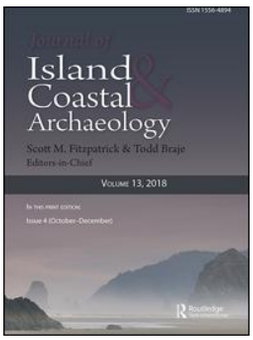

The Journal of Island and Coastal Archaeology

ISSN: 1556-4894 (Print) 1556-1828 (Online) Journal homepage: https://www.tandfonline.com/loi/uica20

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To cite this article: Corinne L. Hofman, Lewis Borck, Jason E. Laffoon, Emma R. Slayton, Rebecca B. Scott, Thomas W. Breukel, Catarina Guzzo Falci, Maroussia Favre & Menno L. P. Hoogland (2020): Island networks: Transformations of inter-community social relationships in the Lesser Antilles at the advent of European colonialism, The Journal of Island and Coastal Archaeology, DOI: 10.1080/15564894.2020.1748770

To link to this article: https://doi.org/10.1080/15564894.2020.1748770

Published online: 27 May 2020.

THE JOURNAL OF ISLAND AND COASTAL ARCHAEOLOGY
https://doi.org/10.1080/15564894.2020.1748770

Routledge
Taylor & Francis Group

Island networks: Transformations of inter-community social relationships in the Lesser Antilles at the advent of European colonialism

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ABSTRACT

The Caribbean Sea was a conduit for human mobility and the exchange of goods and ideas during the whole of its pre-colonial history. The period cal. AD 1000-1800, covering the Late Ceramic Age and early colonial era, represents an archaeologically understudied time during which the Lesser Antilles came under increasing influence from the Greater Antilles and coastal South America and participated in the last phase of indigenous resistance to colonial powers. This article summarizes the results of the Island Network project, supported by the Netherlands Organisation for Scientific Research (NWO) in which a multi-disciplinary set of archaeological, archaeometric, geochemical, GIS, and network science methods and techniques have been employed to disentangle this turbulent era in regional and global history. These diverse approaches reveal and then explore multi-layered networks of objects and people and uncover how Lesser Antillean communities were created and transformed through teaching, trade, migration, movement, and exchange of goods and knowledge.

ARTICLE HISTORY
Received 12 November 2019; accepted 14 February 2020

KEYWORDS
Caribbeanarchaeology; Cayo; Kalinago; networks

Introduction

Over the past two decades, Caribbean archaeological research has focused on patterns of regional and pan-regional mobility of peoples, and the exchange of goods and ideas prior to AD 1492 (e.g. Hofman, Bright, and Rodríguez Ramos 2010; Hofman et al. 2007, 2011; Laffoon 2012; Mol 2013, 2014; Rodríguez Ramos and Pagán-Jiménez 2006). Through the recent discovery of late fifteenth through early eighteenth century Amerindian settlements and associated material culture repertoires, investigations are

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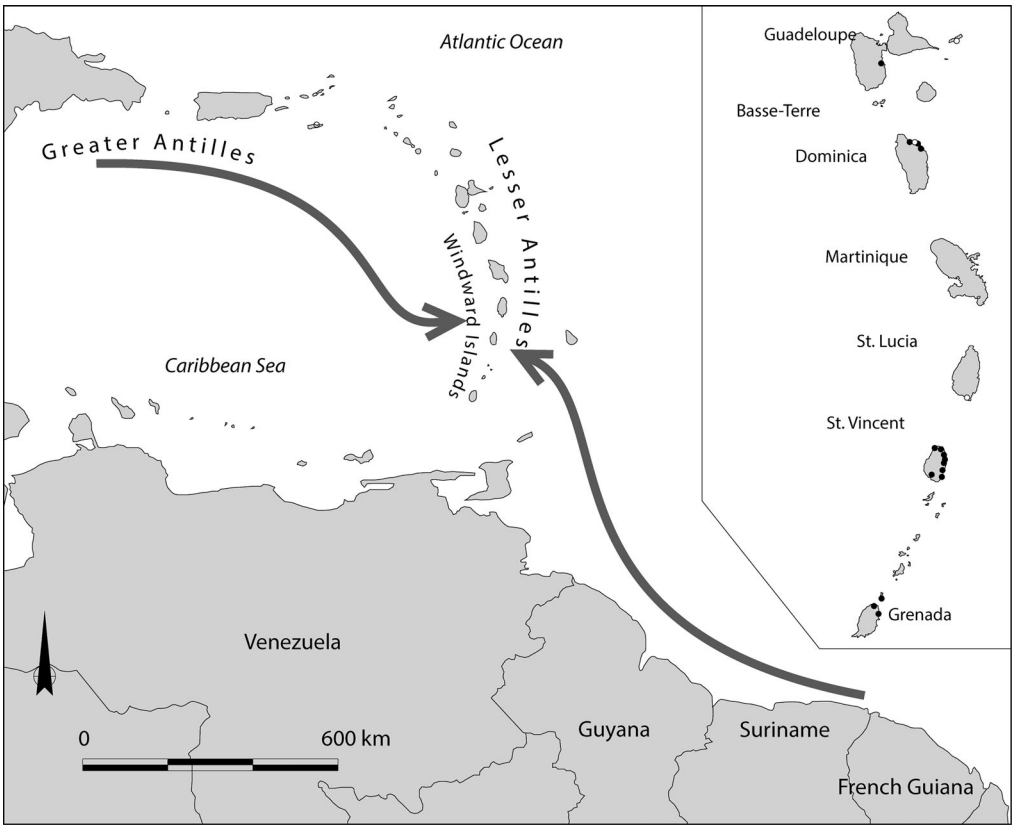

Figure 1. Map of the Caribbean with inset of the southern Lesser Antilles showing the location of specific islands and sites discussed in the text (Map by Menno Hoogland).

now providing new insights into early colonial period indigenous archaeology in the Lesser Antilles. This research highlights continuity and change in inter-community social relationships and transformations of island networks at the advent of European colonialism.

A multi-disciplinary set of archaeological, archaeometric, GIS, and network science methods and techniques have been employed to disentangle the material culture from this turbulent era in regional and global history. Petrography and portable X-ray Fluorescence Spectrometry (pXRF) were used to characterize the chemical and petrographic composition of ceramics in order to provenance the clay raw materials and reveal the nature of potential interactions between groups (i.e. whether goods, or people and/or ideas were moving). Wear trace analysis was used to investigate artifact biographies to reconstruct potential relationships based upon manufacturing strategies and use patterns. Isotopic approaches were applied to animal remains to explore complex networks of interaction manifested through the distribution of non-local artifacts manufactured from faunal raw materials. Canoe route-modelling and least-cost pathway analyses were used to evaluate connections between the islands and the mainland of South America, an important source area for peoples and materials in the (early) colonial period. Network analysis, which has gained prominence in archaeology as a method for modeling, visualizing, and analyzing relational and spatial data in new ways (Borck

2018; Borck et al. 2015; Brughmans et al. 2017; Crabtree and Borck 2019; Hofman et al. 2019; Mills 2017; Mol, Hoogland, and Hofman 2015; Peeples 2019), was used to parse the complex relationship between people, material culture, and social relationships under the violent oppression of colonization and the Trans-Atlantic African Slave trade. These diverse approaches reveal and then explore multi-layered networks, both formal and informal, of objects and people and uncover how Lesser Antillean communities were created and transformed through teaching, trade, migration, movement, and exchange of goods and knowledge.

A conduit for human mobility and the exchange of goods and ideas

The Lesser Antilles, a chain of islands situated between the Greater Antilles and the South American mainland (Figure 1), includes 22 major islands and numerous smaller ones. While the formation of the Lesser Antillean archipelago is largely related to the subduction of the Atlantic Plate under the Caribbean Plate (i.e., resulting in volcanism forming many of the islands), the region is composed of others that are limestone or of mixed lithologies (Hofman and Hoogland 2018b; Knippenberg 2006).

The great variety in environments, the discontinuous distribution of natural resources, the maritime orientation of the Amerindian settlers, and the complexities of the region-wide social interaction patterns ensured that the pre-colonial Lesser Antillean islandscape was dynamic and highly interconnected (e.g., Crock 2000; Hofman and Bright 2010; Hofman and Hoogland 2011; Keegan and Hofman 2017). Amerindians from several areas of the surrounding mainland(s) entered the Antilles sometime between 6000 and 4000 BC and gradually established permanent settlements in both the larger and smaller islands (e.g., Hofman and Antczak 2019; Hofman et al. 2011; Keegan 2000; Napolitano et al. 2019; Rouse 1992). Archaeological evidence suggests that the Caribbean insular region was one large arena within which Amerindian communities established and maintained local and regional circuits of mobility and exchange as they traversed between islands, while maintaining their cultural, social, biological, or linguistic particularities. Extensive social relationships with mainland communities as well as between islanders of varied social-political organizational forms (ranging from local groups to hierarchical societies) have been documented over time and space (e.g., Hofman and Bright 2010; Keegan and Hofman 2017).

The archaeological record in the Caribbean shows that highly mobile populations with various origins, destinations, and motives amalgamated during constant movements over a long period of time (Crock 2000; Hofman and Bright 2010; Hofman and Hoogland 2011). Eventually, people, perishable and non-perishable goods, ideas and information, as well as cultural and social practices led to a growing number of local communities of heterogeneous composition and the ultimate diversification within the archipelago during the Late Ceramic Age. The indigenous networks met by the Spanish in 1492 were flexible, robust, inclusive, and outward-looking systems and had great effects on the rapid European expansion and the widespread exchange networks of people, goods, and ideas between the both sides of the Atlantic, known as the Columbian Exchange (Crosby 2003; Hofman 2019; Hofman et al. 2014). Although we have a rough idea of the social relationships that developed during the Archaic (2000-500/200 cal. BC)

and early Ceramic Age (500/200 cal. BC - cal. AD 400) (Hofman et al. 2007, 2014; Mol 2014; Rodríguez Ramos 2010) the transformation of island networks and social organization during the latest phase of the Late Ceramic Age (from cal. AD 1000 onwards), and their continuity and change during the early colonial period, are virtually unknown.

Europeans first heard of the Lesser Antilles through Columbus' interactions with the indigenous peoples (now labelled as *Taíno*) of the Greater Antilles (Allaire 2013; Curet 2014; Hofman et al. 2008a; Keegan 1996; Keegan and Hofman 2017; Rouse 1992), who mentioned his fear of allegedly cannibalistic people living in the small islands to the southeast (i.e., the Lesser Antilles) (Hofman et al. 2008a, Sued-Badillo 1995). The colonizers' preconceived perceptions of savagery surrounding unfamiliar places and peoples emerged from late medieval ideas (Hulme 1986). Their prejudices were strengthened by fierce resistance from the local Carib, or *Kalinago,* the indigenous inhabitants of the Lesser Antilles (Honychurch 2000). While much of the insular Caribbean and adjacent mainland areas were colonized and settled by the Europeans during the course of the sixteenth century, the Lesser Antilles remained under Amerindian control for 130-150 years (Hofman et al. 2019). The first Lesser Antillean island to be settled by the British and then by the French was St. Kitts in the Leeward Islands. Most of the information that we have from the Lesser Antilles between 1492 and 1623 comes from historical documents. Fifteenth to eighteenth century written accounts by explorers, sailors, and missionaries provide vivid, but often prejudiced and fragmented testimonies of the encroachment of European nations into the Lesser Antilles and the marginalization of Amerindian societies (e.g., Chanca [1494] 1988; Coppier 1645; Du Tertre 1667-71; Rochefort 1658). This episode of ca. 150 years represents an archaeologically understudied period, during which the Lesser Antilles may have acted as a refugium (following J. Scott 2009; see also Acabado 2018; Borck and Sanger 2017; Forrest 2020) for peoples from the Greater Antilles and coastal South America who were fleeing the Spanish conquest and mixing with local inhabitants (e.g., Hofman et al. 2019, 376). This intense interaction created a new ethnic bond where inhabitants identified, and still identify, themselves as *Kalinago* (Boomert 2016; Hofman et al. 2019).

The *Kalinago* participated in the last phase of indigenous resistance to colonial powers by forming strongholds between Grenada and St. Kitts. The co-occurrence of indigenous material culture and European artifacts at these early-colonial sites also provides evidence of the first Indigenous-European interactions and inter-cultural dynamics in this part of the insular Caribbean (Hofman and Hoogland 2012; Hofman et al. 2019). The archaeological record and historical documents indicate that in the late sixteenth century, the *Kalínago* strongholds took part in a complex trans-Atlantic system that emerged as new colonial and trade strategies were combined with pre-existing indigenous exchange and alliance networks. In the Lesser Antilles, most of this trade first began with Spanish ships, and afterwards with the French, English, and Dutch (Boomert 2011; Hauser et al. 2019; Hofman et al. 2019; Martin 2013; Ryzewski and Cherry 2015). Around AD 1800, the Amerindian presence in many of the islands had been dramatically reduced, marginalized, and assimilated under the plantation system. The colonial occupations resulted in unique social formations consisting of Amerindian, European, and African influences. Meanwhile, Carib communities on some islands (such as St.

Vincent) were absorbing an increasing number of enslaved Africans who escaped, leading to the rise of a Black Carib ethnic identity, alongside those communities that remained primarily Amerindian. The Black Carib were deported from St. Vincent to Central America by the British in 1797, where they are still known as the *Garifuna*. Descendants of the *Kalinago* and *Garifuna* also survive to this day throughout the Lesser Antilles, most notably on Dominica, St. Vincent, and Trinidad, where they are actively reclaiming their Amerindian roots as an integral part of their identity in Caribbean society (Honychurch 2000; Sued-Badillo 1995; Reid 2009; Whitehead 1995). Their histories are poorly known and their legacies are archaeologically understudied. The idea that indigenous Caribbean peoples were driven to extinction within a few decades of European presence still dominates popular and scholarly awareness and has led to the existence of a sharp divide between pre-colonial and colonial histories (i.e., pre- and post-1492). As a consequence, data are sorely lacking with regard to Amerindian responses to European and later African influences into their social and cultural realms. This hampers our understanding of the continuity and change of the social relationships between Amerindians and later with Europeans and Africans across the so-called historical divide. Opportunities to redress this imbalance have been hindered by a lack of: 1) focus on Amerindian histories and legacies along a continuum from pre-colonial to colonial times, hereby addressing the problems at the root of the historical divide; 2) archaeological research into Amerindian Caribbean sites dating to the contact and colonial eras; 3) multi-scalar research, in which local, regional, and pan-regional developments and intercultural (Amerindian-African-European) connections are considered (e.g., Armstrong and Hauser 2009; Hofman et al. 2012; Honychurch 1997); and 4) the development and systematic application of an appropriate set of multi-disciplinary methods and techniques to the archaeological record of this region.

Kalinago archaeological legacies have been only recently identified and ca. 20 archaeological sites across the Lesser Antilles have remains of what researchers have called the Cayo ceramic complex, which has been associated with late pre-colonial times and the early colonial *Kalinago* (Boomert 1986). Recent investigations by a team from Leiden University have focused on a number of Cayo sites in the southern Lesser Antilles (Windward Islands), particularly Grenada, St. Vincent, and Dominica (Boomert 2011, Hofman and Hoogland 2012; Hofman, Hoogland and Roux 2015; Hofman et al. 2019). The results from this research form the backbone for the analyses presented below.

Cayo sites and Kalinago villages in the Windward Islands

Around 20 Cayo sites have been documented to date in the Windward Islands between Grenada and Guadeloupe. The majority of these sites are located on the windward side of the islands, and face the Atlantic Ocean. Early European documents also note that the so-called Island Carib (*Kalinago*) preferred the windward coast of the islands because of the steep cliffs and rough seas that aided in defending their settlements (against the Europeans). The chroniclers refer to hamlets or single households dispersed across the landscape (Labat [1722] 2005). The vast majority of Cayo sites have been documented to date on Grenada and St. Vincent. The sites are located on elevated

plateaus near the lower reaches of a river or stream (Hofman and Hoogland 2012; Hofman, Hoogland, and Roux 2015). Excavations at Argyle in St. Vincent and La Poterie in Grenada revealed the plans of the early colonial villages, including round houses, oval structures in the case of Argyle, around a plaza (Hofman and Hoogland 2012; Hofman et al. forthcoming). A total of 12 radiocarbon dates obtained from open-area excavations conducted on St. Vincent and Grenada range from cal. AD 1430 to 1620 (Hofman et al. 2019, Fig. 16.2). The Cayo occupation at La Poterie was overlain by an early Afro-Caribbean habitation dating to the late seventeenth-early eighteenth century (Hofman and Hoogland 2018a; Hofman et al. 2019). European trade wares are associated with both phases of occupation.

Cayo ceramics, European trade wares, and Afro-Caribbean pottery

Vessel styles

The Argyle assemblage is composed of Cayo ceramics and European trade wares, while the La Poterie assemblage includes Cayo ceramics, Afro-Caribbean pottery, and European trade wares dating from the late fifteenth to the eighteenth century. Cayo pottery in both sites is characterized by a variety of different vessel shapes (Boomert 1986; Hofman et al. 2019) with modeled, incised, and painted motifs representing animals and creatures reflecting the worldview of the *Kalinago* peoples. Incised decorations recall stylistic motifs of the Greater Antilles, and bowls with carinated or indented rims (known as flower pots) and white painted inside surfaces with red or yellow designs are typical of the Koriabo style pottery from the South American mainland (Suriname, French Guiana, northern Brazil) (Figure 2; Barreto et al. 2020; Bel 2015; Boomert 1986; Rostain and Versteeg 2004; Versteeg 2003). Similarly, large bowls with modeled decorations representing animal/human faces served as containers for cassava (*Manihot esculenta*) beer and are typical for mainland complexes. European trade wares found with Cayo pottery at Argyle and La Poterie represent a mix of Spanish, Portuguese, Italian, and Dutch material (Figure 3; see also Hofman et. al 2019). Around AD 1800, when the first British and French planters settled in the Windward Islands, earthenwares from Europe were introduced next to locally produced sugar ware. At that point in time, Amerindian and African intercultural dynamics in the context of the plantation economy began to lead to the mixing of Amerindian manufacturing techniques and African vessel shapes and finishing.

Clays and fabrics

The study of Caribbean ceramics has often focused on examining and defining stylistic and morphological characteristics (Rouse 1992; Boomert 2011; Bright 2011) while various types of mineralogical and compositional analyses such as petrography, instrumental neutron activation analysis (INAA), LA-ICP-MS or X-ray fluorescence (XRF) analyses have remained underutilized (but see Descantes et al. 2008; Hofman et al. 2008c; Lawrence et al. 2016; Pavia et al. 2013; also Ting et al. 2018 for some recent exceptions and Hofman et al. 2008b for an overview). Studies that have focused on the Lesser Antilles, have evidenced local production of the pottery in most of the islands where

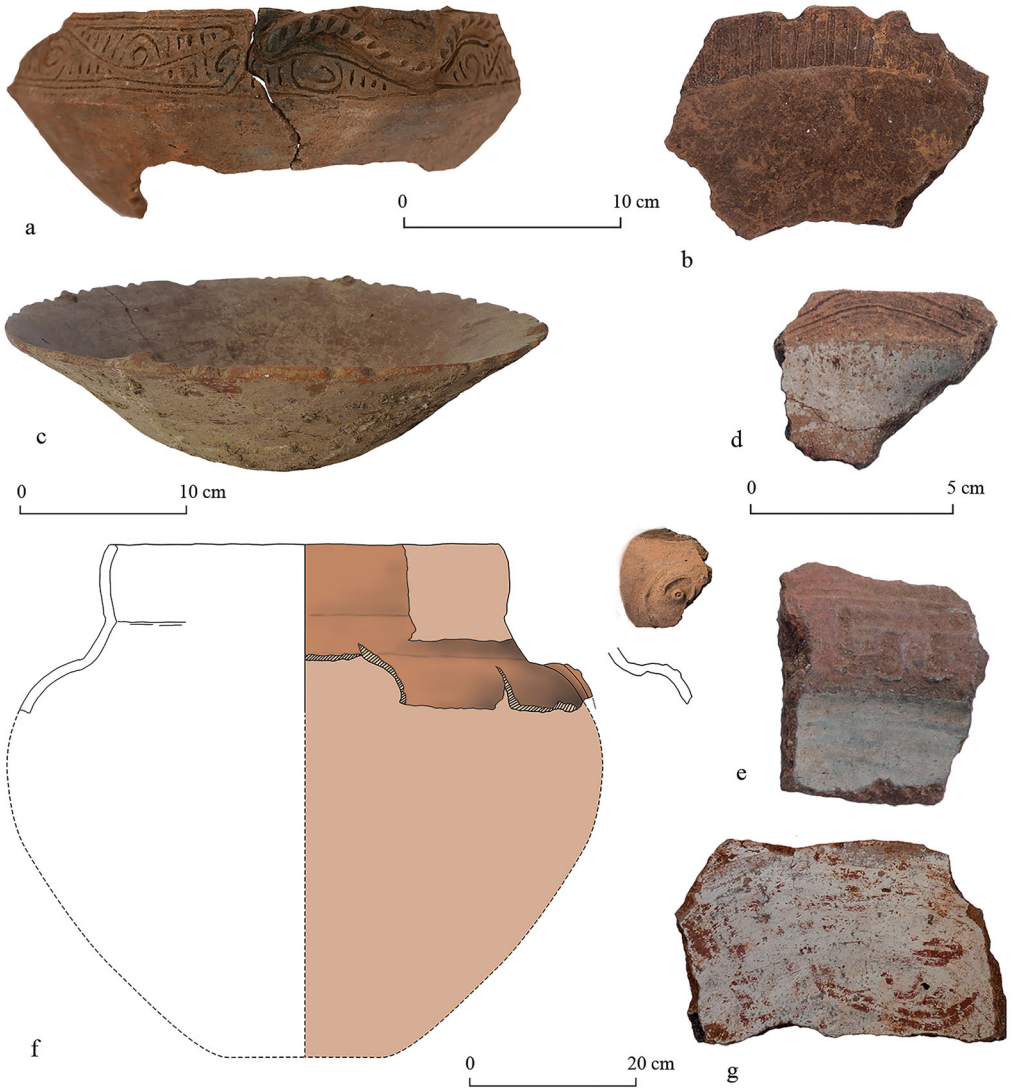

Figure 2. Cayo ceramics showing (a) Meillacoid/Chicoid (Greater Antilles) influences and (b-g) Koriabo (mainland) (Figure by Menno Hoogland).

suitable clay sources are available, but with a minority of imported wares present as well (e.g., Isendoorn et al. 2008). There are cases, though, including the low limestone island of Anguilla in the northern Lesser Antilles and Carriacou in the southern Grenadines, where it appears that the majority of pottery was imported (Donahue et al. 1990; Fitzpatrick et al. 2008; Pavia et al. 2013).

While techniques such as LA-ICP-MS, INAA, and others provide useful quantitative results, the samples require partial destruction of artifacts and/or require laboratory facilities that are not often available on location (Degryse and Braekmans 2014). To help ameliorate this issue, R. Scott et al. (2018) created a portable XRF (pXRF) baseline, which relates the pXRF signature of Caribbean ceramics to geochemical and petrographic data acquired in the laboratory. This baseline has allowed for pXRF to be used

Figure 3. European wares encountered with Cayo materials at the sites of Argyle (b-f, i) and La Poterie (g,h, j-m)- (Figure by Menno Hoogland).

in the field for the rapid sorting of ceramic material from the Lesser Antilles. R. Scott and colleagues are currently working to further refine the baseline to link the pXRF signature to specific petrographic groups.

A combined geochemical and petrographic analysis identified five groups for Grenada and St. Vincent (labelled F6, F9, F10, F11 and F14). F6 contains abundant plagioclase, quartz, and granodiorite inclusions; F9 contains poorly sorted mafic inclusions, mostly andesite and plagioclase, along with variable amounts of hornblende/oxyhornblende. F10 contains andesite, plagioclase, and other mafic minerals, along with large, sub-rounded to angular quartz chunks. F11 is very similar to F10, but lacks quartz inclusions. F14 contains an abundance of zoned and twinned plagioclase inclusions

together with some anhedral clinopyroxene. The pXRF baseline signature for these groups was created using 41 ceramic fragments, which represented the five fabric groups. This meant that the pXRF could be used successfully in the field to sort unknown ceramic material.

In total, 554 sherds from the two islands, covering the Late Ceramic Age (Troumassoid ceramics) and early colonial period (Cayo and Afro-Caribbean, Colonial and sugar ware), were measured using pXRF. Two of the petrographic groups (F9 and F14) are clearly dominant, with F9 being characteristic of material from Grenada. The pXRF results suggest that 86% of the pottery found on Grenada was made from F9 type clay, while 85% of the pottery found on St. Vincent was made from F14 type clay. The colonial and sugar ware material from Grenada had a different composition to the other Grenadian ceramics, but this is still presumed to be "local" due to the location of the pottery kiln. Understanding which local clay sources were used during the different periods, in particular between pre-and post- contact time, have revealed important social patterns as we discuss below (see also R. Scott et al. 2018).

Network analysis: What material relationships can tell us about social patterns

Network analysis was applied to ceramic types and the above mentioned pXRF derived clay groups to explore relationships between the clay groups and the ceramic types to further understand social processes that underlay clay acquisition and knowledge distribution. The network graph in Figure 4 contains two types of nodes: ceramic types and pXRF clay groups. Thus, data from each sherd allows us to separate that sherd into two nodes. Each time that a ceramic style is formed using one of the clay groups, a connection is created between the two nodes. These edges, or the connections, are weighted so the thicker the connection, the more times a ceramic style was made using a particular clay. For instance, one sherd (belonging to the Ceramic Age Troumassoid series) will produce a dyadic (two nodes) network (Troumassoid – Clay A).

In the network in Figure 4, time is broken into three broad periods. By examining the known dates of these ceramic types, this network reveals that with the arrival of Europeans and enslaved Africans, the Clay A source on Grenada becomes much less central to the network of Grenada potters (i.e., including Indigenous, African, and European potters). Following the arrival of Europeans and enslaved Africans, a new source becomes important in the context of European sugar wares. At the same time, Clay A continues to be important for the production of Cayoid ceramics.

Interestingly, the people making the Afro-Caribbean pottery began to use (or continued to use, if they were related to the earlier indigenous potters), Clay A, the primary source for the Cayo and Troumassoid ceramic producers. Both contextually (e.g., Hodder 1987) and as demonstrated in sociological (e.g., Díaz-José et al. 2016) and archaeological (e.g., Douglas and Kramer 1992) studies of information transmission, this strongly suggests that knowledge about clay acquisition and paste recipes was shared between indigenous potters through time (Troumassoid to Cayo). Thus, in an otherwise socially neutral setting, i.e. no invasion or warfare, personal communication networks (e.g., Warriner and Moul 1992), kinship, (or no social distance) and physical distance (e.g., Douglas and Kramer 1992) would explain the distribution of knowledge

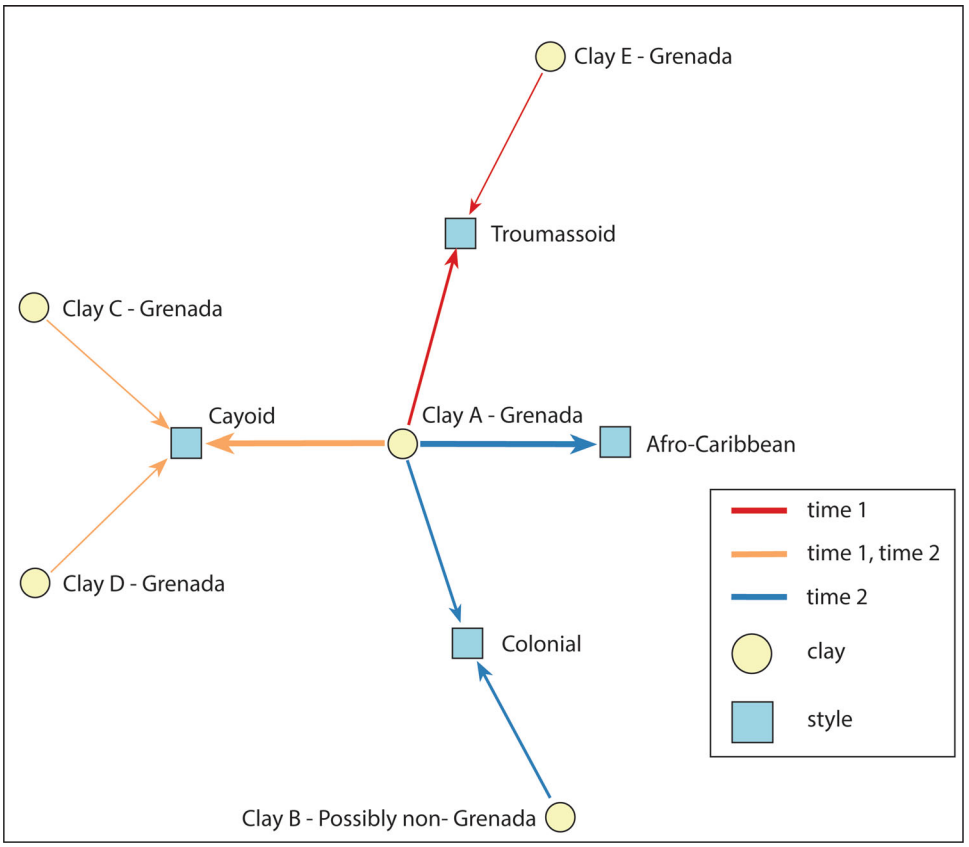

Figure 4. Bimodal temporal network where ceramics identified to their style are one node and pXRF identified clay groups are another. Line thickness represents number of times that a ceramic style was crafted using a pXRF clay group. Line shading indicates time period (Figure by Lewis Borck).

about clay sources/recipes (see for example Borck and Mills 2017). This would lead to both the Afro-Caribbean and European ware potters either both using, or both restricted from using, the locally preferred Clay A.

Figure 4 reveals that the distribution of the use of Clay A during the third temporal period was not standard across communities. This suggests that potters in Indigenous communities were sharing knowledge with potters creating the Afro-Caribbean ceramics, but *not* with those creating the colonial ceramics. Instead, potters making colonial ceramics relied on a different clay source and recipe that may or may not be local.

Thus, during the colonial period, clay sources and recipes that were preferred by Indigenous groups prior to the arrival of European colonists were shared with Afro-Caribbean potters, but not with the potters creating colonial pots. There may be some underlying functionalist explanations (i.e., Clay A does not function well for creating colonial wares), but that seems unlikely considering the sugar wares were often created using similar production techniques (i.e., coiling versus the more typical wheel thrown pottery being imported from Europe) and in forms that indicate domestic and culinary use (similar to the indigenous ceramic types).

This divergence in clay sourcing and recipe between local/enslaved and colonial wares suggests that there was knowledge freely transferred between communities that were marginalized during colonialism, but not from those communities to their colonizers and slavers. This follows patterns of purposeful choices that marginalized communities often make as acts of resistance against their oppressors (e.g., Borck and Mills 2017; Borck and Sanger 2017; J. Scott 1985). This also highlights that the producers of these pots were willing to create a social refugia, so to speak, *within,* instead of seeking isolation outside of, the brutal realities of colonization. This type of knowledge restriction within and between local groups that might otherwise look like a large, but heterogeneous and unequal community on the surface, highlights some of the complicated processes of resistance that can lead to multi-ethnic revolts against elite whites (i.e., Ryzewski and Cherry 2015).

Cayo adornments and paraphernalia

Paraphernalia made from animal bone are found in Cayo assemblages on St. Vincent and Grenada. Below, we discuss four flutes manufactured from deer long bones and pendants made from dog, tapir, and peccary teeth found at La Poterie and the adjacent site of Telescope Point on Grenada (Figure 5a-e). The presence of mammal bone artifacts points towards South American mainland connections where such objects are ethnographically widespread, whilst being previously poorly known in the Windward Islands archaeological record (Giovas 2018).

Bone flutes: Technical repertoires and wear traces

The flutes are comparable in their base design. Wear trace analysis revealed strong similarities in the technical repertoires used to produce the flutes' acoustics (Breukel 2019). Each flute appears to have a different acoustic range, indicated by the subtle differences in notch size and placement, as well as in the number and alignment of the tone holes.

Each instrument is made from deer long bones identified as *Mazama* sp. in the two more intact specimens. As there is no evidence that deer ever lived on any of the Windward Islands, with the exception of Trinidad, it is likely that these deer specimens were transported to Grenada as isolated skeletal remains (cf. Giovas 2018). In terms of manufacture, first, the epiphyses were sawn off, then the outer surface of the bone shafts were smoothed by either scraping or abrading. Decorative motifs were carved using a variety of techniques, including incising, sawing, scraping, and chiseling, generally beginning with the excision of the larger features and proceeding towards the detailed elements (Breukel 2019). The wide, steep walled incision profiles indicate that the tool materials consisted of solid, thin-edged tools (Figure 6a). Though most carved features resulted from multiple gestures, comparisons with variables for distinguishing cut marks suggests the predominant use of lithic flakes (e.g., Greenfield 1999; 2006). However, a few very narrow decorative cuts of exceptional straightness may have been enacted with metal knives instead. Such tools were accessible as highly desired trade goods for early colonial indigenous communities (Hulme and Whitehead 1992).

The three surviving mouth pieces all display V-shaped notches that formed the blowing edge against which the airflow must be directed to produce sound. In one, it was

Figure 5. Bone artifacts from Kalinago archaeological assemblages from Grenada, sites of La Poterie (a, c, d, e) and Telescope Point (b) (Figure by Catarina Guzzo Falci and Tom Breukel).

carefully chipped out using localized pressure, and in another, smoothed and widened by abrading using an organic tool. There is wear trace evidence of their use as musical instruments in the form of small chips opposite the notch where players would press their chins (Figure 6, B). The tone holes are standardized and probably drilled into the shafts using a tubular hollow drill since they lack the tapering profile created by most solid drill bits (Figure 6c). The spacing remains consistent for each flute, but differs between instruments (Breukel 2019).

The similarities in the operational sequences and technological equivalence for the musical functioning of the pipes suggests they originate from within a knowledge tradition

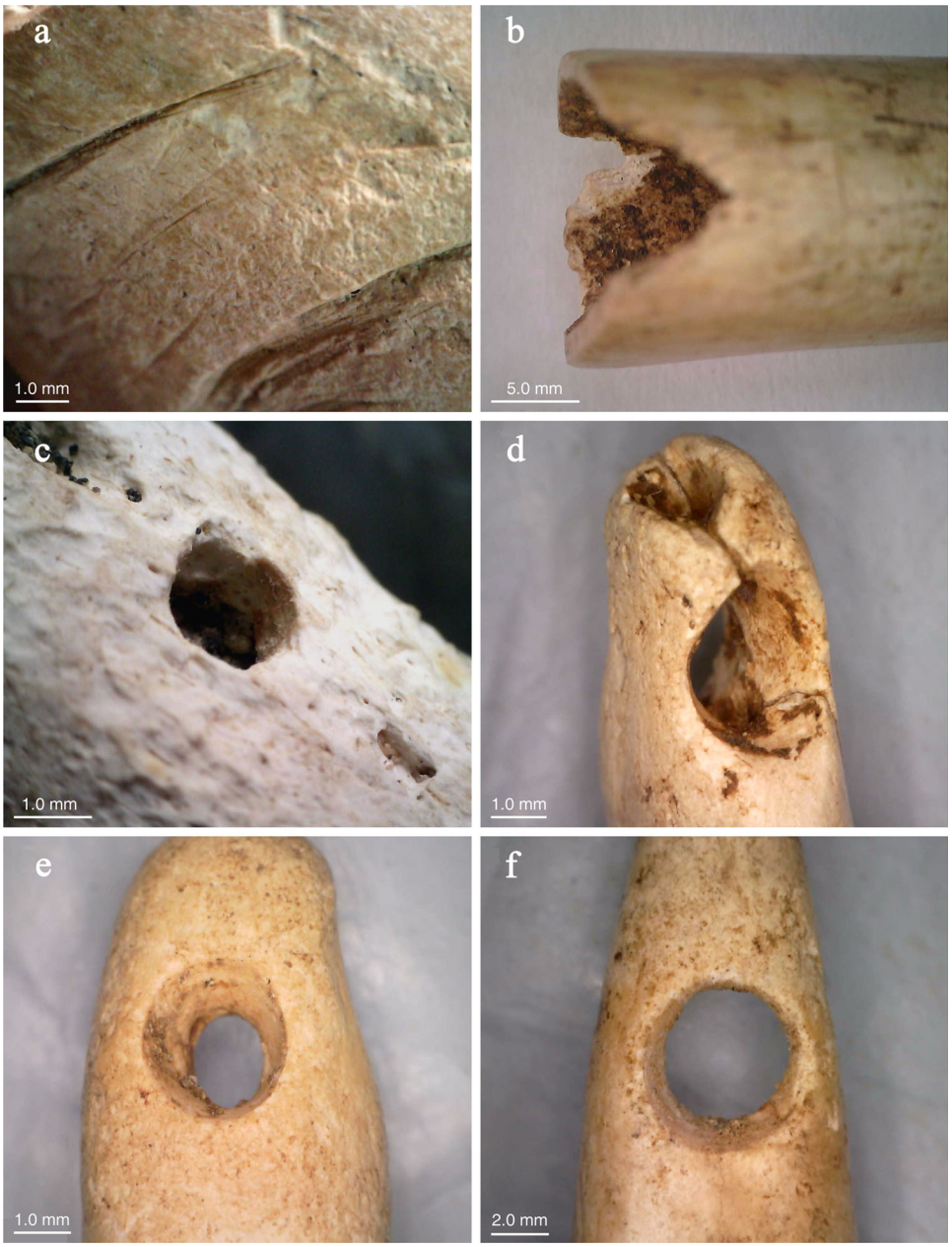

Figure 6. Technological and use wear traces on flutes and tooth pendants; (a) engraving through multiple incisions; (b) mouthpiece with V-shaped notch on the foreground and use wear visible behind it; (c) outline of a tone hole perforation; (d) perforation of LPG-1 with an oval shape, caused by deformation as a result of use: (e) perforation of LPG-2 with preserved technological features, notably concentric drilling traces; (f) perforation of LPG-3 markedly deformed by use (Figure by Tom Breukel and Catarina Guzzo Falci).

of flute-making. They were probably not made by the same persons owing to individual variation in the preparation of the shaft and the technical execution of the decorative aspects, indicating the sharing of this knowledge amongst multiple *Kalinago* crafters.

Bodily ornaments: Production sequence, use life and origin

Bodily ornaments using the teeth of animals are well known among indigenous communities from the lowlands of South America and often use varied monkey species, peccary, jaguar, and caiman (Harding 2003; Ribeiro 1988, 188). Necklaces, pectorals, belts, arm bands, and baby slings were crafted using varying numbers of teeth of a single or several species. Within each of these types of ornaments, specific attachment systems can also vary considerably. For instance, a tooth can hang loosely on a string, be sewn against a cotton band, or even have most of its surface covered by resin and/or a woven fabric. Different attachments lead to the formation of different patterns of use-wear (Guzzo Falci et al. 2018).

Production sequence and use life

The two tapir and the peccary teeth from La Poterie were also examined through ware trace analysis to assess their production sequence and use life. The teeth present differential preservation across their surfaces, as a result of post-depositional processes. Some sectors display surface pitting, cracking, flaking, and soil encrustation.

The removal of the teeth from the mandible of the animals left no recognizable traces. This suggests that the teeth were either pulled out after decomposition of the soft tissues or that the mandible around the tooth was itself broken. Researchers experimenting with the production of teeth pendants from mammals have successfully removed teeth from the mandible by cooking it or soaking it in water for periods of over a month (e.g., Rainio and Tamboer 2018). A single perforation with a diameter of 3-4 mm was drilled on the root of each tooth, by use of a solid drill bit. The tapir incisor and canine were drilled in a mesiodistal direction, while the peccary incisor was drilled in lingual-buccal direction. The perforations were started from both surfaces of a tooth until the drilled cones reached the pulp canal (biconical perforation). Concentric rings produced by drilling remain visible only on the tapir canine (Figure 6e).

The perforations of the peccary and tapir incisors have been widened by prolonged use. The perforation of the tapir incisor is deformed in a coronal-apical direction, assuming an oval shape (Figure 6d). The pronounced use-wear observed all around the perforation suggests a relatively loose attachment, in which the tooth could move up and down. At the same time, the cones of the perforation display slightly deformed notches towards the lingual surface of the tooth. We can interpret these use-wear patterns as evidence that a thick string was used to sew the tooth against a fabric.

The tapir canine was not affected by use-wear to the same degree as the tapir incisor. Nonetheless, rounding on the inner cone of the perforation shows that it was worn, but for a shorter period (Figure 6e). A string passed through the perforation and held the tooth sewn against a surface, as suggested by the presence of smoothing of the root on the lingual surface.

Table 1. Sample information and isotope results.

Lab ID	Site	Island	Modification	category	taxa	Element	$^{87}Sr/^{86}Sr$	$\delta^{18}Oca$
T881	La Poterie	Grenada	Perforated	tapir	*Tapirus terrestris*	incisor	0.71319	−2.5
T882	La Poterie	Grenada	Perforated	tapir	*Tapirus terrestris*	canine	0.71012	−1.2
T883	La Poterie	Grenada	Perforated	peccary	Tayassuidae	incisor	0.71523	−5.6
U030	Pearls	Grenada	Perforated	jaguar	*Panthera onca*	Incisor	0.70853	−4.5

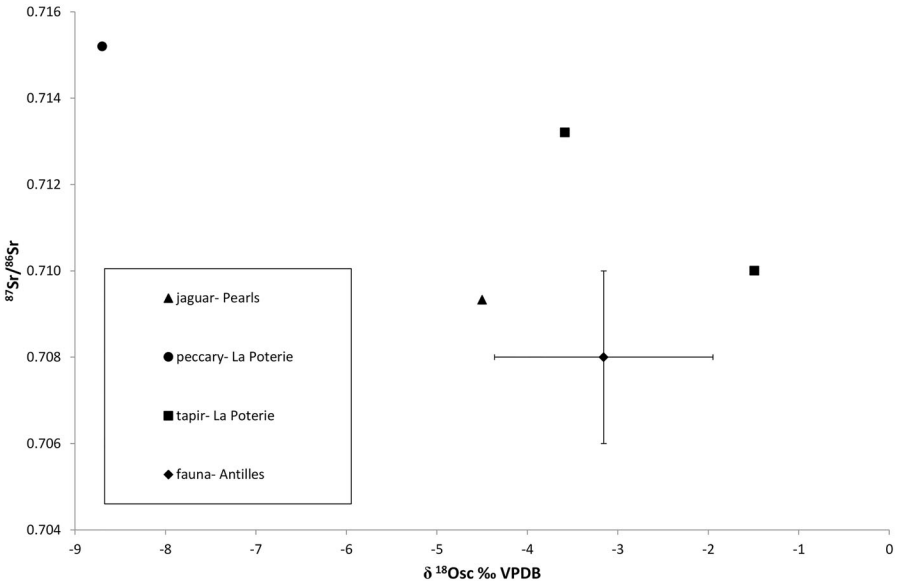

Figure 7. Chart of strontium and oxygen isotope values obtained from the dental enamel of mammalian tooth pendants from Grenada.

The peccary incisor is extensively worn, with the inner walls of the perforation almost entirely worn down (Figure 6f). Nonetheless, the outer rim of the perforation has a ragged appearance, suggesting that it was not directly subjected to string tension. Certain sectors of the root around the perforation are rounded, smooth, and with a darker color than the surrounding surface. These traces may correspond to an attachment in which part of the root was covered by fabric.

Each of the three studied teeth was likely attached in a different way from the other. Their degrees of use-wear development also differ, in particular between the two tapir teeth. In this sense, the use-wear data is in agreement with the results of the provenance study presented below: the teeth were not only coming from different regions, but they also likely belonged to different composite ornaments. The varied origins, perforation techniques, and suspension patterns of these specimens indicates that they must have taken diverse routes to the Windward Islands. They provide further evidence that local island communities were interacting with many different mainland communities across northern South America.

Provenance

Pendants made from the teeth of large mainland mammals (jaguar, tapir, peccary) are rarely recovered from archaeological contexts in the insular Caribbean and these unique

objects have limited distributions (Laffoon et al. 2014, 2016). Such pendants are known to have circulated from the Early Ceramic Age until the early colonial period. Although they can be ascribed to mainland origins on the basis of taxonomic identification, isotope analyses are useful for further investigating their geographic provenance. Combined strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$) isotope analyses were conducted on one peccary (*Tayassu pecari/Pecari tajacu*) and two tapir (*Tapirus terrestris*) teeth pendants from La Poterie. The isotope results confirmed not only that the specimens are of mainland origins but that all three specimens originated from three different regions (Table 1 and Figure 7). The nearest and most likely provenance for all pieces is somewhere in the interior of northern South America. Although the spatial variation of bioavailable strontium and oxygen isotopes for this macro-region is not well characterized, based on the current relevant isoscapes (Laffoon et al. 2012, 2014, 2017) possible areas of origins can be proposed. For the tapir incisor, the combined isotopic data is most consistent with an origin in or near the Guiana Shield Region of northeastern South America or small pockets of the Cordillera de Mérida of western Venezuela. The tapir canine tooth has combined isotope values more consistent with low elevation areas (e.g., *llanos*) of north-central Venezuela. The peccary incisor has isotope values that are most consistent with high elevation areas of the Guiana Shield Region and the Columbian Andes. The diverse geographic origins of all three tooth pendant specimens provides independent evidence for interactions between *Kalinago* communities in the Windward Islands and various communities in northern mainland South America. Interestingly, a perforated jaguar tooth pendant recovered from an Early Ceramic Age context at the site of Pearls on Grenada, also possesses combined isotope values that are distinct from those of La Poterie, indicating a fourth source area for large mammal teeth on the mainland. It can be proposed that the exotic and distant (minimally $>$ 100 kilometers, possibly much greater) origins of these adornments may have played a role in their symbolic and/or social value.

Discussion: Moving between the islands and mainland

Movement around the islands was modeled using least cost pathway analysis (e.g., Surface-Evans and White 2012) on seascapes (e.g., Gustas and Supernant 2017) to provide an additional layer of understanding of migration and voyaging practices into the Lesser Antilles. Previous research has examined the capabilities of Amerindian canoe technology (e.g. Bérard et al. 2016; Fitzpatrick 2013) and modeled seafaring routes between the northern coast of South America, Trinidad and Tobago, and Antilles (Callaghan 2001). Callaghan was the first to apply computer modeling to postulate how peoples may have traveled across the Caribbean Sea, primarily to determine possible colonization or migration routes. While he explored movement between Trinidad and Tobago to Grenada to address difficulties in making that crossing due to lack of visual connections, he did not specifically model routes to the Lesser Antillean from the Guianas.

Recent efforts to model additional canoe routes (Slayton 2018) detail possible travel corridors between the area around the Guianas—the potential source area for people and goods—and the Lesser Antilles. To focus on directed exchange, as evidenced by the examples of material mobility above, routes were modeled between sites containing

Cayo materials. These routes were constructed using a least cost pathway approach, where the shortest time path is modeled using an isochrone method (Slayton 2018). This path was determined by calculating how far a canoe could move from the starting point in 30 minute intervals based on the direction and force of current and wind as well as on a set canoe speed (3 knots), which was used to represent the efforts of the human crew.

These modelled routes indicate that there was a slight cost differential to traveling in this region, either due to changes in seasonal weather conditions or vessel launch areas (Figures 8 and 9). The time-cost of these routes averaged between three and a half days and six and a quarter days, depending on whether the routes were moving towards or away from the islands and the season of travel (January, April, August, and November). According to the results of the model, it was easier for canoers to paddle from the Guianas to the Lesser Antilles than in the reverse. This may have impacted the diffusion of mainland and European-styled materials from the south into the north, following the travel corridors with lower costs. However, due to the position of stopover points and seasonal spread of cost values, it is clear that there was not simply one corridor that defined movement between the island(s) and the mainland.

Instead, the possibility of stopover connections could have influenced route selection. For example, direct movement to St. Vincent over all months tested showed that movement past Tobago would not only have been possible, but perhaps encouraged by environmental forces such as currents and winds. Tobago could have functioned as a rest stop for crews traveling between the islands and the mainland. Breaking a journey on Tobago would have allowed canoers to rest, resupply, and meet with people living on the island, thus providing an additional opportunity for exchange. There is much to suggest that this opportunity was sought after, as Tobago was referred to as a stopover location by early European chroniclers (e.g., Reeves 1749, 24; Rochefort 1658; Young 1795, 5). These references to active canoe travel corridors running past the island suggest that these routes could represent past seafaring actions.

Modeled routes from the mainland to Grenada indicate that people also likely passed through the Galleons Passage (between Trinidad and Tobago), potentially interacting with communities on both islands before reaching the Windward Islands. This would fit with the locations of known sites from this period, which dot the southwest corner of Tobago and the eastern coast of Trinidad (Boomert 2016). Several modelled routes pass near sites dating to this period, suggesting that there may have been a relationship between route and site location (Slayton 2018). People, Cayo pottery, and knowledge of its manufacture, as well as European wares were possibly exchanged across this passage. Canoers moving along this route to Grenada would have various opportunities to make contact with different communities depending on the season and desired direction of travel. European trade wares may have been introduced via these travel corridors, as the Spanish occupied the northern edge of the mainland and adjacent islands from the early sixteenth century and frequent Indigenous/European trade along the coast is reported.

Beyond looking at inter-island mainland relationships, these routes can suggest why sites are located where they are. Routes moving north favored trajectories that would

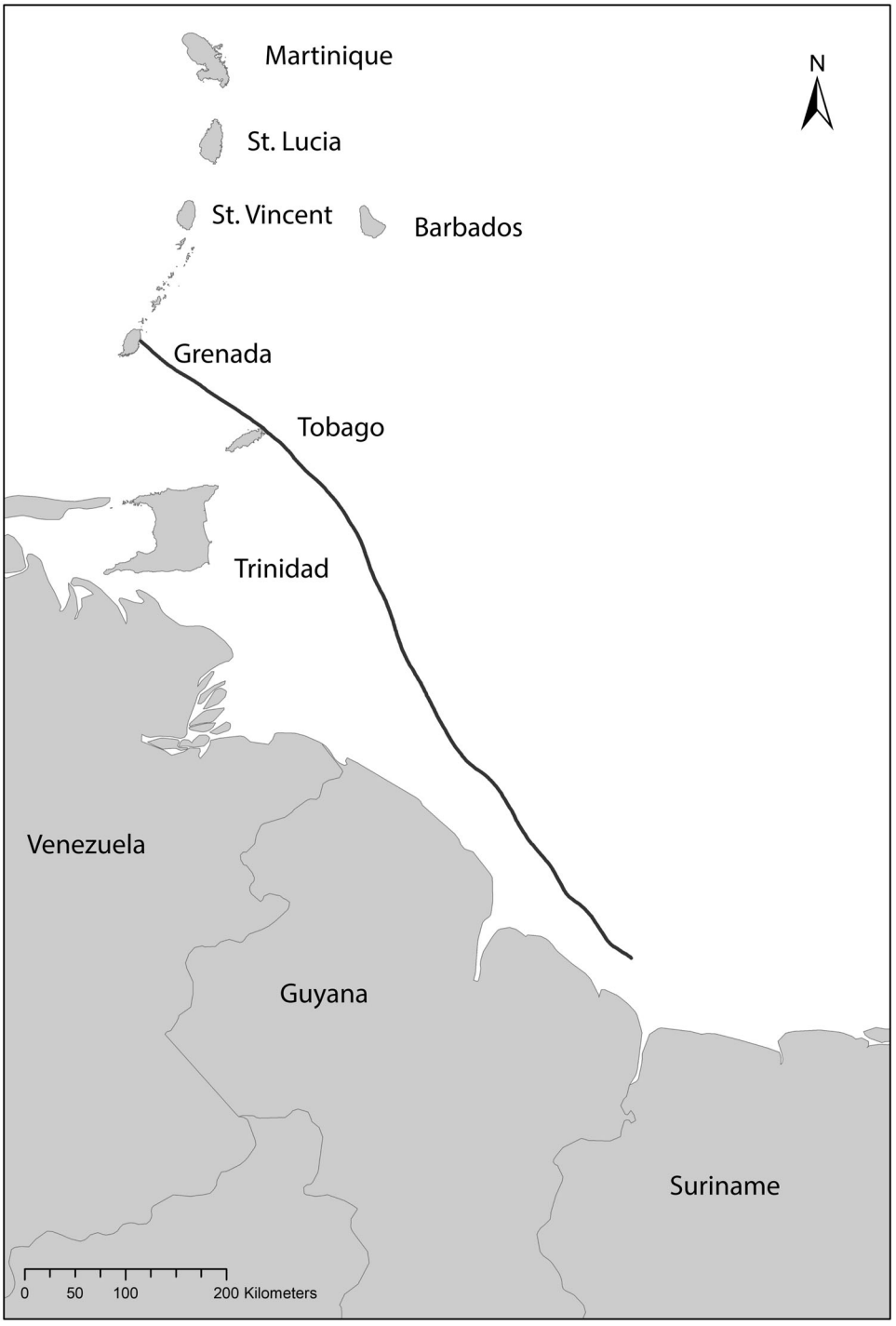

Figure 8. Route between Telescope Point, Grenada and southern Guyana in November. The path passes by the coast of Tobago (Figure by Emma Slayton, adapted from Slayton 2018: Figure 107).

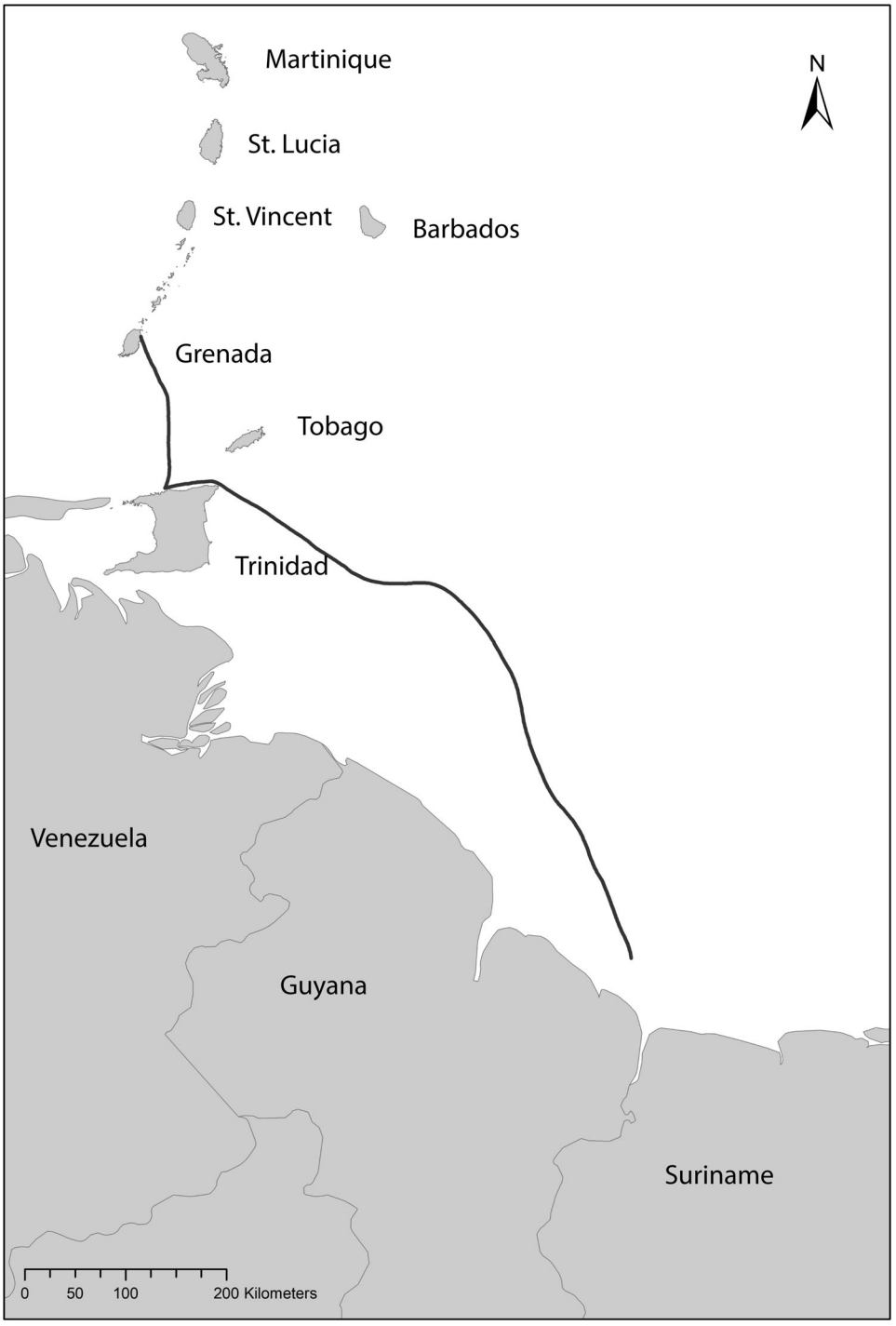

Figure 9. Route between southern Guyana and La Poterie, Grenada modeled for November. The path meets the Trinidad coast close to the Ceramic Age site of Blanchisseuse (Figure by Emma Slayton, adapted from Slayton 2018: Figure 112).

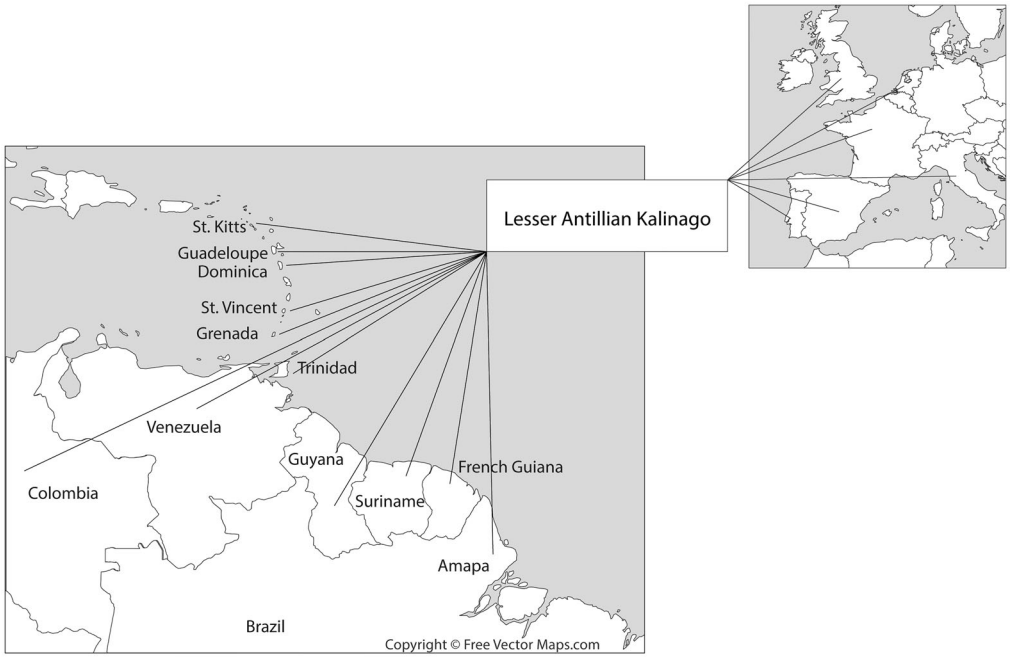

Figure 10. Map of regions from this article whose people and their material culture (including technology and style) create the vast web of relationships and histories that formed the Lesser Antillean Kalinago (Figure by Lewis Borck and Maroussia Faber).

push them into the windward coast of the islands. Approaching coastlines from the east allowed for canoers to let the currents do the work of pushing them into the island, making the end of a voyage much easier. It is also possible that, in addition to providing good defensive positions, placement of sites along the windward coast of these islands may also have provided ease of travel to these areas from the South American coast, reflective of longstanding mainland/island relationships.

Additionally, the location of some sites seems to be tied to canoe routes. This is true for the Ceramic Age site of Blanchisseuse on the northern coast of Trinidad, which in many modeled routes acts as the point of egress to the Lesser Antilles halfway through voyages from the Guianas to Grenada (Slayton 2018). Historical accounts containing a reference to canoe use also reference the names of inhabited places that lie off the coast of modeled routes.

Conclusions

The widespread presence of non-local individuals in burial assemblages and the occurrence of exotic ceramic, lithic, shell, and bone artifacts in archaeological sites in the Lesser Antilles emphasize how pre-colonial communities throughout the archipelago were integrated in social networks that incorporated local, regional, and pan-regional interaction spheres and stretched across a thousand years. This resulted in a dynamic pre-colonial social landscape in which communities on the same island or, more often, between neighboring islands formed local networks based on kinship or other

communal relationships. Many archaeological sites form so-called settlement pairs, situated within each other's catchment area (Bright 2011; Keegan 1992). Intensive exchange of everything from pottery, to spouses, to information on food production would have been exchanged between these settlements.

The analyses of the early colonial assemblages have provided important new insights into the transformations of indigenous island cultures and societies, exchange relationships, and inter-cultural dynamics, in particular between the late fifteenth and early eighteenth century. The movement of peoples, objects, and ideas from the mainland and the Greater Antilles in what has been labelled the Cayo complex in the Lesser Antilles, emphasizes the role of migrants in the formation of this new *Kalinago* ethnic/cultural identity (Figure 10).

The circulation of European trade wares in early colonial indigenous villages reflects the early negotiations between Amerindians and Europeans in the initial years of encounters, while the division of clay sources between Cayo, Afro-Caribbean, and European sugar wares in our case study from Grenada highlight potential undercurrents of resistance and cross-ethnic community building during these negotiations. From the Spanish, Dutch, French, and English sources we know that during the seventeenth and eighteenth centuries, other types of perishable indigenous goods such as hammocks or indigenously domesticated tobacco had a lasting impact on these trade networks. The influence of a forced African diaspora, and the concomitant *Kalinago*-African-European inter-cultural dynamics, as shown in the case of Grenada, profoundly impacted Caribbean societies and their social relationships up to this day.

Acknowledgements

The research leading to these results has received funding from the Netherlands Organisation for Scientific Research (NWO grant no. 360-62-060) as part of the research program titled "Island Networks: Modelling intercommunity social relationships in the Lesser Antilles across the historical divide (AD 1000-1800)". The research also benefited from funding from the ERC-Synergy project NEXUS1492 (grant no. 319209). We thank Emma de Mooij for her editorial help and the reviewers and Scott Fitzpatrick for their useful comments on this paper. We specifically want to acknowledge the people of Grenada and St. Vincent for their hospitality, Neil and Colin Willcox and Dolton Charles for giving us access to their collections, and foremost to Irvince Auguiste and Sardo Sutherland, Kalinago from Dominica and St. Vincent with whom we have collaborated in all stages of the research.

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