Use of natural resources for indigenous ceramic production in the Lesser Antilles during the Ceramic Age and Early Colonial Period

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Chapter 1: General introduction

"All cassava get same skin but all nah taste same way"

People may look alike, but all act differently (Guyana proverb[1])

The Caribbean are a highly diverse area in many respects. Keegan and Hofman (2017) even liken both the area and our way of studying it to a kaleidoscope. An apt comparison. And also one suitable to this research project and background, which ranges from the multicoloured birefringence patterns and scatter plots on the one hand to the diverse archaeological and cultural backgrounds on the other. In order to be able to focus our different lenses on the same topic in the next chapters, this first chapter will be devoted to an orientation in space and time, an overview of past archaeometric studies on ceramics in the study region and finally to the research background, aims and research questions themselves.

Orientation in space: general overview of the natural context of the Caribbean region

The Caribbean consist of a chain of more than 700 islands surrounded by the Caribbean Sea, the Atlantic Ocean and the Gulf of Mexico. Although sometimes other divisions are applied, they are commonly subdivided into three main archipelagos: the Lucayan Archipelago, the Greater Antilles and the Lesser Antilles, the latter of which can be further subdivided into the Leeward Islands, Windward Islands and Leeward Antilles. Trinidad and Barbados are sometimes considered separately and sometimes grouped under the Windward Islands, depending on perspective. All these Caribbean islands display marked internal differences in terms of size, geology, history etc. For example, the largest island, Cuba, is with its 105806 km² more than 20000 times bigger than Mustique, one of the many small islands of the Grenadines (Keegan & Hofman 2017, Clarke et al. 2023).

Below, a map is included of the Lesser Antilles – this project's main study region within the Caribbean – with labels for the islands studied (fig. 1).

[1] (Caribbean Dictionary. (n.d.). https://wiwords.com/words/all-cassava-get-same-skin-but-all-nah-taste-same-way, Accessed 02/05/2024)

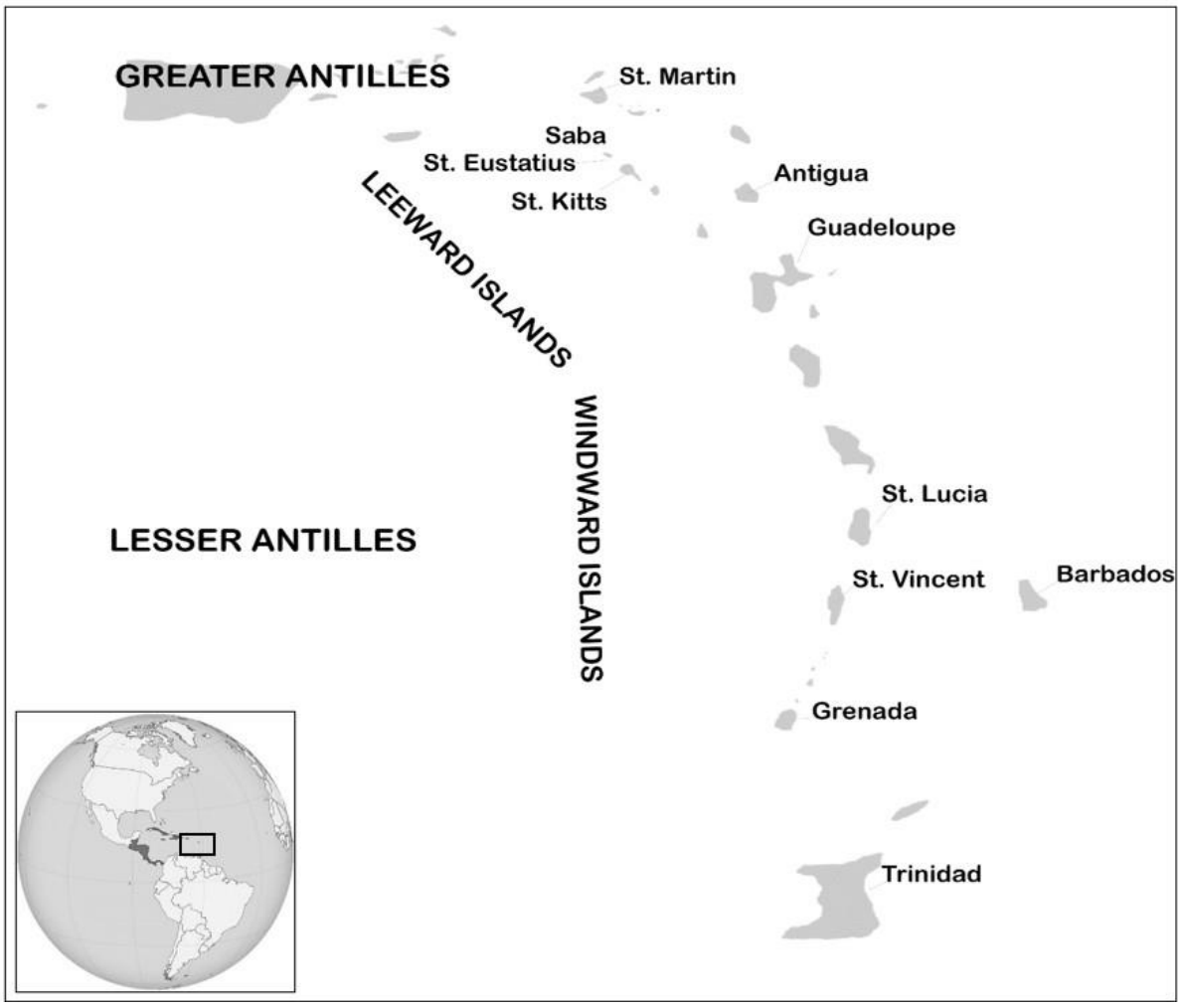


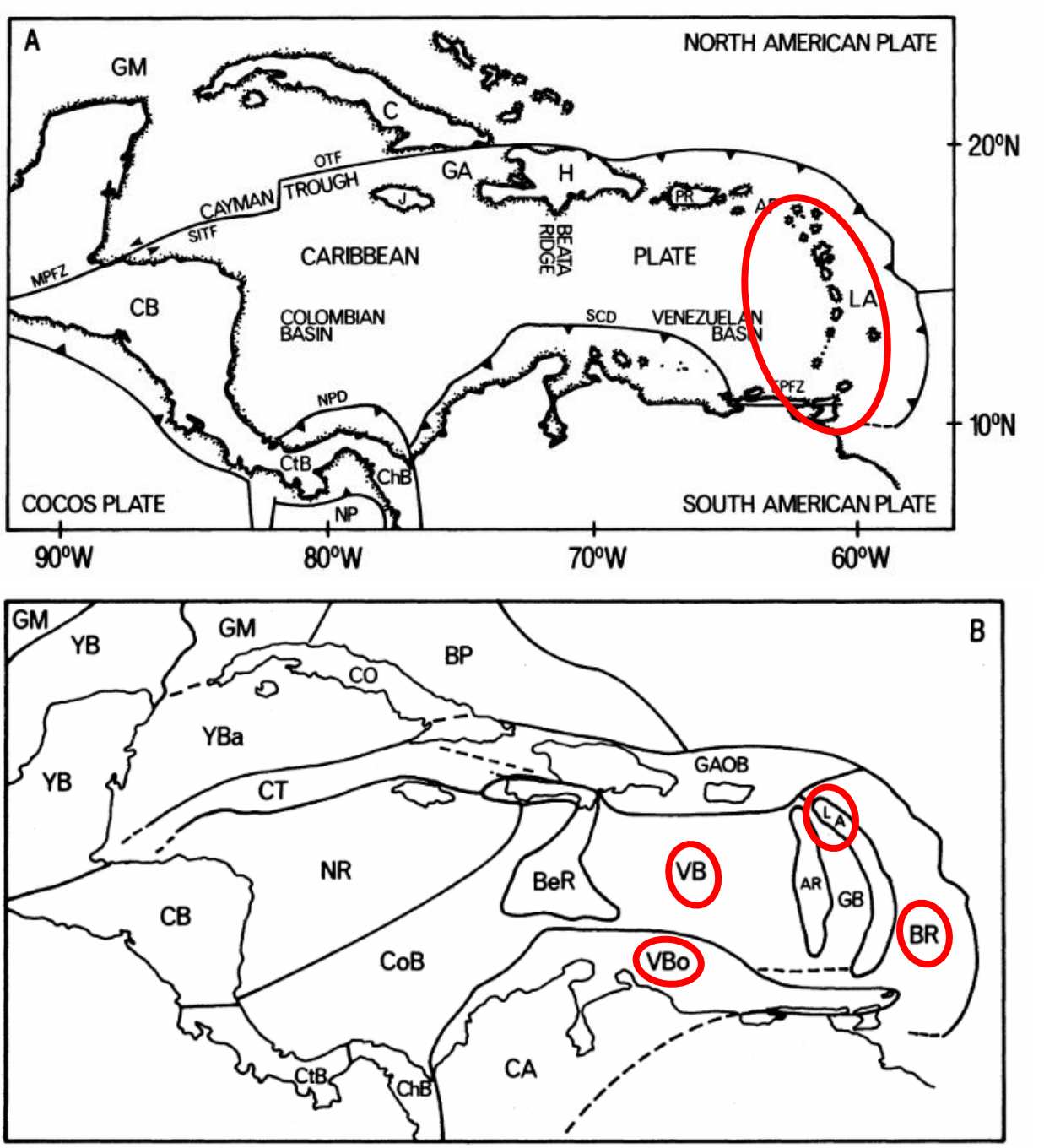
Fig. 1: Lesser Antilles geographic overview, with labels for the islands studied in this PhD.. Basemaps from https://foundation.wikimedia.org/wiki/File:Lesser_Antilles_virgin_SVG_map.svg and https://upload.wikimedia.org/wikipedia/commons/5/57/Central_America_and_the_Caribbean_on_the_globe_%28red%29.svg (accessed 24/07/2024) .

The Caribbean islands are almost entirely situated in the tropics, with latitudes between 10° and 26° north. They are subjected to a relatively stable temperature range (between 15°C and 30°C due to the warm waters of the Caribbean Sea) and to reasonably predictable trade winds from the north-east on the one hand and precipitation on the other hand, punctuated by cyclones between June and November. Although their climate has always fallen within this broad description, Caribbean weather and by extension its climate has been subjected to substantial variability because it is dependent on the wider climate system of the North Atlantic and large-scale events such as the movement of the Inter Tropical Convergence Zone (ITCZ)[2] and El Niño Southern Oscillation (ENSO). Generally speaking, it can be inferred from paleoclimatic data that there was a warmer and wetter phase early to mid-Holocene (5000 – 2000 BCE), followed by a drier phase mid- to late Holocene (1500-300 BCE), again followed by a drier Medieval Warm Period (950-1300 CE), finally followed by a wetter period from 1380 CE onwards.

[2] Definitions of underlined words can be consulted in the glossary pp. 183-191.

This would show its impact through lengthening and shortening of rainy seasons and more or less concentrated and extreme precipitation events. Other environmental factors subject to change with potentially large implications for human occupation in the area are soil erosion and relative sea level change. During the known pre-Columbian occupation of the region, the relative sea level has risen more than 5m, meaning a land loss of more than 15% over time. Moreover, this rise has not always been gradual, but often in a series of sudden coastal flooding events. The Caribbean islands have always been susceptible to regional climate change, probably with a profound impact on the populations living there (Cooper 2013).

The Caribbean is a geologically complex region. It displays several plate boundary interactions, subduction zones, divergent plate boundaries and volcanism. Four geological provinces with numerous subdivisions can be found in the region. Figure 2 shows the fault zones, plate positions and main geological provinces. Of particular interest for this study are the geological provinces of the Eastern Caribbean (Lesser Antilles and Barbados Ridge) and Northern South America (Venezuelan borderland). The volcanic arc of the Lesser Antilles consists of a series of islands from Grenada in the south to the Anegada Passage between Anguilla and the Virgin Islands in the north. It is a double arc system. In the southern half, these two arcs are superimposed forming the volcanic islands from Grenada up to Martinique. From Martinique northwards, it splits into an outer ridge with limestones (Limestone Caribbees) and an inner volcanic ridge which is a continuation of the volcanic Windward islands, together constituting the Volcanic Caribbees (Draper et al. 1994, p. 8). The Barbados Ridge consists of a forearc ridge. This ridge only emerges above sea level at the island of Barbados, which is capped with limestones and underlain by deformed sedimentary rocks (Draper et al. 1994, p. 8). The Venezuelan borderland marks the boundary of the Caribbean and the South American plates. This geological region consists of weakly metamorphosed volcanic and sedimentary rocks and extends into parts of Trinidad (Draper et al. 1994, p. 9).



Key: AP=Anegada Passage; AR=Aves Ridge; BeR=Beata Ridge; BP=Bahamas Platform; BR-Barbados Ridge and Lesser Antilles Deformed Belt; C=Cuba; C A=Colombian Andes; CB=Chortis Block; ChB=Choco Block; CO=Cuban Orogenic Belt; CoB=Colombian Basin; CT=Cayman Trough; CtB=Chorotega Block; EPFZ=E1 Pilar Fault Zone; GA=Greater Antilles; GAOB=Greater Antilles Orogenic Belt; GB=Grenada Basin; GM=Gulf of Mexico; H=Hispaniola (Haiti+Dominican Republic); J=Jamaica; LA=Lesser Antilles; MPFZ=Motagua-Polochic Fault Zone; NP=Nazca Plate; NPD=North Panama Deformed Belt; NR=Nicaraguan Rise; OTF=Oriente Transform Fault; PR=Puerto Rico; SCD=South Caribbean Deformed Belt; SITF=Swan Island Transform Fault; VB=Venezuelan Basin; VBo=Venezuelan Borderland; YB=Yucatan/Maya Block; YBa=Yucatan Basin.

Fig. 2: (A) Map of the Caribbean region showing the relative positions of plates, physiographic regions and major islands. Direction of subduction shown by solid triangles. (B) Geologic provinces of the Caribbean region. Maps from Draper et al. (1994, p. 5). The regions of interest for this study are encircled in red on both maps.

Orientation in time: general overview of archaeological cultures, styles and dates

Early Ceramic Age

Between ca. 800 and 200 BCE, communities related to the Arawak linguistic family of continental south America began to enter the Caribbean Sea (Keegan & Hofman, 2017, p. 51; Wilson, 2007, pp. 59–95). Before that point, there was already a (largely aceramic) habitation on some of the islands. A farming-based subsistence economy was further developed and the mainland communities brought along the Saladoid ceramic series (cfr. 2.1.1.2), which showed remarkable similarities across all the different islands, although at the same time with many local variations (Reid et al. 2014).

On Trinidad, the Saladoid becomes visible during the last centuries BCE. Palo Seco and Cedros are two important Trinidadian Saladoid sites, but Saladoid ceramics have been recovered from all across the island. In the first centuries CE, other ceramic traditions such as the Barrancoid originally stemming from the Lower Orinoco (South America) start to assert their influence on Trinidad through processes of exchange and gradual adoption, especially on the island's southwestern littoral at the sites of Erin and Quinam. Barrancoid-influenced ceramics and Late Palo Seco Saladoid ceramics occur in close association at these sites, potentially suggesting that both wares were manufactured and used largely simultaneously. Deliberately crushed quartz, quartz sand, sponge spicules or a combination of these were frequently used tempering materials in Erin ceramics, which is the local manifestation of the Barrancoid (Boomert 2000, 127-217).

Between approx. 500 and 700 CE, the emergence of other ceramic styles such as Bontour shell-tempered ceramics which is very different from the previous Saladoid -Barrancoid material, marks a period of great dynamism in the South Caribbean, eventually resulting in the transition to the Arauquinoid series (Boomert 2000, 127-217; Boomert 2013, 141-149, Stienaers et al. 2020).

On Barbados there was also an influx of Saladoid pottery producing people during the Early Ceramic Age, either directly from South America, or indirectly through the northern Caribbean. Similarly to the Erin complex in Trinidad, the Saladoid material recovered on Barbados also displays Barrancoid influences. This (modified) Saladoid tradition on Barbados can be dated from approx. 400 BC to 650 CE (Farmer 2014).

Saladoid ceramics are encountered on sites in the Windward islands until approx. 600 CE and in the Leeward islands until 850 CE (Keegan & Hofman, 2017, pp. 51–82; Keegan, Hofman, & Ramos, 2013, pp. 185–198). On figure 8, p. 13, a timeline of all these different time periods for the different (sub)regions is included.

The Saladoid ceramic series (fig. 3)

During the first millennium BC, the Saladoid series, which was named after the site of Saladero (lower Orinoco, Venezuela), started to appear across the Antilles, with an increased momentum from approx. 200 BC. By the end of the millennium, it was ubiquitous on all islands from Trinidad to Puerto Rico. Inherent to all Saladoid pottery are white-on-red painted decorations, bell shaped vessels, adornos which are modelled-incised and zones with cross-hatched incisions. Traditionally, the series was described as highly uniform, but more heterogeneity in terms of morphology, technology and style has become apparent upon closer scrutiny.

In the later phase (400-600/900 CE), the Saladoid style changes somewhat, with for example a preference of (anthropo)zoomorphic adornos over cross-hatched patterns, an extended colour palette which now included black and orange as well and distinctive punctuated and/or cross-hatched curvilinear incisions (Hofman and Reid 2014, pp. 300-303, Boomert 2000, Wilson 2007).

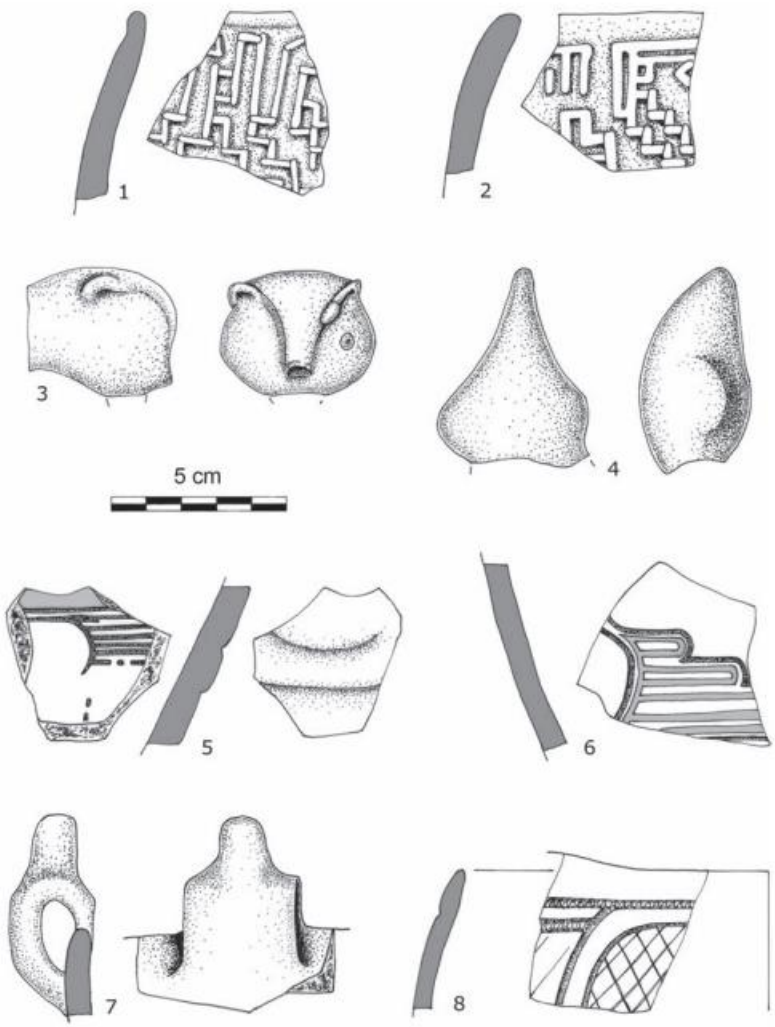


Figure 16.2. Saladoid pottery from Suriname. 1-2. thin strips of clay applied, Kaurikreek site. 3-4. zoomorphic adornos, Kaurikreek site. 5-6. white and red (= grey) painting, Wonotobo site. 7. wide handle with a lug, Wonotobo site. 8. thin zoned crosshatched incisions, Wonotobo site. (Stéphen Rostain)

Fig. 3. Examples of Saladoid pottery. Images by Stéphen Rostain, from Silverman and Isbell (2008, p. 285)

The Barrancoid ceramic series (fig. 4)

The Barrancoid series originated from mainland south America and was named after the site of Barrancas, Venezuela. Starting from the second millennium BC, it developed around the banks of the lower Orinoco from the local Saladoid tradition and spread ever northward up to the Orinoco delta. Around 350 CE, Barrancoid influences become visible on Trinidad as well in the form of the sponge-rich Erin wares and on Barbados. Stylistically, the style strongly resembles the Saladoid and is represented by handles with incisions and anthropomorphic and zoomorphic adornos. Due to these strong ties between Saladoid and Barrancoid on the Caribbean islands, often the choice is made to refer to Saladoid with Barrancoid influences rather than also define it as a separate style. After 650 CE, no more Barrancoid is attested (Reid 2014, p. 70, Boomert 2000, Farmer, 2014).

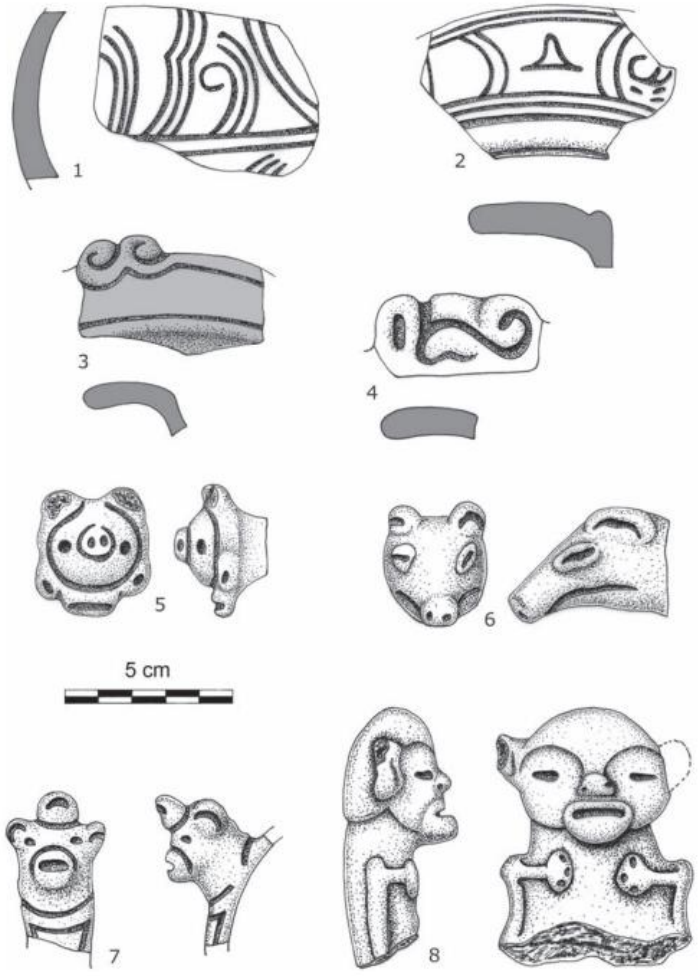


Figure 16.4. Barrancoid pottery from the Wonotobo site in Suriname. 1-2. wide incisions. 3-4. modelled and wide incised rim (grey = red painting). 5-6-7. zoomorphic adornos. 8. anthropomorphic adorno. (Stéphen Rostain)

Fig 4. Examples of Barrancoid pottery. Images by Stéphen Rostain, from Silverman and Isbell (2008, p. 287)

The Late Ceramic Age

Around 600-850 CE, the Saladoid series of styles disappeared from the Lesser Antilles and made way for more localised ceramic expressions. These are grouped under the Troumassoid series, with the Mamoran subseries for the Leeward islands and the Troumassan and Suazan subseries for the Windward islands and Barbados. In Trinidad, the Arauquinoid series became predominant. The early part of the Late Ceramic Age which these (sub)series represent lasted until approx. 1200-1300 CE. On Barbados, after the (modified) Saladoid, Troumassan Troumassoid (ca. 650 – 1150 CE) ceramics appeared (Hofman 2013, pp. 205–221; Bérard 2019, Keegan & Hofman 2017, p. 215).

The period between the thirteenth century and the arrival of the Europeans starting from 1492 is usually considered as the late part of the Late Ceramic Age. The fact that the Leeward Islands know a strong decrease in settlement numbers and an increase of Greater Antillean influence also manifests itself in the ceramics found on the still inhabited Leeward sites, which display a Chican Ostionoid component affiliated to the Greater Antilles, from ca. 1300 CE onwards (Hofman & Hoogland 2011; Hofman & Hoogland 1999; Keegan & Hofman 2017, p. 229).

In the Windward Islands, the number of settlements did not go down as drastically as on the Leeward Islands. Especially on Grenada, St. Vincent and Dominica, the emergence of an Island Carib or Kalinago culture is hypothesised. The Island Carib (Kalinago/Kalipuna) started to arrive from the South American mainland at some point between 1250 – 1500 CE. Although their presence remained archaeologically uncertain for a long time, they have now been associated with the Cayo ceramic complex (Boomert 1986, Boomert 2009, Hofman & Hoogland 2012, Keegan & Hofman 2017). In Cayo assemblages, influences from the Greater Antilles, the South American mainland and early European colonisers are attested (Allaire 1994, Boomert 1986, Boomert 2009, Hofman & Hoogland 2012, Keegan & Hofman 2017, pp. 231-235, Hofman et al. 2020).

From the early 16th century onwards, there was also an influx of people of sub-Saharan African descent on the Windward Islands. These Africans had either been captured during Island Carib raids on nearby colonies, or had escaped the Greater Antillean colonies and fled to the Lesser Antilles (Allaire 2013). Available archaeological and historical evidence suggests that they intermingled with the Island Carib (Bright 2011, Hofman & Bright 2004, Martin 2013).

Despite fierce resistance, the Carib gradually lost more and more ground to the Europeans in the course of the 16th and 17th centuries which resulted in the disruption of the to them essential ties with other islands and the mainland. In 1660 a treaty was signed between the French and the Island Carib to cease all warfare and in which the Carib maintained control over Dominica and St. Vincent, on condition that French missionaries would also be allowed to live there (Wilson 2007, pp. 155–169).

Initially, the Spanish colonial forces focussed their attention on the Greater Antilles because they encountered stronger Indigenous resistance in the Lesser Antilles and – perhaps more importantly – regarded them as *Islas Inútiles* due to their relative paucity in natural resources in comparison with the Greater Antilles. However, soon afterwards this power vacuum started to be filled by other European naval powers who did recognise the opportunities offered of having a presence in the Lesser Antilles (Keegan & Hofman 2017, pp. 257-258).

During the early colonial period, the Lesser Antilles became part of an economical system primarily based on various plantations (e.g. sugar, cotton, tobacco). To work on these plantations a combination of enslaved and indentured servants was used, the relative importance of these categories varying from island to island. The enslaved workforce primarily consisted of imported African slaves, Amerindians and their descendants. Indentured servitude was a system primarily in place in early colonial Barbados where white men would "sell" themselves as workforce for a predetermined number of years. For some of the islands, this plantation economy was their main economic forte (e.g. Barbados), while for others (e.g. St. Martin) their importance was more geopolitically inspired due to their location. This could pertain to having a presence in the region, important (trade) ports, interesting local natural local resources such as salt or a combination of the above (Beckles 1990, Reid 2018, Hartog 1981).

The Arauquinoid (fig. 5) and Mayoid ceramic series

From 500 CE, Bontour pottery, which is the local manifestation of the Arauquinoid series, starts to appear on Trinidad. This Arauquinoid series may have developed out of its Barrancoid predecessor in mainland South America. Bontour pottery is frequently shell-tempered. Stylistically, the pots are far less decorated than earlier material, but fine incisions and punctuations which are sometimes filled with red paint can typically be encountered (Saunders 2005, pp. 12-13, Boomert 2013, pp. 149-152, Boomert 1985).

The Mayoid series, produced on Trinidad during the transition between the late pre-colonial and early colonial period, can be divided into two complexes, the Guayaguayare complex and the Mayo complex, named after these respective sites. Both are tempered with *caraipé*, but the former is situated slightly earlier chronologically. The Guayaguayare complex is dated to the latest phase of the pre-colonial period on the island (14th to 16th century), while the Mayo complex belongs to the early colonial period on the island (17th and 18th century), when the Spanish attempted to gain more control over the island through missionary activities.

The fact that all Mayoid ceramics are tempered with *caraipé* and the very close resemblance of Mayo cooking pots with Mainland Arawak *buck-pots*, hint at strong ties to the mainland. *Caraipé* tempering material is typical for the Indigenous population of the coastal region of the Guianas, where this tempering tradition even persists until today (Boomert 1986, Boomert 2010, Boomert 2013, pp. 149-152).

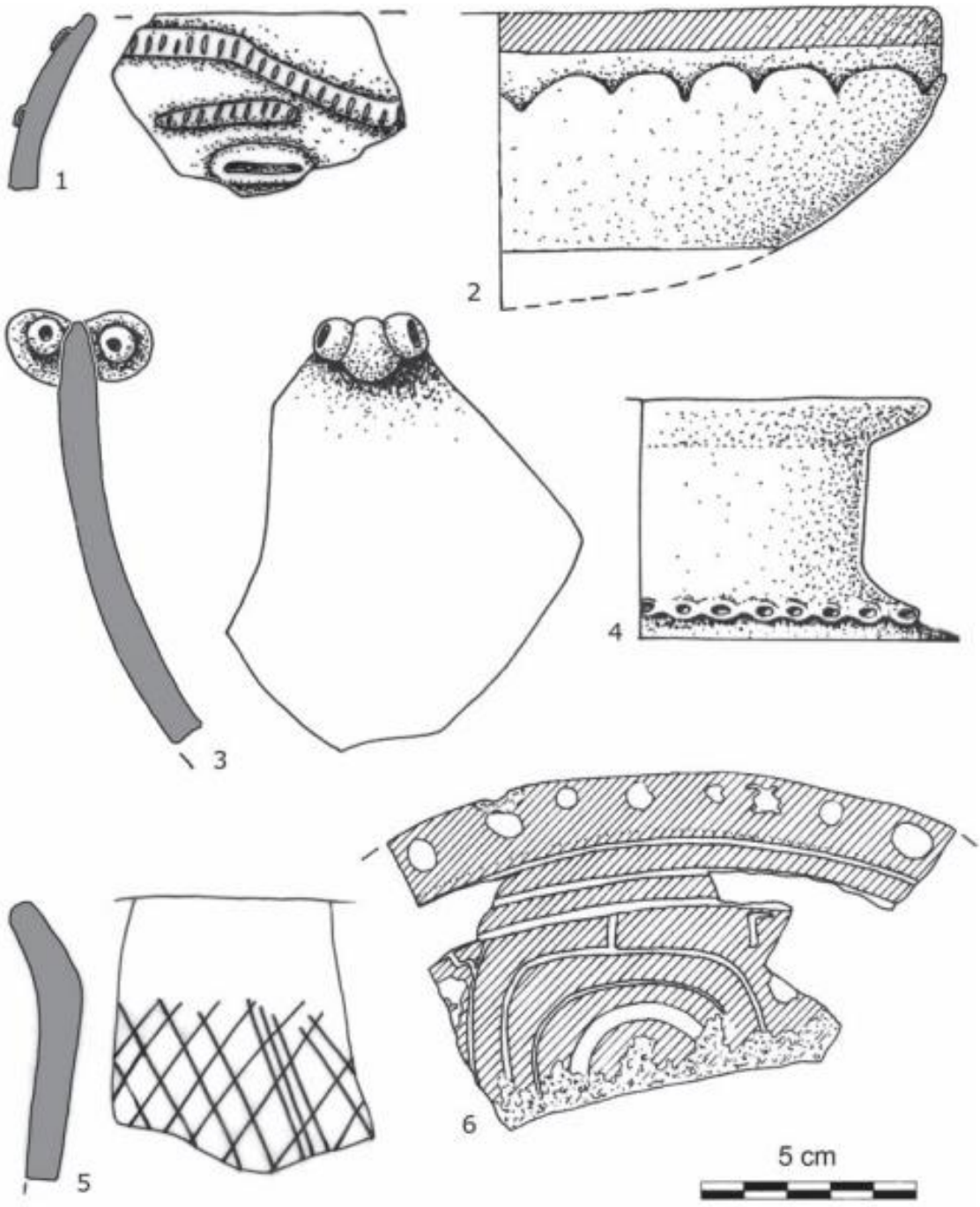


Figure 16.6. Arauquinoid pottery. 1. anthropomorphic appliqué, Kwatta culture. 2. thickened wall and red painting (= hachured), Kwatta culture. 3. zoomophic adorno, Babarkoeba culture. 4. punctuated appliqué ridge, Barbakoeba culture. 5. parallel incisions, Thémire culture. 6. white on red (= hachured) painting, Thémire culture. (Stéphen Rostain)

Fig. 5.Examples of Arauquinoid pottery, drawn by Stéphen Rostain. From Silverman and Isbell (2008, p. 291)

The Troumassoid (fig. 6) ceramic series

The Troumassoid ceramic series, which derives its name from the Troumassée site in St. Lucia, is divided into three subseries: Troumassan, Suazan and Mamoran Troumassoid. The former two subseries can be encountered on all southern Lesser Antillean islands, the latter on the northern Lesser Antilles and Virgin Islands. Troumassan Troumassoid can be dated to approx. 500-1000 CE, Suazan Troumassoid to approx. 1000-1500 CE and the Mamoran Troumassoid to approx. 800-1200 CE. Characteristic of the Troumassan Troumassoid are bowls in the shape of a boat, kidney or inverted bell, round and hemispherical bowls, double bowls, effigy bowls and cylindrical pot stands. In terms of decoration, polychrome painting and curvilinear incisions are often applied. In the Mamoran subseries, red-slipped decoration and broad-lined curvilinear incisions are common.

The Suazan Troumassoid is much cruder and more simplified than its Troumassan Troumassoid predecessor. It is characterised by thick walls, a rough finish with scratched or scraped surfaces and finger-indented rims (Hofman & Reid 2014, pp. 339-340, Donop 2014, pp. 331-332, Allaire 1991, Hofman 2013, Petersen et al. 2004).

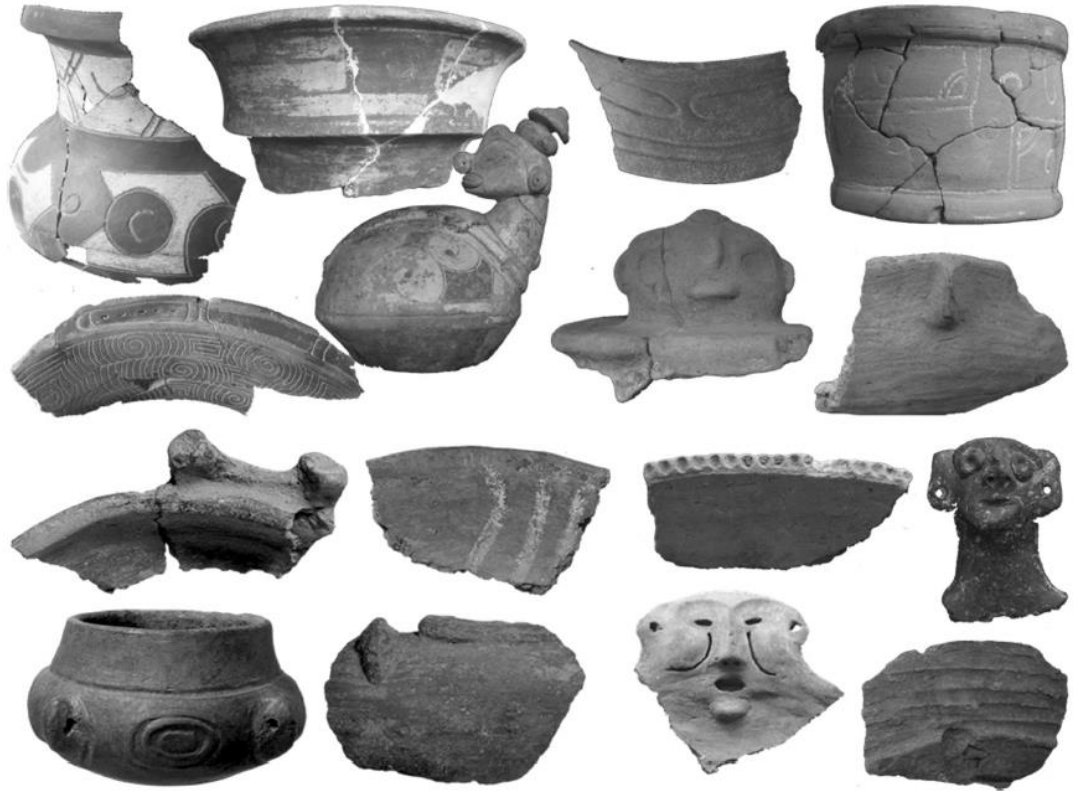


Figure 2. *Overview of ceramic assemblages in the Lesser Antilles through time, clockwise from top left: Saladoid, Troumassan Troumassoid, Suazan Troumassoid, and Mamoran Troumassoid.*

Fig. 6.Examples of Saladoid and Troumassoid pottery. From Hofman et al. (2008, p. 20).

Cayoid series (fig. 7)

The Cayoid (or Cayo) is the ceramic tradition of the Island-Carib or Kalinago. The series is therefore constrained to their geographical (Windward Islands, Guadeloupe, Martinique and Trinidad) and temporal (transition between late precolonial and early colonial period) boundaries and has so far been attested at approx. 20 sites. The pottery displays marked influences of Koriabo (<Guianas), Meiilacoid/Chicoid (<Greater Antilles) and Suazan Troumassoid (<Windward Islands), reflecting the diversity of people's backgrounds related to this style (mainland, Greater Antilles, earlier Windward inhabitants). Unrestricted, flaring bowls with carinated or indented rims, possibly decorated with white, red, black or yellow paint, restricted jars from red clay with corrugated inner surfaces and flat lips, occasionally with modelled decorations and griddle fragments without legs are typical vessel shapes. They are considered to be mostly locally manufactured, with the exception of painted flower bowls, which display *caraipé* temper similar to their Trinidadian (Mayoid) or Mainland (Koriabo) counterparts and maybe a few other shapes. In terms of decoration, the painted/slipped designs, incised and grooved motifs, punctuations, lobed rims and outward-bossed wall sections are related to the Koriabo tradition while the curvilinear incised and punctuated motifs closely resembling Meillacoid or Chicoid designs and medium-sized biconical bowls with concave necks are related to the Greater Antilles. Occasionally also foreign European elements are included into the pottery, e.g. evidenced by a Vincentian sherd with European glass beads embedded (Allaire 1994, Boomert 2014, pp. 95-96, Boomert 1986, Boomert 2011, Hofman and Hoogland 2012, Hofman et al. 2020, pp. 33-49).

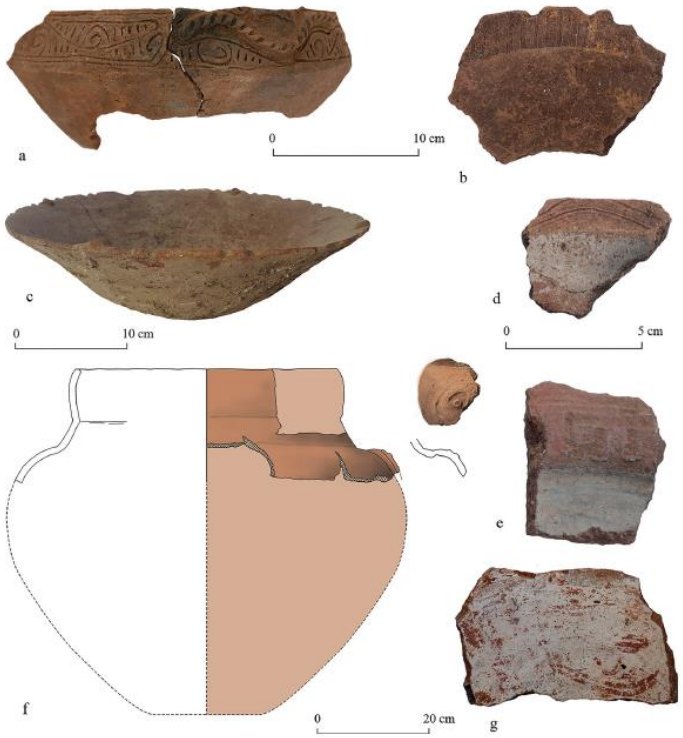


Figure 2. Cayo ceramics showing (a) Meillacoid/Chicoid (Greater Antilles) influences and (b-g) Koriabo (mainland) (Figure by Menno Hoogland).

Fig. 7. Examples of Cayoid ceramics. From Hofman et al. (2020, p. 7)

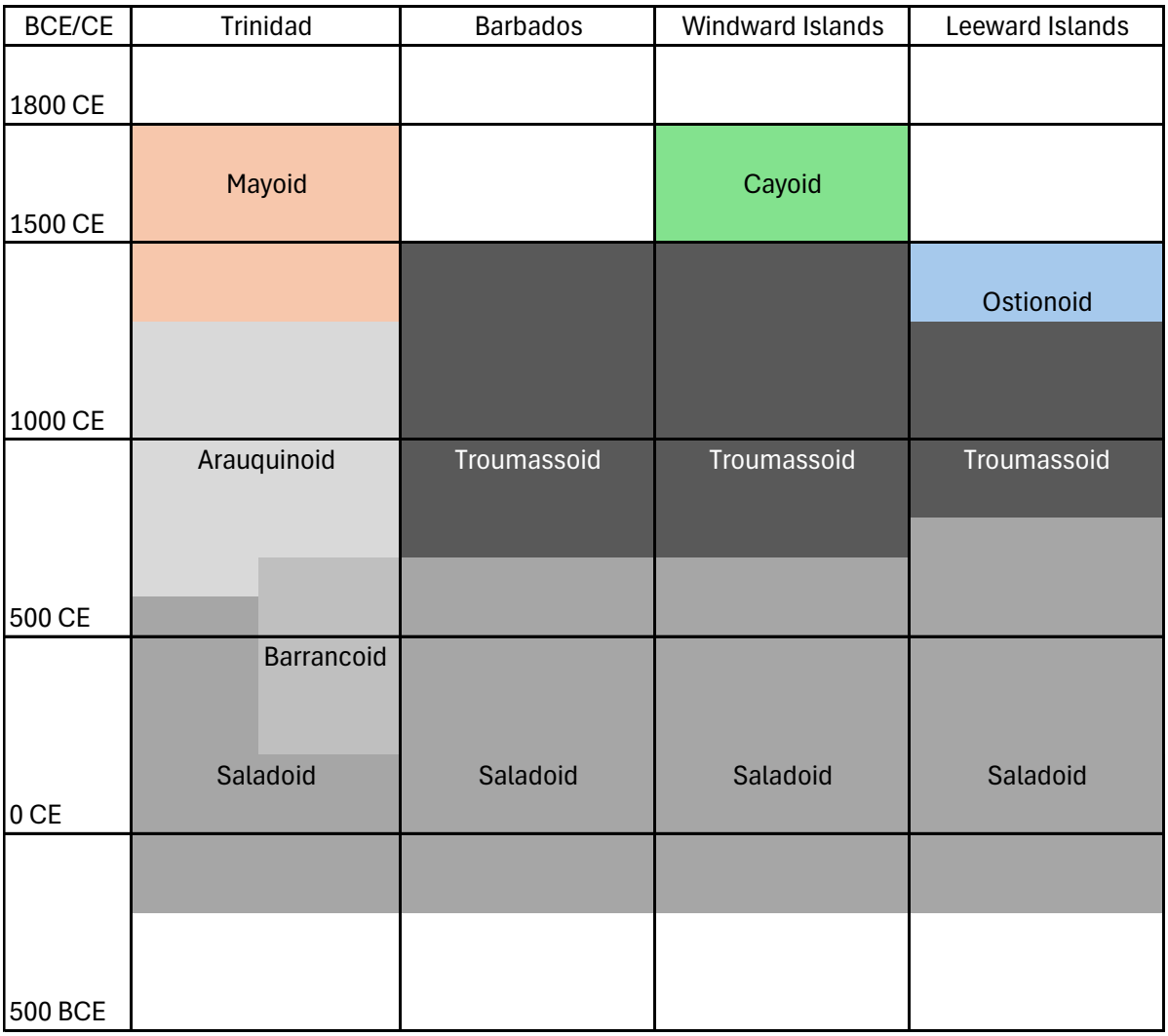


Fig. 8: Overview of the pre-colonial and early colonial periodization of Indigenous ceramic series in the Lesser Antilles. Coloured groups mark a transition phase with marked influences of the mainland and/or Greater Antilles.

Archaeometry on ceramics within the Lesser Antilles

Archaeometry has steadily been receiving more and more attention in Caribbean Archaeology over the last few decades. Although especially ceramology has up to now primarily been focused on non-archaeometric aspects such as typology, macroscopic paste compositions etc., there has been a clear increase of interest in archaeometric studies on ceramics. So far, approximately 30 archaeometric ceramic peer-reviewed entries have been published covering the areas of the Windward islands, Leeward islands and Trinidad and the timeframe of human occupation predating approx.1800 CE. This number excludes publications concerning the Greater Antilles or the colonial period after approx. 1800 CE. The vast majority of such archaeometric studies were published in a 2008 special issue about archaeometry in the Journal of Caribbean Archaeology. To be counted as 'archaeometric' in the context of this manuscript, the study in question should have actively used at least one natural scientific analytical technique such as thin-section petrography with polarizing microscopy, mineralogy or chemical analysis on Caribbean ceramics in order to study the actual ceramics or their raw materials (inorganic). Studies examining related products such as residue analysis (organic), while of course strictly speaking also being archaeometric in nature, are not considered here because these do not concern themselves with the study domain of the present PhD study. 'Peer-reviewed published' excludes material such as conference talks and theses at various academic levels (Ba, Ma, PhD). Indeed, 2008 can be considered a very important year for archaeometric endeavours in the region, as it is also the year in which the volume 'Crossing the Borders' (Hofman, Hoogland and Van Gijn, 2008) was published, which was specially dedicated to Caribbean archaeometry. In that book, Hofman, Hoogland and Van Gijn (2008, pp. 11-12) note that petrographic studies on ceramics between 1979 and 2008 had focused on and provided insights into differential use of clay sources through time and between pottery styles (9 studies), clay procurement and use at local (5 studies) or non-local sources (7 studies) and selective choices made within such clay sources (1 study), totaling 23 studies. Within this same timeframe, they specify another eight studies which determine the chemical composition of ceramics for provenance determination. From 2016 onwards, after an 8 year gap, a renewed interest in the field can be perceived.

However, despite this attention the domain has received over the last two decades, a lack of regional integration and marked differences in the amount of attention that certain time periods and/or regions have received, still exists. For example, the pre-colonial period (Saladoid and Troumassoid) is much more represented within the archaeometric literature corpus than the transition phase between the late pre-colonial and early colonial period (Cayoid, Mayoid and Afro-Indigenous wares). Investigational bias also persists in the amount of attention certain islands or island groups have received. For example, Trinidad and the Windward Islands are archaeometrically overrepresented in comparison to their Leeward counterparts. In addition, within the latter island group, islands such as Saba and St. Eustatius have been studied in much greater detail than e.g. Antigua, often due to practical considerations depending on the background of the research projects.

In the next paragraphs, the main findings of these works will be presented by describing the current state of affairs concerning the islands and periods of interest for this PhD arranged according to subregion (Trinidad, Barbados, Windward Islands, Leeward Islands). Note that names of inclusions, fabrics, clay types etc. have not been modified here from the original publications to minimize reader bias without having been able to see the actual materials.

Trinidad

Despite extensive typological and/or macroscopical investigations by Boomert (e.g. 1986, 2000, 2013) which largely defined the current ceramic knowledge base and framework detailed above, very little archaeometric data for Trinidad is available pre-dating the NWO/HERA/NEXUS research projects, despite earlier sampling (cfr. infra). So far, these research projects have led to two archaeometric publications on Trinidadian ceramics: Degryse et al. (2018 in Reid 2018) about the Red House subset of samples and a more general publication of Stienaers et al. (2020) about all Trinidadian samples taken for the project(s). Since both publications – and especially Stienaers et al. (2020) – are inextricably linked to the materials of this PhD project, they are not further discussed here but are instead an integral part of chapters five and six detailing the archaeometric results. Stienaers et al. (2020) can also be consulted in the appendices. Methods used are thin-section petrography, XRF and ICP-OES.

Barbados

Barbadian ceramics have twice formed the subject of previous petrographic analyses. The sites mentioned are included on figure 9.

Drewett (2000) petrographically analysed 22 Saladoid and Suazan Troumassoid sherds from 6 sites (Chancery Lane, Little Welches, Maxwell, Hillcrest, Heywoods, Silver Sands). Two main clay sources were identified: turbidite quartz clays from the accretionary prism and marsh clays from the limestone reef cap. Both the Saladoid samples and Suazoid Heywood samples were predominantly tempered with quartz from local sandstone outcrops. The Suazoid samples from Silver Sands contained more carbonate inclusions, so were assumed to have been sourced from the marsh clays.

Lawrence et al. (2016) expanded on these initial findings by petrographically analysing an additional 23 thin sections from all pre-colonial periods from Chancery Lane, Goddard, Heywoods, Hillcrest and Silver Sands. All were assigned to a "quartzose-tempered" group rich in quartz and sandstone, which was further subdivided into "quartzose-soil" and "quartzose-carbonate" subgroups. Again, these samples were found to have been locally produced. The authors also encountered similarly-tempered sherds on Carriacou, so some export from Barbados to this island may have existed.

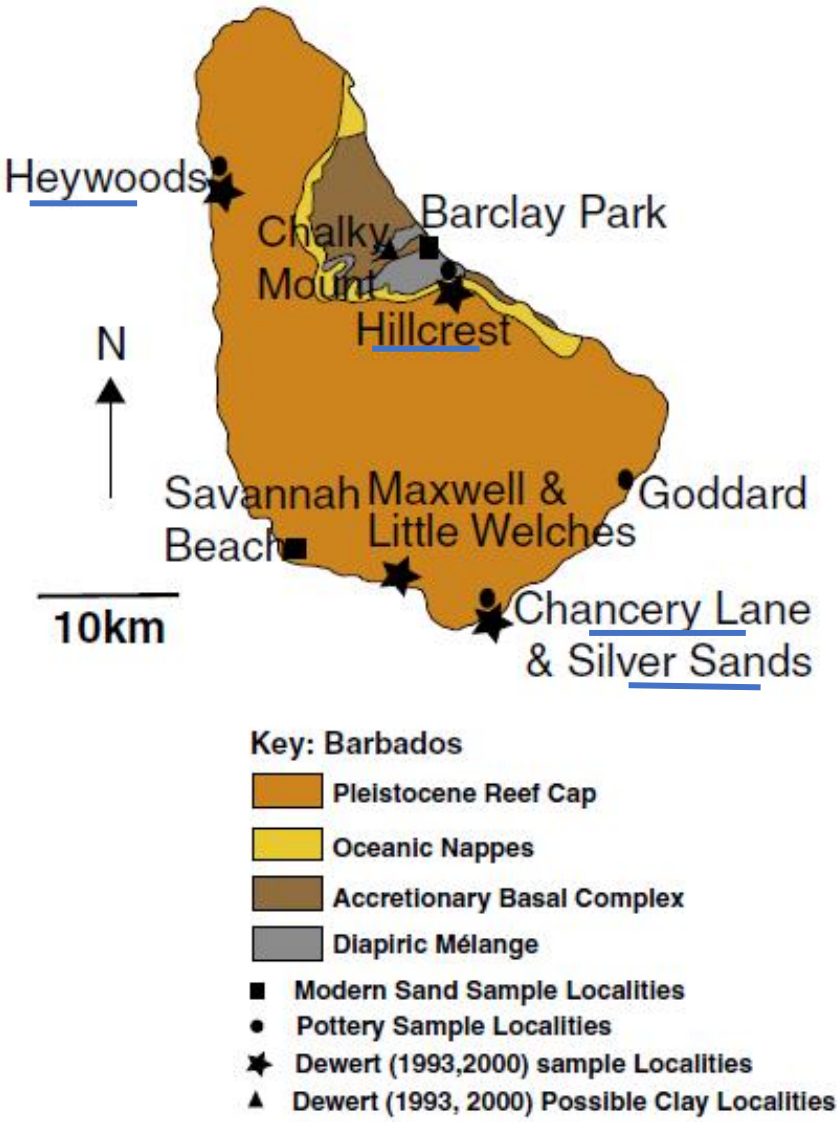


Fig. 3. Geologic map of Barbados Island, showing sample sites where sherds were collected for this study.
Modified from Speed et al. (1993). Locations where Drewett (2000) reported petrographic observations are also shown.

Fig. 9. Sampling locations from previous archeometric work in Barbados by Drewett (2000) and Lawrence et al. (2016). Sites also incorporated into this PhD study are underlined. Map adapted from Lawrence et al. (2016).

Windward Islands

The first Windward Island to have received archaeometric attention, was St. Lucia. Faupl (1986) petrographically analysed 14 pre-colonial sherds from the island and found that they all had a very similar igneous, dacitic inclusions . Since all analysed sherds also contained quartz, he postulated that they could be provenanced to the younger Belfond Pumice deposits on the island. In their 2008 article, Isendoorn et al. (2008) also examined ceramics and clays from St. Lucia using XRF. They found that the majority of the samples could be assigned a southern St. Lucia provenance, but also identified several outliers of which it could not be definitively stated whether they came from an as yet unidentified source on St. Lucia, or from outside of the island.

In the same 2008 special publication in the Journal of Caribbean archaeology, Fitzpatrick et al. (2008) presented their petrographic and chemical neutron activation analyses (INAA) of approx. 100 pre-colonial sherds from Carriacou (an island of the Grenadines, a stretch of small islands between Grenada and St. Vincent). They identified five tempering groups from two distinct, non-local clay sources. This import was later additionally corroborated in two follow-up studies, Pavia et al. (2013) and Lawrence et al. (2016). Pavia et al. (2013) petrographically identified and described three main compositional groups to be encountered on Carriacou: potassic volcanic, placer and quartzose. All were non-local to Carriacou. Lawrence et al. (2016), apart from analysing Barbadian samples (cfr. supra), also described samples from Carriacou and neighbouring island Union using thin-section petrography. Regarding the Carriacou samples, they arrived at the same conclusions as Pavia et al. (2013) but added an additional "mixed" group. These groups could also be encountered on Union. The pottery had been imported into Carriacou, but it was not completely resolved whether the analysed samples could be provenanced to Union, or whether Union served as a conduit. Some samples at least appear to have been imported from Barbados.

Grenada and St. Vincent have received extensive attention within the NWO/HERA/NEXUS projects. Unlike the Trinidadian examples, however, the publications detail (at least partially) different samples and/or combine different techniques than in chapters five and six of this manuscript. Therefore, they are considered here. Scott et al. (2018) and Hofman et al. (2020) employed an analytical baseline constructed on the basis of the same materials as in this PhD, but used this baseline to analyse an additional 554 ceramic samples from Grenada and St. Vincent with pXRF, focusing on Troumassoid, Cayo and early colonial material. Additional network analyses on a subset of ceramic samples from Grenada in combination with chemical data from Grenadian clay sources, revealed an interesting pattern. One clay source was consistently used through time (incl. the early colonial period) for a majority of all Indigenous ceramics, indicating a distribution of knowledge. This knowledge was also shared for the Afro-Indigenous ceramics, but hardly for the non-European colonial ceramics, as these were made from clay from other sources (Hofman et al. 2020).

Although not in itself belonging to the islands under study, it may be worthwhile for comparative purposes to additionally mention two archaeometric publications focusing on Martinique. Firstly, Belhache (1991) is mainly devoted to the analysis of sand temper encountered within Martinique sherds. They used X-ray diffraction (XRD), polarizing microscopy, X-ray fluorescence (XRF), scanning electron microscopy (SEM) and cathodoluminescence. Secondly, Walter et al. (1991) extensively present their findings of a combined petrographic and chemical approach on 33 pre-colonial sherds from all Ceramic Ages. Their analytical techniques consisted of thin-section petrography, XRD, and electron dispersive and wavelength dispersive scanning electron microscopy (SEM-EDS/WDS).

Belhache et al. (1991) conclude that production was most likely local to the island and Walter et al. (1991) could distinguish different provenance within the island between southern and north-eastern samples. The most abundantly encountered inclusions were quartz, feldspars, pyroxenes, amphiboles and argillaceous fragments, distributed over four compositional groups.

Leeward Islands

Saba, St. Eustatius and St. Martin

These Leeward Islands have by far received the most archaeometric attention. The foundation for this was a chapter in the PhD manuscript by Hofman 1993 (pp. 170-196) detailing petrographic analyses on a subset taken from the 600+ Saban sherds analysed during her PhD research. 11 fabric classes could be defined. In terms of inclusions, these displayed various amounts of feldspar, quartz and epidote (hardly present), pyroxenes, amphiboles and iron oxide concretions. The vast majority was constituted by a combination of classes 9 (36%) and 8 (18%), followed by 1,4,7 and 10 (all 6-10%). Their main characteristics are summarized below (table 1-A).

Class 1	Poorly sorted. High to very high feldspar and basaltic hornblende, low to very low hypersthene and augite.
Class 4	Well sorted. High to very high feldspar and basaltic hornblende. Medium hypersthene. Low to very low augite.
Class 7	Poorly sorted. High to very high feldspar and basaltic hornblende, low to very low enstatite and hypersthene.
Class 8	Poorly sorted. High to very high feldspar and basaltic hornblende. Low to very low iron oxide concretions.
Class 9	Poorly sorted. High to very high feldspar and basaltic hornblende. Low to very low iron oxide concretions.
Class 10	Poorly sorted. High to very high feldspar and basaltic hornblende. Low to very low iron oxide concretions.

Table 1-A. Summary of the most numerous classes described in Hofman 1993.

Furthermore, a relationship between fabric and type and/or function could be found in some cases, e.g. fabric class 4 correlated with red slipped and decorated pottery, class 9 with undecorated rim and body sherds, class 8 with griddles and bases. Finally, on the whole, a good match with local clays was established, with also some non-local sherds identified.

These Saban findings were expanded upon in Hofman et al. (2005) for pottery from Golden Rock on St. Eustatius for which predominantly local origins were postulated. In Hofman et al. (2008), St. Martin and Anguilla were additionally added to the dataset. In this article, they established that the limestone islands were much less popular sources for ceramic raw materials and that despite the availability of local clays, around 30% of the total investigated pottery assemblage could be provenanced to one of the neighbouring islands.

The publication of Donahue et al. (1990) details an investigation of sherds from St. Martin, but also from Barbuda, Montserrat and Anguilla. More specifically, they executed petrographic analyses (with point counting) of 44 sherds. They defined three pastes: exclusively volcanic, volcanic and carbonate and volcanic, carbonate and grog. Thin sections with significant carbonate or grog were restricted to the post-Saladoid from Barbuda and to lesser extent Anguilla. Also here, the source was found to be the volcanic islands.

Antigua

Fuess et al. (1991) informs us about their preliminary archaeometric study concerning 97 Saladoid and post-Saladoid sherds from 21 sites in Antigua. Within the article itself, a conference update, the final results are not published.

Other Leeward islands

Also incorporated into our dataset are ceramics from St. Kitts and Guadeloupe. However, no peer-reviewed published archaeometric entries were found for these two islands for the pre-colonial and early colonial period. Publications regarding later colonial ceramics for the plantation industry are not considered here.

Two publications covering investigations from Leeward Islands not included into our dataset which are relevant to mention here nonetheless, are Crock et al. (2008) and Lawrence et al. (2021). In Crock et al. (2008), sand temper within Anguilla and St. Croix ceramics are compared to sand sourced from islands in the vicinity with black sand beaches: St. Kitts, Nevis, Montserrat and Antigua. Through PCA, they were able to distinguish several distinct sources, but it was not always clear whether these were local or not.

Finally, in Lawrence et al. (2021), 20 late ceramic age sherds from Nevis (Coconut Walk) were investigated using petrography with point counting and compared with 11 sand samples from the island. Two compositional groups (Felsitic and Volcanic) could be identified and a local production was deemed the most logical scenario.

The current research project(s)

Research questions and aims

This PhD project uses ceramic artefacts and clay samples gathered mostly in the context of a HERA/NEXUS/NWO project (cfr. infra). Emphasis within the current PhD research lies on remedying the existing knowledge gap in archaeometric studies, but will of course also feed into the other objectives of the overarching research projects.

The main aims of this PhD study are:

- Integrating available existing and new petrographic and chemical ceramic data from 11 islands in the Lesser Antilles from both pre-colonial and early colonial periods into an archaeometric baseline for future reference.
- Complementing the above-mentioned ceramic baseline with clay and/or soil data to enhance the probability of provenance hypotheses and complement the ceramic baseline with potential valuable additional data for future research.
- Draw provenance hypotheses concerning these petrographic and chemical data.

In order to investigate these aims, the central research question reads as follows:

"How do various continuities and changes in production patterns of the ceramic repertoires of the Lesser Antilles manifest themselves between the pre-colonial and colonial periods as seen from petrographic and chemical data?"

The first main sub-question of this PhD pertains to **which continuities and changes are visible in the production of ceramics from the region**. This in turn generates a number of follow-up questions. Which raw materials were used in the Lesser Antilles? Were the raw materials gathered locally and were the finished products used locally or were the raw materials and/or finished products part of an exchange network? What does "local" mean in a Caribbean context (site, region, island, archipelago …)? Were all these aspects the same for the entire region and timespan or were there differences? If so, which differences? In this respect, special attention will be paid to the pre-colonial vs. the (early) colonial situation.

The other main sub-question will narrow down the focus of this project, namely **how we can study this from an archaeometric viewpoint.** Ceramics are a material category which preserves well and is not easily recycled. This combination opens up a vast array of possibilities for study (e.g. typology, compositional analysis, residue analysis …). Especially given the large study region and time dimension, however, it would be impossible to study all these aspects of ceramology within the constraints of this PhD research. Therefore, the ceramological constraints will limit the scope to examining the mineralogy and chemical composition of the ceramic samples and related clay samples. Other ceramological aspects, material categories and archaeological subdisciplines will only be considered if and when directly informative for the ceramic samples and other research (sub)questions at hand.

HERA CARIB, NWO Island Networks and NEXUS1492

In addition to an underrepresentation of domains such as archaeometry, historical narratives in the region have until recently been heavily influenced by the viewpoint of the various European nations (e.g. France, the UK, Spain, the Netherlands …) who had or still have established their presence in the region since 1492 CE. In order to contribute to bridging these gaps, three large international and transdisciplinary research projects (HERA CARIB, NWO Island Networks and NEXUS1492) were initiated during the last decade in the Caribbean region, headed by a research team from the Faculty of Archaeology at Leiden University, The Netherlands in collaboration with the Free University Amsterdam, KU Leuven and the University of Konstanz and various local partners. Their main objectives are summarised in table 1.

Project(s)	Research objectives
HERA CARIB[3] and NWO Island Networks[4]	These projects were a collaboration between the universities of Leiden, Leuven and Konstanz to study and understand the impact of the cultural encounters on Lesser Antillean Indigenous Carib societies across the so-called 'historical divide' through a combination of archaeology, history, archaeometry and social network theory. The projects also contribute to local historical awareness and valorisation of Indigenous heritage.
NEXUS1492[5]	NEXUS1492 was framed by two principal objectives. The first principal objective sought to provide a local perspective on the first encounters or contacts between the so-defined 'New World' and the 'Old World' by focusing on the histories and legacies of the Indigenous Caribbean across the 'historical divide' and by addressing the complex intercultural interactions over the ensuing centuries. This by creating a multi-scalar temporal (1000-1800 CE) and regional (pan-Caribbean) approach to Amerindian archaeology, specifically addressing the westernised concept of the 'historical divide' and thereby bridging the gap between pre-colonial and colonial histories. This is done by using a trans-disciplinary research design and a systematic approach to develop and apply cutting-edge multi-disciplinary methods and techniques. The second objective was centred around raising awareness of Caribbean histories and legacies, striving for practical outcomes in future heritage management efforts with implications for local communities, island nations, the pan-Caribbean region, and globally. This second objective was reinforced by the involvement and participation of mostly Caribbean scholars as well as local communities in the proposed research, thereby enhancing international cooperation and a sense of ownership. Furthermore, a joint heritage agenda was designed to mitigate loss of Indigenous cultural remains caused by natural and human forces, and to raise historical awareness of these challenges on local, regional, and global scales.

Table 1. Project overviews of related Leiden University research projects.

[3] https://www.universiteitleiden.nl/nexus1492/about/affiliated-projects, accessed 19/01/2021
[4] https://www.universiteitleiden.nl/nexus1492/about/affiliated-projects, accessed 19/01/2021
[5] https://www.universiteitleiden.nl/nexus1492/about/project-objectives, accessed 19/01/2021

Thesis outline

In order to study these aims and questions, 351 ceramic samples are investigated from eleven islands in the Lesser Antilles (Saba, St. Eustatius, St. Martin, St. Kitts, Antigua, Guadeloupe, St. Lucia, St. Vincent, Grenada, Barbados and Trinidad). Analytical techniques will consist of thin-section petrography, X-Ray Fluorescence (XRF) and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). The clay dataset consists of 242 samples studied with XRF or ICP-OES from all the islands mentioned above except St. Kitts.

The next chapters of this manuscript will be devoted to contextualising and answering the (sub)questions outlined in the previous section. To this effect, chapter two will focus on the general natural context of the Lesser Antillean Islands under consideration. Starting from chapter 3, the emphasis lies on the materials and sites studied in this thesis. Chapter 3 will detail the materials (i.e. ceramic and clay samples) themselves and a situation of the sites they were gathered from. Also included in chapter 3 is a discussion about available clay and soil information relating to the clay sampling sites. The following three chapters, chapters four, five, and six, contain the new analyses and the results thereof. Chapter four will detail the methods of our investigations, chapter five presents the results of the petrographic analyses and chapter six will integrate these petrographic results with the chemical data in order to arrive at provenance hypotheses. Chapter seven presents the general discussion and conclusions. In this final chapter, the research questions will be explicitly revisited and avenues for future research will be suggested. Supporting material can be consulted in the appendices.