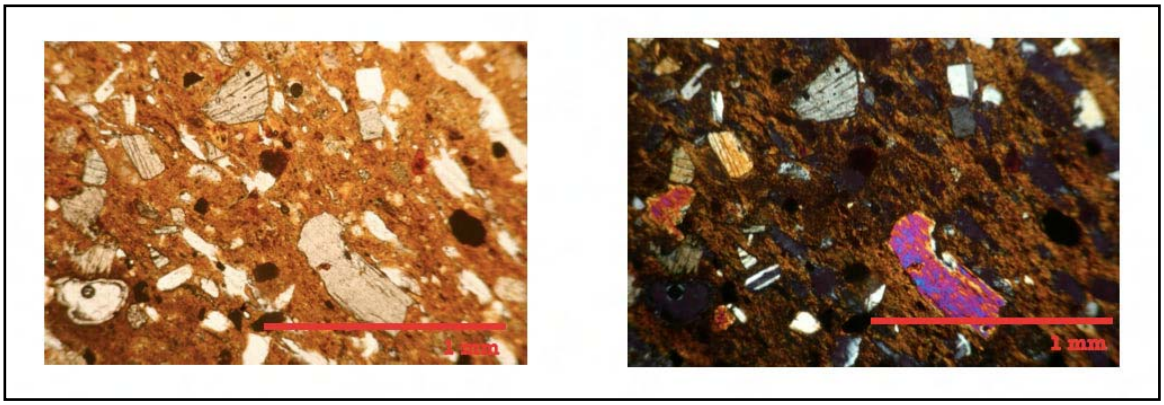

Figure 11. Petrographic Group 2 (40x ppl and 40x xpl). This sample contains hornblende, biotite, plagioclase feldspar, and quartz.

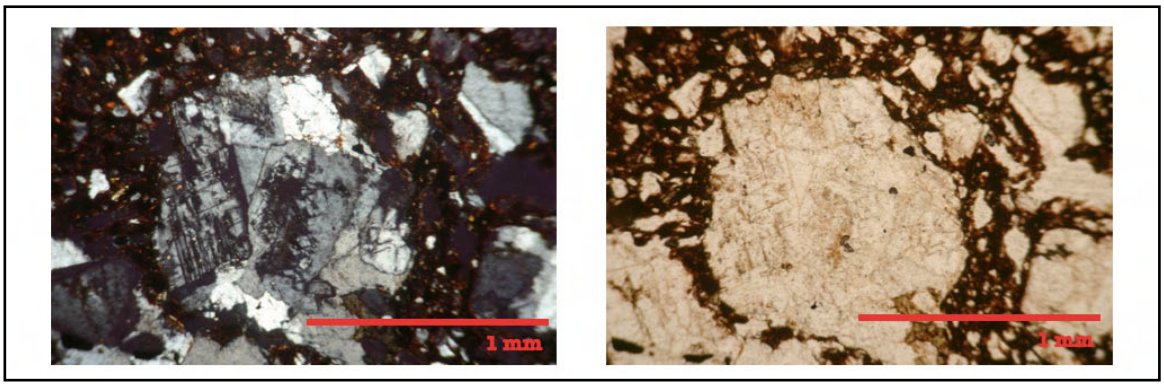

Figure 12. Petrographic group 3 (40x ppl and 40x xpl). This sample contains large quantities of recrystallized quartz and plagioclase feldspar.

exhibits undulatory extinction. Plagioclase feldspar is anhedral and ranges between 0.1 and 0.5 mm. It exhibits carlsbad twinning and shows signs of mechanical deformation. The hornblende is smaller than other variants (approx. 0.25 mm) and is anhedral.

The third variant includes only hand built ceramics from Rue Dumanoir and Grande Pointe in Guadeloupe (n=1), and Macabou (n=1), Pointe Petite Poterie (n=2), and Morne Cabrit (n=2) in Martinique. These samples contain hornblende (approx. 0.75 to 1 mm), plagioclase feldspar (0.2 to 0.5 mm) and quartz (0.1 mm). The hornblende is lathlike and shows some signs of chemical deformation. The plagioclase feldspar exhibits both microcline and carlsbad twinning. Alhough for the most part, the plagioclase is anhedral, it shows little sign of chemical or mechanical deformation. Petrographic analyses of ethnographic samples taken from Madame Trime also are included in this group.

The smallest compositional group defined through INAA was Group 3. Samples include wares from St Martin (n=2), Rue Dumanoir (n=1) (from Guadeloupe), and Macabou (n=1) (Martinique) (Figure 12). Petrographically, the ceramics from St. Martin and Guadeloupe are distinct from previously described samples and from the one sample from Macabou. The pastes of the Rue Dumanoir and St. Martin samples are dominated by recrystalized lithic fragments containing predominately quartz (approx 60%), plagioclase feldspar (20%) and trace amounts of potassium feldspar. The quartz is anhedral, but does exhibit undulatory extinction under cross-polarized light. Although most plagioclase feldspars are anhedral, there are a few inclusions examples of euhedral, lathlike feldspar inclusions in a poikalitic relationship with quartz. The anhedral feldspars exhibit some deformed twinning indicating source rocks that underwent regional metamorphism (Figure 12).

The one sample from Macabou appears to be a petrographic outlier for this group. The ceramic was typologically identified as Amerindian and contains a mineralogical assemblage consistent with other hand-built ceramics recovered from Martinique, with one major exception—the sample contains high quantities of shell temper (ca. 5%), a manufacturing technique that is inconsistent with present-day ethnographic production and other colonial ceramics. The addition of shell temper explains the anomalous chemical results for this sample.

Conclusion

The majority of the samples within this initial study were recovered from historically known kiln sites. These potteries were situated by their owners based on a number of criteria including the convenience to water-born carriage and access to resources required for the production of pottery. For these large scale pottery production sites, key resources include fresh water, fuel, and most importantly access to nearby clay sources. Although INAA establishes the chemical recipe of all constituent components including clays, detrital inclusions within the clay, and added tempering agents, the method does not characterize the clay component exclusively. We believe that due to the strategies employed by the kiln owners, it is likely that the clays employed at each location are distinct, and not from a common source. Further work identifying distinct clay sources would clarify this.

The results of the combined analysis point to two interesting trends. First, there was a ceramic industry on Guadeloupe in the eighteenth and nineteenth centuries. This industry, however, appears to have focused solely on wheel-thrown industrial and domestic ceramics produced at the known kiln sites in southern Basse Terre and Les Saintes. Although hand-built ceramics were recovered from Guadeloupe, the chemical and mineralogical constituents point to at least two production sites distinct from the known Guadeloupe and Les Saintes kiln sites, and the heterogeneity of ceramic recipes as represented in membership to chemical and petrographic groups points potential inter-island trade. The formal characteristics of these samples, coupled with the chemical and petrographic data, suggest that Martinique is the source of these ceramics. This demonstrates that some demand on Guadeloupe was satisfied through inter-island trade or *cabotage* bringing ceramics (and no doubt other things). The second insight gained from the combined analysis of ceramics is the variation in manufacturing choices in both the historic and pre-Columbian pottery. The two ceramic traditions can be readily differentiated based on the presence or absence of shell temper.

This pilot study points to the potential of compositional studies of industrial and domestic ceramics produced in the eighteenth and nineteenth centuries. Our data are preliminary. The small sample size, lack of comparative clay samples, and restricted geographic distribution of the study limits our ability to draw significant conclusions about the extent and nature of inter-island trade within the Antilles. Because of this, resolution in terms of provenance appears to be at the scale of segregating island production. More importantly, whereas anomalous results point to potential social and economic networks the limited nature of our data restricts our ability to generalize from these results and understand the impact of this trade on the daily life of the enslaved and free island residents.

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Appendix 1. Samples analyzed by INAA, their sites, types, forms, and contexts.

Sample	Site Name	Type	Form	Context
GUA001	Pointe Petite Poterie	Domestic Hand-Built	Pitcher	Kiln
GUA002	Pointe Petite Poterie	Domestic Wheel	Restricted Bowl	Kiln
GUA003	Pointe Petite Poterie	Domestic Hand-Built	Coco Nèg	Kiln
GUA004	Pointe Petite Poterie	Domestic Wheel	Storage	Kiln
GUA005	Trois Rivières Grande Anse	Domestic Wheel	Pitcher	Kiln
GUA006	Trois Rivières Grande Anse	Industrial	Drip Jar	Kiln
GUA007	Trois Rivières Grande Anse	Industrial	Drip Jar	Kiln
GUA008	Trois Rivières Grande Anse	Domestic Hand-Built	Pot	Kiln
GUA009	Trois Rivières Grande Anse	Domestic Wheel	Storage	Kiln
GUA010	River Mouth Grande Anse	Industrial	Tile	Kiln
GUA011	River Mouth Grande Anse	Industrial	Drip Jar	Kiln
GUA012	River Mouth Grande Anse	Domestic Wheel	Bowl	Kiln
GUA013	River Mouth Grande Anse	Domestic Wheel	Unknown	Kiln
GUA014	River Mouth Grande Anse	Domestic Wheel	Storage	Kiln
GUA015	Pointe Borgnesse	Industrial	Sugar Cone	Kiln
GUA016	Pointe Borgnesse	Industrial	Drip Jar	Kiln
GUA017	Pointe Borgnesse	Domestic Wheel	Storage	Kiln
GUA018	Pointe Borgnesse	Domestic Wheel	Unknown	Kiln
GUA019	Pointe Borgnesse	Domestic Wheel	Pitcher	Kiln
GUA020	Morne Cabrit	Industrial	Tile	Kiln
GUA021	Morne Cabrit	Domestic Hand-Built	Coco Nèg	Kiln
GUA022	Morne Cabrit	Domestic Wheel	Vase	Kiln
GUA023	Morne Cabrit	Domestic Wheel	Vase	Kiln
GUA024	Morne Cabrit	Domestic Wheel	Pitcher	Kiln
GUA025	Morne Cabrit	Domestic Hand-Built	Coco Nèg	Kiln
GUA026	Trois Ilets	Industrial	Tile	Kiln
GUA027	Trois Ilets	Industrial	Tile	Kiln
GUA028	Trois Ilets	Industrial	Tile	Kiln
GUA029	Trois Ilets	Domestic Wheel	Pitcher	Kiln
GUA030	Grande Baie	Domestic Wheel	Pitcher	Kiln

Appendix 1 (continued).

Sample	Site Name	Type	Form	Context
GUA031	Grande Baie	Industrial	Drip Jar	Kiln
GUA032	Grande Baie	Industrial	Storage	Kiln
GUA033	Grande Baie	Industrial	Storage	Kiln
GUA034	Macabou	Huecoid	Bowl	Midden
GUA035	Macabou	Domestic Hand-Built	Unknown	Midden
GUA036	Macabou	Domestic Hand-Built	Unknown	Midden
GUA037	Macabou	Industrial	Unknown	Midden
GUA038	Colonial de l`Embachure	Domestic Hand-Built	Pot	Refuge
GUA039	Colonial de l`Embachure	Domestic Hand-Built	Pot	Refuge
GUA040	Grande Pointe	Domestic Hand-Built	Pot	Plantation
GUA041	Grande Pointe	Industrial	Storage	Plantation
GUA042	Grande Pointe	Domestic Wheel	Pitcher	Plantation
GUA043	La Mahaudière	Domestic Wheel	Pitcher	Plantation
GUA044	La Mahaudière	Industrial	Storage	Plantation
GUA045	La Mahaudière	Domestic Wheel	Unknown	Plantation
GUA046	La Mahaudière	Industrial	Drip Jar	Plantation
GUA047	Rue Dumanoir	Domestic Hand-Built	Pitcher	Urban
GUA048	Rue Dumanoir	Domestic Hand-Built	Jar	Urban
GUA049	Rue Dumanoir	Domestic Wheel	Jar	Urban
GUA050	Grande Terre Poterie	Industrial	Tile	Kiln
GUA051	La Mahaudière	Vallauris	Cooking Pot	Plantation
GUA052	Château du Buc	Domestic Hand-Built	Cooking Pot	Plantation
GUA053	Château du Buc	Domestic Wheel	Unknown	Plantation
GUA054	Grande Pointe	Vallauris	Cooking Pot	Plantation
GUA055	Grande Pointe	Vallauris	Cooking Pot	Plantation
GUA056	La Mahaudière	Vallauris	Cooking Pot	Plantation
GUA057	Mme Trime	Domestic Hand-Built	Coco Nèg	Ethnographic
GUA058	Mme Trime	Domestic Hand-Built	Coco Nèg	Ethnographic
GUA059	Mme Trime	Domestic Hand-Built	Coco Nèg	Ethnographic
GUA060	Mme Trime	Domestic Hand-Built	Coco Nèg	Ethnographic

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