2012

"Excellent Clay for Pots": An Archaeological and Microscopic Investigation of Barbadian Redware during the Early Colonial Era

Erik andre Siedow
College of William & Mary - Arts & Sciences

"Excellent Clay for Pots:" An Archaeological and Microscopic Investigation of Barbadian Redware during the Early Colonial Era

Erik Andre Siedow

Richmond, Virginia

Bachelors of Arts, The College of William & Mary

A Thesis presented to the Graduate Faculty
of the College of William and Mary in Candidacy for the Degree of
Master of Arts

Department of Anthropology

The College of William and Mary
January 2012

APPROVAL PAGE

This Thesis is submitted in partial fulfillment of
the requirements for the degree of

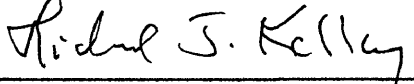
Master of Arts

Erik Andre Siedow

Approved by the Committee, December 2011

Committee Chair
Professor Frederick H. Smith, Anthropology
The College of William & Mary

Professor Marley R. Brown, III, Anthropology
The College of William & Mary



Professor Michael J. Kelley, Applied Science
The College of William & Mary

ABSTRACT PAGE

In the seventeenth and eighteenth centuries, pottery manufacture emerged in the British Caribbean island of Barbados. Many of the potters were enslaved Africans and poorer classes of whites, and the industry was concentrated primarily in the eastern parishes of the island. The pottery produced consisted of glazed and unglazed red earthenware comprising a variety of utilitarian forms. Archaeologically, it has been nearly impossible to distinguish locally made Barbadian red earthenware from imported forms. This thesis focuses on the successful use of scanning electron microscopy to identify radiolaria within ceramic sherds from the Codrington estates and Pot House. Radiolaria are holoplanktonic protozoa fossils that formed radiolarian-enriched clays in specific regions over the eastern shore of Barbados, which were deposited between the Miocene and Eocene Epochs. The radiolaria fossils are proving to be an important diagnostic marker of at least some Barbadian-made red earthenware. This thesis also seeks to begin to establish a framework for grounding archaeometry into a broader, anthropological and theoretically informed interpretation adapted from Clifford Geertz's "thick description." The results produced by this radiolarian study are used as a model to incorporate archaeometric analyses into archaeological theory.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

While I stress the importance of interdisciplinary research and cooperation throughout this thesis, this kind of approach would not have been possible without the help of multiple institutions that graciously made available their scientific instrumentation for use, and generously offered support from their staff. I would like to acknowledge the Applied Research Center at Jefferson Lab in Newport News, Virginia, and the Integrated Science Center at The College of William & Mary in Williamsburg, Virginia, for allowing me to learn and operate various microscopic and analytical instruments. I would like to thank Dr. Michael Kelley, Brandt Robertson, Olga Trofimova, and Nicholas Moore for their technical instruction and input. I would also like to thank Kevin Farmer at The Barbados Museum and Historical Society for allowing me access to their archaeological collections. Lastly I would like to thank Dr. Frederick Smith for his guidance both abroad at Barbados, and at home. Without their support this project would have never been realized.

LIST OF FIGURES

I. INTRODUCTION

The ubiquity of red earthenware, or redware, ceramics found on historic-period sites in Barbados attests to the importance of local pottery manufacture in Barbados during the early colonial era. This Barbadian pottery industry emerged during the mid to late seventeenth century, and pottery manufacture was primarily concentrated in the eastern parishes of the island. Documentary evidence and secondary histories indicate that enslaved African, free black, and poor white potters produced glazed and unglazed red earthenware vessels that comprised a wide variety of utilitarian forms. Archaeologically however, it has been nearly impossible to distinguish locally made Barbadian red earthenware from imported, mostly English, wares. As for utilitarian ceramics, there are few (if any) diagnostic features of locally made Barbadian ceramics. As a result, it is unclear what ceramic forms were being produced historically in Barbados. Photographs from the late nineteenth and early twentieth centuries give some clues as to the variety of vessel forms. It is also possible to distinguish some of the vessel forms from the few remaining whole vessels and museum pieces in Barbados. Yet, in general, it has been difficult to identify locally made Barbadian red earthenware forms recovered on archaeological sites, where typically we only have small fragments of these vessels.

Historical sources indicate that red earthenware manufacture emerged in Barbados during the latter half of the seventeenth century. According to Jerome S. Handler (1963a, 1963b)—an anthropologist who extensively studied the development of the Barbados pottery industry—enslaved male potters employed wheel-thrown and kiln-fired technologies of European derivation to produce conical sugar molds used in sugar factory curing houses for draining molasses, as well as domestic red earthenware utilitarian vessels used in food storage and

cooking. In addition to these locally produced vessels, plain red earthenware ceramics were imported from England in large quantities in order to meet both the industrial needs of the factories and domestic uses (Handler and Lange 1978:139). Pottery production was concentrated in the Scotland District on the island, namely the eastern parishes of St. John, St. Joseph, and St. Andrew. These parishes consisted of poor soils for sugarcane cultivation but had an abundance of clay suitable for pottery manufacture. Early travelers identified the superiority of these clay sources on the island and attested to the "excellent clay for pots" in this region (Smith 1630; Ligon 1673, Schomburgk 1848).

Red earthenware manufacture developed within the context of an emerging sugar industry, which emphasized a high degree of industrial efficiency for increased capital gain. Prior to 1670, indentured European servants constituted the skilled artisan positions on plantations in Barbados (Beckles 1989:115). As planters shifted to an economy based on sugar, enslaved Africans became the primary source of labor. In many cases, they took over the skilled positions poor whites and indentured servants once occupied. Many became engaged in craft production, including pottery making. As a result, these enslaved artisans began to consolidate a privileged status within the plantation complex (Beckles 2006:77). In order to maximize profit and decrease dependency on imported industrial goods, it is likely that plantation managers began to rely more heavily on locally produced red earthenware vessels to meet the demand for sugar production. In particular, Barbadian potters would have made ceramic sugar molds used in the sugar curing process. Enslaved potters not only produced utilitarian, industrial, and domestic wares for use on the plantation, but it is also likely that these potters exchanged and sold some of their wares within internal marketing systems on the island (Handler and Lange 1978:143; Hauser 2008). As part of an internal marketing system that was integral to the broader

Barbadian plantation complex, red earthenware ceramics were exchanged at weekend markets between enslaved peoples, free blacks, and whites. Ultimately, the local manufacture of Barbadian red earthenware became a vital component of the island's socio-economic structure.

Archaeological considerations of pottery production and use on historic sites in the Caribbean have largely been informed by ideas of creolization. Interactions between various West and Central African ethnic groups and Europeans have dominated discussions about the way cultural continuity and syncretism are represented in ceramic vessel composition and form. The wheel-thrown, kiln-fired pottery tradition practiced in Barbados may mask some diagnostic features frequently used for interpreting locally made Caribbean pottery. Caribbean wares are usually identified as hand-built, open- or low-fired wares (Hauser and Armstrong 1999, Heath 1999, Loftfield 2001, Petersen 1999). Because European wheel-thrown, kiln-fired traditions dominated in Barbados, it is difficult to analyze Barbadian redware using typical diagnostic features used for locally made pottery found on other islands.

The purpose of this thesis is to evaluate the potential for using archaeometric techniques to identify diagnostic markers of locally made Barbadian red earthenware. The initial goal of this project was to subject red earthenware pottery fragments recovered archaeologically from historic sites in the eastern parishes of Barbados known to have produced pottery, to a variety of microscopic and chemical investigations in attempts to discover any distinguishable characteristics. These characterization tools included optical microscopy, scanning electron microscopy, and energy dispersive x-ray spectroscopy. Initial findings suggested that silicon to aluminum ratios may help characterize Barbadian-made redware ceramics. Although samples containing what were later identified as radiolaria exhibited elevated silicon to aluminum ratios compared to samples that did not contain radiolaria, statistical significance could not be

achieved. While archaeologists have failed to characterize Barbadian-made redwares using simple visual techniques at a macroscopic level, this thesis will focus on the successful use of scanning electron microscopy as a means to identify holoplanktonic protozoa fossils known as radiolaria within the ceramic body, which appear to be a diagnostic marker in at least some of the samples of Barbadian redware analyzed thus far.

Archaeometric studies are typically designed to answer specific archaeological questions, but rarely reach the level of broad cultural interpretation. Broader cultural implications of archaeometric studies are often overshadowed by their emphasis on method. The scientific techniques used in archaeometric examinations also tend to emphasize an objective consideration of material remains by focusing strictly on the chemical composition of artifacts, rather than the conscious or unconscious decisions made by the people constructing these objects. Drawing on my archaeometric analysis of red earthenwares from Barbados, I seek to show that archaeometric studies can and should pursue deeper theoretical questions and bridge the gap between scientific and interpretive approaches.

It is not my intention to discredit archaeometric studies. I believe that archaeometry as its own specialty application can contribute a great deal to our understanding and interpretation of the archaeological record. However, it is my recommendation that archaeometric studies be guided by, or incorporated into an overarching theoretical framework. Archaeometric publications often appear as case studies that lack theoretical insights that can enhance our understanding of past people. In many ways, archaeometry has become entrenched in a kind of processualism by analyzing the material record from a detached and objective perspective. It is my intention to begin to establish a framework for grounding archaeometry into a broader, anthropological and theoretically informed interpretation adapted from Clifford Geertz's "thick

description." From this adaptation, I will also draw on landscape theory as it pertains to the retrieval of clays that are used to manufacture redware ceramics. The combination of these two approaches will serve as a foundation for a theoretically guided application to archaeometric studies.

The pages that follow are organized into chapters that build upon each other in terms of developing a framework for interpreting the presence of Barbadian redware on historic sites. Chapter II explores the ways that archaeologists have interpreted the presence of Caribbean earthenwares on historic and pre-Columbian sites, and the pottery traditions practiced on different islands. These works will be examined in conjunction with the development of Barbadian pottery traditions in order to delineate the uniqueness of Barbadian practices. Chapter III presents the archaeometric methodology applied to the study of Barbadian redwares. Here, specific archaeological sites will be discussed as they pertain to the origins of the samples analyzed in this study. Chapter IV synthesizes the results produced by these archaeometric techniques into the development of a broader, theoretically informed interpretation based on Geertz's notion of "thick description." The culmination of this thesis will demonstrate a diagnostic marker for locally produced Barbadian redware, and place the use of this diagnostic marker within broader themes of archaeological theory.

II. HISTORICAL BACKGROUND

Pottery studies have been an important focus of Caribbean historical archaeology. Much of this research, and the major focus of this thesis, has dealt with pottery in terms of understanding broader themes of cultural continuity within the African diaspora. This chapter explores some of the major works that address the identification and development of Afro-Caribbean ware during the colonial period. The emergence of pottery production in Barbados will be addressed within the context of Afro-Caribbean ware, and I examine the challenges associated with trying to unravel Barbados's unique history of ceramic manufacturing. The archaeometric characterization of pottery discussed in this chapter offers a fresh methodological perspective that seeks to understand ceramic production in the Caribbean in new ways. The culmination of these studies informs both the direction and interpretation of this project, and it is necessary to consider the results produced by this project within the sociocultural context of pottery production and use in the Caribbean.

Meliville Herskovitz, a leading figure in African Diaspora studies in anthropology in the early twentieth century, explored African "survivals" or "retentions" in the Americas in order to challenge racist structures that denied African Americans a past. His models provided a useful framework for investigating the African Diaspora in the Americas and relied heavily on insights from West and Central African antecedents. Although he identified survivals and important modifications to various African traditions in the Americas, the model embraced an uncritical focus on acculturation. In the 1970s, Sidney W. Mintz and Richard Price (1976) devised new models for investigating Diasporic communities in the Americas, which avoided the shortfalls of acculturation studies. Mintz and Price, while recognizing the value of Herskovitz' ideas,

highlighted the creolized nature of the African Diaspora and sought to explain the "birth" of a unique African American culture in the New World. They argued that the process of creolization was forged during the earliest interactions between Africans from various ethnic groups and between Europeans and Africans on the plantations in which they worked. The parameters of these interactions were set by environmental and ecological circumstances, overarching objectives of the plantation system, and the monopoly of power maintained by a European class (Mintz and Price 1976:34). This monopoly of power wielded by Europeans in the New World colonies strongly influenced the ways in which sociocultural continuities from Africa could be maintained, as well as the ways in which innovations could occur (Mintz and Price 1976:24). These social and cultural continuities, for the purpose of this thesis, are reflected in the pottery produced and used on plantations in Barbados.

Free and enslaved potters in Barbados produced ceramics for both personal use and plantation use. Personal use pertains not only to domestic wares for use in the household, but wares that would have contributed to internal marketing systems as well. Ceramics made for use on the plantation include industrial wares, architectural wares, and any other vessel type that contributed to the maintenance of plantation activity. Many of the tasks involved in ceramic production could be carried out with only minimal contact with European masters, but others called for the frequent, recurrent, or uninterrupted social interaction with those who held power. Mintz and Price (1976:26-27) argued that the principal avenue of encounter was that created by the communication and delegation of command. Further, they wrote,

> "...it seems reasonable to expect that almost any subsystem of an African-American culture – whether music, speech, or religion – would be highly syncretistic in terms of its diverse African origins, as well as in terms of inputs from European (and often other) sources; and we must expect it to possess a built-in internal dynamism and a marked adaptiveness to changing social conditions as well" (Mintz and Price 1976:62).

It is through this lens that archaeologists have come to understand the role of pottery on historic Afro-Caribbean sites. This debate also mirrors those of colonoware pottery in North America (see for example, Ferguson 1992).

James Petersen et al. (1999:164) distinguished two different pottery traditions in the Caribbean based on the form and production methods of ceramics found on historic sites. The first, "Afro-Caribbean" ware, refers to hand-built, open-fired earthenware, which represents a syncretic mix of West African traditions, as well as the occasional use of some European traits. According to Petersen et al. European traits are typically related to vessel form and include pots, pitchers, and other forms from Europe. Afro-Caribbean wares incorporate these European forms and reinterpret them in a syncretic pot-making industry derived from Africa. The authors define the second pottery tradition in the Caribbean as "Euro-Caribbean" ware, or pottery that is wheel-made, kiln-fired, and primarily derived from European practices. Petersen et al. favor usage of island-specific pottery types, such as Afro-Antiguan or Afro-Montserratian, when it can be demonstrated that such pottery was locally produced (1999:165).

Petersen et al. (1999:159) based their classifications on evidence drawn from 166 largely fragmentary earthenware vessels from Anguilla, Antigua, Barbuda, and Montserrat, dating from the eighteenth through twentieth century. Their samples shared general traits, such as hand manufacture, namely coiling and modeling, and open firing conditions. Temper, vessel form, and decoration helped Petersen et al. distinguish the origin of manufacture (1999:178). As with Mintz and Price, Petersen et al. embrace a creolized model and argue that

"...diverse West African traditions of pottery making were amalgamated and generalized in their transference to new contexts in the western hemisphere during the colonial period, and they

contributed to what can be recognized as Afro-Caribbean ceramics. This occurred first in the contexts of plantation slavery, and then later, in modified form, within later colonial and post-colonial contexts following emancipation" (Petersen et al. 1999:192).

Barbara Heath (1999) expanded on Petersen et al.'s interpretation of pottery making traditions on historic sites in the Caribbean. Drawing on evidence from St. Eustatius, Heath contends that researchers must consider multiple lines of evidence in order to better understand Afro-Caribbean pottery. Heath's approach calls for an investigation into pottery traditions that take into account the social and economic roles Afro-Caribbean wares played within the local community. Her work relies heavily on documentary evidence (Heath 1999:199, Heath 1988:9). Heath sorted ceramic sherds from an Afro-Caribbean context in St. Eustatius according to paste attributes observable at a macroscopic level. Thin-sections were also collected to determine diagnostic features of mineralogical composition. Heath attempted to identify the location of clay sources, and determined that while the majority of the sherds were produced locally, they came from different clays sources on the island. Six percent of the sherds analyzed were found to be incompatible with the geology on St. Eustatius and were, thus, imported (Heath 1999:207). Heath argues that while archaeologists must continue to explore aspects of pottery production unique to different islands in the Caribbean, they must also begin to study it as a widespread phenomenon capable of providing evidence of broad changes in the Caribbean from colonialism through emancipation. Heath (1999:217) believes pottery traditions can be understood by defining the range of forms potters chose to fashion, the manner in which this pottery was distributed and exchanged, and the ways in which people used these vessels. In St. Eustatius, Heath clearly shows how the sale and exchange of locally made ceramic vessels contributed to

Afro-Caribbean culture, and how form speaks to issues of creolization and consumerism (Heath 1988, Heath 1999).

Mark Hauser and Douglas V. Armstrong (1999) also emphasize the exchange of pottery as a means to better understand Afro-Caribbean ware. They argue that these wares shed light on social and economic relations within the African Diaspora and must consider people within the Caribbean as a web of interacting social and economic interests (Hauser and Armstrong 1999:66). Moreover, they reject attempts to universalize interpretations of low-fired earthenwares found in contexts associated with peoples of African descent because they believe that the reduction of these earthenwares can homogenize ethnicity (thus the reason for Petersen et al.'s (1999:164) classification of pottery traditions into Afro- and Euro-Caribbean). According to Hauser and Armstrong, such attempts fail to account for the diversity of West African ceramic forms and simply assume local production and distribution. The authors contend that the study of traits as indicators of ethnicity fails to recognize transformations in the meaning of material culture over time and space (Hauser and Armstrong 1999:72; see also Hauser 2008).

Archaeological considerations of pottery production and use on historic sites in the Caribbean have largely been informed by ideas of creolization. Interactions between various African ethnic groups and between Africans and Europeans have dominated the discussion for understanding cultural continuity and syncretism symbolized in vessel composition and form. Historical contextualization significantly aids in the interpretation of locally produced Caribbean pottery, and these interpretations have been subjected to broader questions of intra- and inter-island exchange. These paradigmatic approaches are vital to understanding the role of pottery production and use. Pottery production in Barbados was shaped by similar forces and can be contextualized within themes of creolization and exchange.

Jerome S. Handler, showed that pottery techniques were introduced from England and developed in association with the sugar plantation economy. Following emancipation, a cottage pottery industry emerged that produced household utilitarian wares similar to those used during the slavery era (Handler 1963b:130). Until the 1960s, a vibrant potting community existed in Chalky Mount, which was the basis of Handler's ethno-historical approach to understanding pottery traditions on the island following emancipation (Brown 2010, Handler 1963a, Handler 1963b). A revived form of the pottery industry still exists today in the area. Although historical evidence of early pottery production on the island is limited, Handler scoured a variety of sources in order to present a historical sketch of pottery manufacture during early colonial times.

Redware manufacture began in Barbados between 1650 and the 1670's, and enslaved Africans were involved in this manufacture by the late seventeenth century. Wheel and kiln technology was employed by these potters to produce industrial wares such as conical sugar molds and molasses drip jars, used for sugar refining (Handler and Lange 1978:139). Ceramic vessels quickly began to replace wooden boards and barrels used for claying and curing sugar, however, many plantations continued to rely on wooden boards and barrels until the mid-eighteenth century (Loftfield 2001:226). The use of wooden boards became obsolete in Barbados due to the limited availability of trees and the ready availability of clay sources for ceramic molds. In contrast, Jamaica, with its abundant wood resources continued to use wooden boards along with ceramic vessels much later (Handler 1963b:131, Handler and Lange 1978:144). The red earthenware vessels were made on a number of Barbadian plantations for use on the estates and for sale to other plantations. Plantation managers also continued to import similar redware vessels from England in order to meet the demands of sugar making. Major pottery manufacture was concentrated in the eastern parishes of St. John, St. Joseph, and St.

Andrew, also known as the Scotland District. Much of the soil in these parishes cannot sustain sugarcane, but the clays in this region were considered superior for pottery manufacture. Using tax records, Handler was able to identify a number of kilns operating during the early colonial era, the majority of which belonged to plantations (Figure 1). Although most ceramic vessels were probably manufactured on plantations, an independent cottage industry also sold ceramics to estates (Loftfield 2001:226). These kilns were largely located in the Scotland District and its bordering parishes of St. Thomas, St. Philip, and St. Peter, further demonstrating the superiority of the clays in that region (Handler and Lange 1978:142-143).

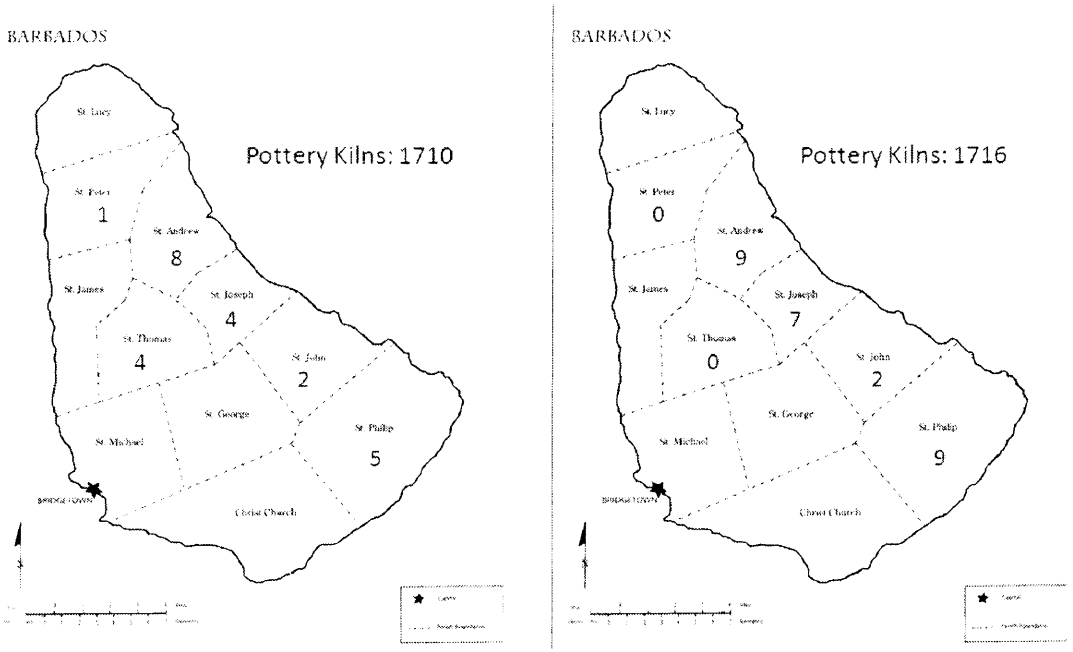


Figure 1: Map of Barbados with corresponding kilns identified in each parish (Handler and Lange 1978:142).

According to Handler, enslaved male potters in Barbados employed wheel-thrown and kiln-fired technology to construct pottery during the early colonial era, and these techniques continued well into the twentieth century (Handler and Lange 1978:139). Handler (1963b)

attempted to trace the origins of this pottery tradition in Barbados by assessing pottery-making centers in Europe. Relying on documentary evidence, he identified indentured servants traveling to the West Indies from locations such as Bristol, Wincanton in Somerset, Nottingham, Brislington, and parts of Staffordshire, all of which produced ceramics during that time (Handler 1963b:133-135). Prior to 1670, indentured European servants comprised the skilled artisan positions on plantations in Barbados (Beckles 1989:115). As planters shifted to a sugar monoculture, indentured servitude was phased out and replaced by enslaved Africans who were trained and tasked with craft production. Drawing upon Handler's evidence, it is clear that Europeans trained enslaved peoples in the art of wheel-thrown, kiln-fired pottery production.

Considering the development of pottery production in Barbados, Petersen et al. (1999) would define this pottery tradition as Euro-Caribbean. Although predominately produced by Africans and Afro-Barbadians, the influence of wheel-thrown and kiln-fired technology is indicative of Euro-Caribbean ware. In other Caribbean contexts, African women are typically associated with the production of Afro-Caribbean wares, while men tend to be associated with the production of Euro-Caribbean wares (Brown 2010, Farmer 2011, Heath 1999, Petersen et al. 1999). The delegation of male labor to the production of Euro-Caribbean wares is reflective of European ideas about artisan labor within the plantation complex. Males were typically assigned artisan roles, and because pottery manufacture was an integral part of sugar production, plantation managers assigned enslaved males to the pot house. This is in stark contrast to Afro-Caribbean wares because the production of these wares took place in a context separate from the plantation manager's needs. As an institution separate from the direct needs of the planters, African traditions of hand-built, open-fired manufacture by women were maintained.

While this gender division is generally accepted by archaeologists and historians, Kevin Farmer (2011) identified a case in Barbados by which enslaved women participated in pottery manufacture within the Euro-Caribbean tradition. Farmer, drawing on a deed from 1787 which outlined the lands and assets of the Thickets estate in St. Philip, discovered a list that delineated the names of enslaved workers and their occupations on the property. By analyzing the names on the list, Farmer was able to infer that women were engaged in work in the estate's pot house. While it appears that males were ultimately responsible for throwing the pottery, women may have participated in collecting or curing the clay. Given the size of the pottery operation on the Thickets estate, Farmer concluded that breaking these gender roles may have been necessary to keep up production (Farmer 2011:3-4). Although the discussion of the Euro-Caribbean pottery tradition dominates in Barbados, some evidence suggests that an Afro-Caribbean tradition existed on the island as well.

Based on available evidence, very few hand-built ceramics were manufactured in Barbados (Loftfield 2001: 231, Petersen et al. 1999:189). According to Handler and Lange (1978:143), some historical sources show that enslaved Africans were making and using household or domestic earthenwares by the first half of the eighteenth century. Enslaved potters that practiced within the Euro-Caribbean tradition may have applied some African practices in surface finish or decorations to their wheel thrown vessels, and there may have been some female potters who produced household wares through Afro-Caribbean traditions as well. Sandra Browne (2010:4) suggested that for a brief time, enslaved women constructed coiled or pinched pots as they did in Jamaica, but this practice was soon displaced. In earlier periods, non-wheel and non-kiln domestic pottery may have taken place in the Scotland District, and some of these wares could have been exchanged or sold through the internal marketing system. Handler

and Lange (1978:141) identified only three sherds associated with hand-built ceramics in their investigation of Newton cemetery and were unable to identify any other Afro-Caribbean sherds during their survey of the island.

Thomas C. Loftfield (2001) presented the largest body of evidence for the existence of Afro-Caribbean pottery traditions in Barbados, emphasizing the role of creolization between Europeans and Africans. According to Loftfield, the fact that pottery is formed from a fluid medium provides evidence of cultural preferences in manufacture and use. Evidence of African and European cultural preferences should be apparent in a medium such as clay, which, once formed into a durable vessel, retains the ideas of the maker (Loftfield 2001:227). His excavations at Codrington College yielded such evidence of Afro-Caribbean wares. From one late seventeenth-century context and one early eighteenth-century context, several sherds of a black, coiled, open-fired ware were recovered. According to Loftfield, these sherds appeared to represent an unaltered African ceramic form. One of the vessels was a small cooking pot, while the other was a small cup, probably for drinking. From a similar early eighteenth-century deposit, the base of a wheel-thrown, kiln-fired vessel decorated with crosshatch marks was recovered. This form of decoration is often associated with African production. Two vessel fragments recovered from seventeenth-century levels at Codrington showed presumed "Africanisms" in form, but not in manufacture (Loftfield 2001:231). These rare finds support the claim that two pottery traditions, Afro- and Euro-Caribbean, existed in Barbados. Loftfield concluded that,

"In Barbados, the development of an industrial ceramic manufactory apparently overpowered the effects of the plantation system to preclude the manufacture of coiled vessels, open firing, and the survival of African forms. Although some African ceramic traits may have appeared in vessels produced during the early stages of the development of the ceramic industry, and some newly arrived Africans may have attempted to produce traditional vessel forms, cheap wares,

locally made with English technology and in English form, soon predominate in Barbados" (Loftfield 2001:231).

The ubiquity of red earthenware ceramics found on historic sites in Barbados attests to the importance of local pottery manufacture in Barbados during the early colonial era. Recent classification of Barbadian redware has relied heavily on vessel form as an indication of creolization. The identification of form along with historical contextualization has contributed to our knowledge of Barbados's unique pottery tradition that included both Afro- and Euro-Caribbean elements. Beyond the limited evidence of Afro-Caribbean ceramics however, it has been difficult to infer anything else about the presence of redware ceramics on historic sites. European technology employed in Barbados produced ceramics identical to imported wares, making it difficult to discern anything about intra- or inter-island exchange networks. Archaeologically, it has been nearly impossible to distinguish locally made Barbadian red earthenware from imported---mostly English---wares. The introduction of archaeometric analysis has presented another way to characterize archaeological evidence of pottery found on historic sites in the Caribbean. These studies aim to add compositional, geological, and chemical knowledge of pottery to other lines of evidence provided by form or historical context in order to gleam insight into exchange networks.

Archaeometry, sometimes considered archaeological science, is a rapidly advancing field that consists of the application of scientific techniques to archaeological material. More specifically, archaeometric studies deal with dating methods, artifact studies, mathematical methods, remote sensing techniques, conservation science, and environmental reconstruction. These newly emerging techniques are often sophisticated and specific to certain research goals. These studies have been applied to historic ceramics found on sites all over the world. To

provide a few examples, Scarlett et al. (2007) combined instrumental neutron activation analysis with historical and archaeological evidence to understand exchange and distribution systems of locally made pottery among Latter-day Saints's communities in nineteenth-century Utah. Using x-ray fluorescence and scanning electron microscopy, Gill and Rehren (2011) chemically characterized the body and glaze of ceramic tiles from two seventeenth-century Islamic monuments in India. Minc and Sherman (2011) conducted a clay survey in Oaxaca, Mexico using instrumental neutron activation analysis and ceramic petrography in order to enhance an understanding of pottery production and exchange within the valley and neighboring regions. In the Iberian-Roman city of Basti (Spain), Cultrone et al. (2011) conducted a study on ceramic fragments using mineralogical analysis and x-ray fluorescence in order to investigate clay sources and firing temperatures. Studies such as these have been conducted in the Caribbean as well in attempts to provide insight into locally produced ceramics specific to different islands.

Hauser (2008) provides us with a comprehensive example for the application of archaeometric techniques to locally produced pottery in Jamaica. He was interested in exchange and distribution networks of the "yabba," a distinct Afro-Jamaican ware. Hauser argued that tracing the movement of these wares sheds light on the relationship between different sites pertaining to enslaved Africans (2008:37). His research design was based on the relationship between provenance and provenience; where provenance refers to the location of geological materials used in ceramic production, and provenience refers to where the artifact was recovered. Provenance studies rely on discerning patterns of elements, minerals, and included materials, which constitute the composition of the artifact. These patterns coordinate with naturally occurring geological formations, thus providing a link with provenience and ultimately extracting commodity circuits (Hauser 2008:162-163).

Hauser analyzed 4,259 sherds of glazed, slipped, and untreated yabbas using instrumental neutron activation analysis and petrographic analysis. His results showed that pots recovered from sites located on the north coast of Jamaica appeared to be made using the same ceramic recipes as pottery recovered from the south coast and central part of the island. Different potters sold their ceramics on the north and south coast with little facilitation by the planting class. Although his results do not indicate an island-wide system of distribution, they provide a lens to understand enslaved craft production and an ability to evaluate and track the flow of commodities within an economic system separate from the planter class (Hauser 2008:190). Hauser's work represents an attempt to combine historical and archaeological contextualization with archaeometry in order to better understand Afro-Jamaican ware during the colonial era, with an emphasis on intra-island exchange.

Hauser and Armstrong (1999) examined low-fired earthenwares to reconstruct complex relationships associated with their presence on historic sites in St. John. They emphasized understanding low-fired earthenwares within the context of exchange as commoditized goods, and demonstrated that people on the East End site were engaged in a trading network that extended locally to the rest of the island and regionally throughout the Caribbean. Using x-ray fluorescence and petrographic analysis on twenty-one ceramic sherds, the authors were able to determine the source and provenance of the clays found on the East End. St. John has only one geological unit for producing clays therefore any ceramic sherd containing different clay constituents would have to be imported. By chemically characterizing sherds from the East End site, the authors were able to assess intra- and inter-island exchange networks.

Isendoorn et al. (2008) characterized clay sources and pre-Columbian ware pertaining to late Cedrosan Saladoid, Cedrosan Saladoid, and Suazan Troumassoid cultures in St. Lucia using

instrumental neutron activation analysis and x-ray fluorescence. Clay samples were collected from multiple geographical locations on the island and tested using a variety of techniques. Test-pots and test-bars were made in order to better understand the workability and plasticity properties of the clays collected. They were experimentally fired to investigate their firing and post-firing behavior (Isendoorn et al. 2008:18). Through these archaeometric techniques, the authors found that the majority of the pottery from St. Lucia appeared to be of local origin. They were also able to determine three main provenance areas based on immobile trace elements in clays associated with specific regions on the island. From this data, several sherds suggested non-local clays, or that their constituents were imported from unidentified sources in other parts of the island, or from different islands altogether. They argued that the different availability of clays among geographically diverse islands in the Lesser Antilles must have necessitated the establishment of networks for the procurement and distribution of raw materials or finished ceramic vessels (Isendoorn et al. 2008:22).

Ahlman et al. (2008) evaluated Afro-Caribbean sherds found at Brimstone Hill in St. Kitts. The authors subjected five clay samples and forty Afro-Caribbean ware sherds to instrumental neutron activation analysis in order to examine any similarities in chemical signatures between the pottery sherds and clay sources. Their goal was to learn more about intra- and inter-island trade networks among enslaved Africans and to discover the role Afro-Caribbean ware played in the daily life of enslaved Africans at Brimstone Hill. Results from this study showed that some of the samples found at Brimstone Hill were manufactured on the island and that enslaved Africans on St. Kitts likely participated in inter-island exchange of this ware (Ahlman et al. 2008:119).

Kelly et al. (2008) cite much of the work done in the Caribbean and North America involving the production of low-fired earthenwares, but they note that these studies tend to focus on their production and use as aspects of identity creation and resistance throughout African diaspora related sites. The authors contended that industrial wares such as sugar molds or drip pots make up an overlooked subset of low-fired earthenware, and their ubiquity across historic sites in the Caribbean warrants attention. Using instrumental neutron activation analysis and optical thin-section petrography, they attempted to identify chemical, mineralogical, and physical composition properties of a wide variety of industrial ceramics from Guadeloupe and Martinique. The authors hoped to gleam insight into regional interaction spheres between neighboring islands. Upon the analysis of 56 different samples, their findings showed that while all of the constituent components of a ceramic could be identified, their method does not characterize the clay component exclusively. They concluded that strategies employed by kiln owners are distinct and that the clays were not from a common source.

The Euro-Caribbean pottery tradition practiced in Barbados presents a challenge in interpreting the presence of redware on historic sites. Although vessel typologies may be differentiated, wheel-throwing and kiln-firing practices mask conventional ways for determining origin. The majority of the studies discussed thus far attributed low-firing, hand-built practices to production in the Caribbean, but this tradition is nearly non-existent in Barbados. These studies also focused on utilitarian or domestic wares in pursuit of identifying evidence of Afro-Caribbean creolization. Building upon these lines of historical, archaeological, and archaeometric inquiries, this thesis will establish new approaches to identifying Barbadian redware.

III. METHODS

The current study took place in three phases. The initial pilot study was a cursory investigation that sought to chemically and microscopically characterize a wide variety of ceramic samples, ranging from Amerindian cultures to the historic period in Barbados. In the second phase, a preliminary investigation was conducted following the pilot study, which focused on the use of scanning electron microscopy on redware ceramic sherds from two different historic sites in the parish of St. John: Codrington plantation and Pot House. In the third phase, a final study was conducted on a larger number of samples from more specific contexts within Codrington plantation and Pot House. This chapter will detail the progression of each of these three phases and how they culminated to shed new light on the composition of Barbadian redware. Different archaeometric techniques such as energy dispersive x-ray spectroscopy and scanning electron microscopy informed the progression of this study and contributed to building a diagnostic marker of locally produced Barbadian red earthenware.

Phase I Pilot Investigation

The initial goal of this project was to subject red earthenware pottery fragments recovered archaeologically from historic sites in the eastern parishes known to have produced pottery, to a variety of microscopic and chemical investigations in attempts to discover any distinguishable characteristics. Twenty-seven glazed and unglazed red earthenware ceramics from multiple contexts in Barbados were characterized by means of optical microscopy, electron microscopy, and energy-dispersive x-ray spectroscopy. High resolution optical microscopes (Zeiss Axiolab and Hirox) were used for general observations of the samples. Optical

microscopy does not require special sample preparation in this case and it allowed quick preliminary sample investigation and detection of possible features of interest such as body inclusions (Figure 2).

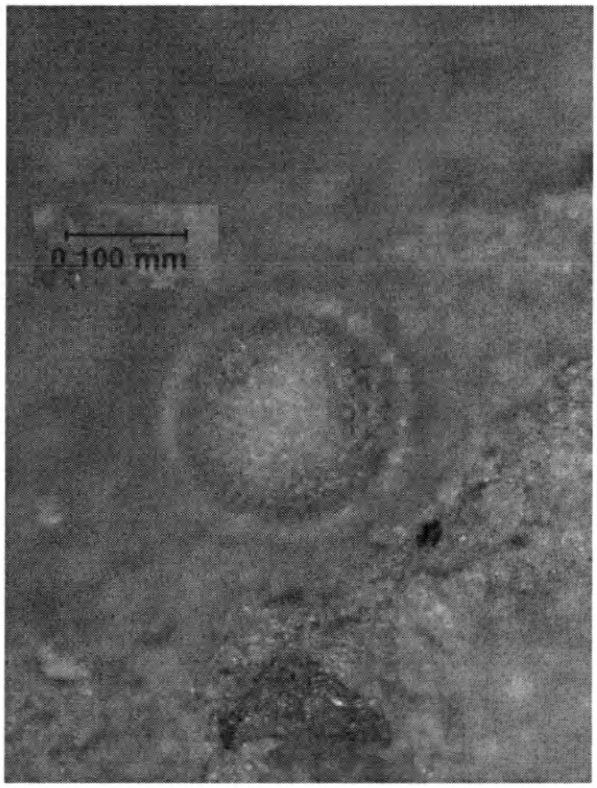


Figure 2: Image of redware sample generated by Hirox microscope.

A scanning electron microscope (Hitachi S-570) with large-sized specimen stage and lanthanum hexaboride cathode was used with an electron beam current of 15 KeV. Samples for characterization were prepared by breaking ceramic sherds into small fragments to reveal a cross-section of the body not exposed to external elements. Samples varied in size depending on the fracture pattern, but none exceeded twenty millimeters in diameter. To prevent charging by the electron beam, samples were sputter-coated with a gold-palladium film of about 10-15 nanometers thick. Sputter-coated samples were used to obtain high resolution micrographs of

the morphology of ceramic samples, with great depth of field. An energy dispersive x-ray spectroscopy application attached to the Hitachi S-570 was used for chemical characterization of sample surfaces. This method provided rapid qualitative, or with adequate standards, quantitative analysis of elemental compositions with a sampling depth of 1-2 microns. The biggest advantage of this technique lies in its ability to determine the chemical composition of a separate feature of interest within the sample (Figure 3).

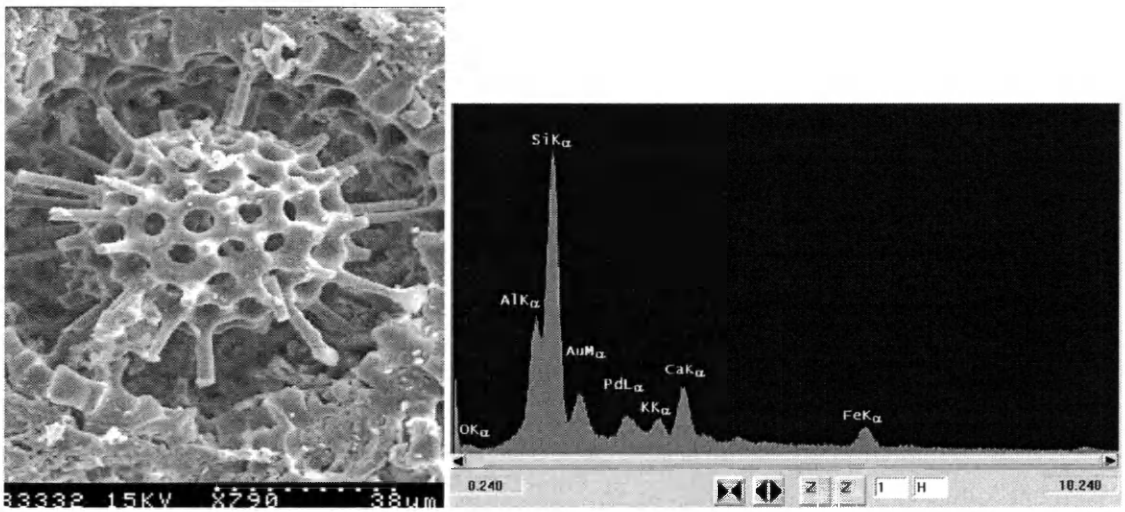


Figure 3: Image of redware sample generated by Hitachi S-570 and energy dispersive x-ray spectroscopy result.

These initial investigations sought to better understand the chemical composition of Barbadian red earthenware ceramics in order to potentially link them to a clay source on the island. Further, microscopy was used to identify any distinguishing features that could then specifically be subjected to chemical characterization. Initial findings suggested that silicon to aluminum ratios may help characterize Barbadian-made redware ceramics. Although samples containing what were later identified as radiolaria exhibited elevated silicon to aluminum ratios compared to samples that did not contain radiolaria, statistical significance could not be

achieved. Ultimately, scanning electron microscopy was able to identify holoplanktonic protozoa fossils known as radiolaria within the ceramic body of at least some of the samples analyzed. As such, microscopy was pursued in attempts to distinguish locally made Barbadian redware from imported forms through investigating the presence or absence of radiolaria within the ceramic body.

Radiolaria are holoplanktonic protozoa widely distributed throughout the water columns of arctic, subtropical, and tropical waters (Figure 4). They are an ancient group of single-cell organisms that have existed since the Precambrian Era, and more than 5,000 species are now known to have existed (Haeckel 2005:7). The greatest diversity and largest number of radiolarian species occur in the tropics, and their abundance decreases towards the poles. The Pacific Ocean houses the greatest diversity and abundance of radiolaria (Anderson 1983:1). Their abundance in a geographical region is based on the quality of the water mass, temperature, salinity, and available nutrients. They are largely non-motile organisms and their general morphology reflects an adaptation for a floating existence. The skeleton of these organisms, when present, is composed of amorphous silica (Anderson 1983:5). Radiolarian cells are divided into two major regions: the central capsule and the extracapsulum. The central capsule is a mass of cytoplasm that contains all of the vital organelles that sustain life. The extracapsulum is a peripheral layer of cytoplasm, which surrounds the central capsule, and is composed of a variety of structures that facilitate its movement throughout the water (Anderson 1983:3). When silicate skeletal structures are present, they are normally located within the extracapsulum. Skeletal morphology is the only major attribute that can be used to identify fossilized radiolarian, as all of the living components of the cell no longer remain (Anderson 1983; Haeckel 2005; Campbell 1952).

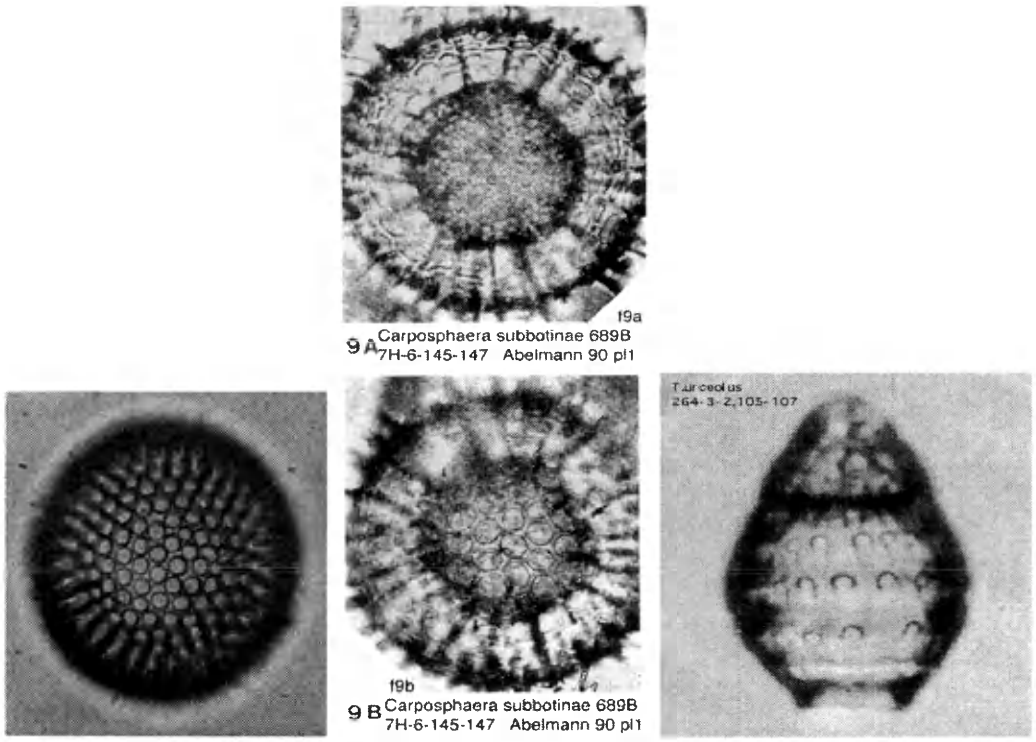


Figure 4: Examples of radiolaria. From left to right: *Cenosphaera riedeli* (Blueford 1982), *Carposphaera subbotinae* (Borisenko 1958), *Theocampe urceolus* (Haeckel 1887).

While there is much debate over the classification of radiolaria, most modern taxonomists recognize three divisions within radiolaria: Spumellaria, Nassellaria, and Phaeodaria. The skeletal morphology associated with each class ranges in complexity and has been exhaustively described through combinations of geometric shapes and arrangements. For the purpose of this study, a very basic summary should suffice in differentiating these radiolarian classes. Spumellaria are considered to be the most primitive radiolaria and their skeletal structures, when present, can be characterized by the presence of spicules. Nassellaria are identifiable by the presence of a latticed, central skeletal structure. Lastly, Phaeodaria can be characterized by oblong spherical structures that are weakly connected through slight depressions in shape on either end, resembling a "collar" like structure. Phaeodaria can be difficult to identify in the fossil record because they often break apart at these connections (Anderson 1983:10-17).

Sediment trap studies have been conducted in order to identify radiolarian abundance and diversity in both the water columns and surface sediments of the Atlantic Ocean (Goll and Bjorklund 1971; Takahashi and Honjo 1981). According to Goll and Bjorklund (1971:445-447), radiolaria are more abundant and better preserved in the sediment on the eastern side of the Mid-Atlantic Ridge, with the exception of the Caribbean Basin. They found that in the Caribbean Sea, the abundance of radiolaria in the water column averaged at 22,000 specimens per thousand cubic meters of filtered water. Although many studies have struggled with determining consistent radiolarian composition within surface sediments, sedimentary distributions of radiolarian species are probably broader than their actual living habitats due to post mortem skeleton transport either during descent through the water column or by sediment relocation. For the purpose of this study, it is important to note that radiolarian deposition of siliceous skeletal remains in surface sediments has occurred since the Precambrian era. These processes must be considered in conjunction with the formation of Barbados during the Miocene and Eocene Epochs.

Barbados was formed by multiple complex geological processes involving tectonic plates. At the southeastern edge of the Caribbean Plate, convergence with the Atlantic sea floor produced the Barbados Ridge Complex, an accretionary prism situated between the Atlantic Abyssal Plain and the Tobago Trough (Steineck et al. 1984:1465). Representative of the sea-floor spreading hypothesis, this convergence created a subduction zone where the Americas plate plunged beneath the Caribbean plate, pushing it upwards (Meyerhoff and Meyerhoff 1972:38). Although this hypothesis is predominately accepted to account for the formation of Barbados and the rest of the Lesser Antilles, Meyerhoff and Meyerhoff (1972) use geological and geophysical facts to dispute the sea-floor spreading hypothesis. After an exhaustive analysis of plate

movements and geological comparisons, Meyerhoff and Meyerhoff concluded that geologically, the Barbados Ridge Complex is not part of the Caribbean or Lesser Antilles, but instead a part of the South American continent. Nevertheless, the mass of the Barbados Ridge Complex increased to form the Barbados Ridge. This was achieved through multiple accretion events, including off-scraping and accretion of trench fill, abyssal plain deposits, and trench slope deposits. These cumulative events elevated the Barbados Ridge to form the island of Barbados, the only exposed part of the Barbados Ridge.

Barbados can be roughly divided into three separate regions characterized by different geological formations (Figure 5). Constituting the majority of the island on the west is a coral or limestone cap formation, and to the east, the Scotland formation. Separating these two regions is a narrow oceanic formation (Young and Hosein 1984). The Scotland formation, located in the Scotland District of Barbados on the eastern side of the island, experienced millions of years of erosion which eventually breached a Plio-Pleistocene limestone cap to expose early Eocene to Miocene sediments of diverse character, origin and tectonic style (Steineck et al. 1984:1465). The Scotland formation developed during the early to late Eocene Epoch and comprises primarily quartz, sandstone, conglomerate, and mudstone. This was reflective of an abyssal fan and trench fill depositional environment. The oceanic formation that surrounds the Scotland formation developed between the early Miocene to early Eocene Epochs, and consists of foraminiferal-nannoplankton ooze, radiolarian mudstones, and volcanigenic interbeds. This formation composition resulted from a deep oceanic depositional environment (Steineck et al. 1984:1465).

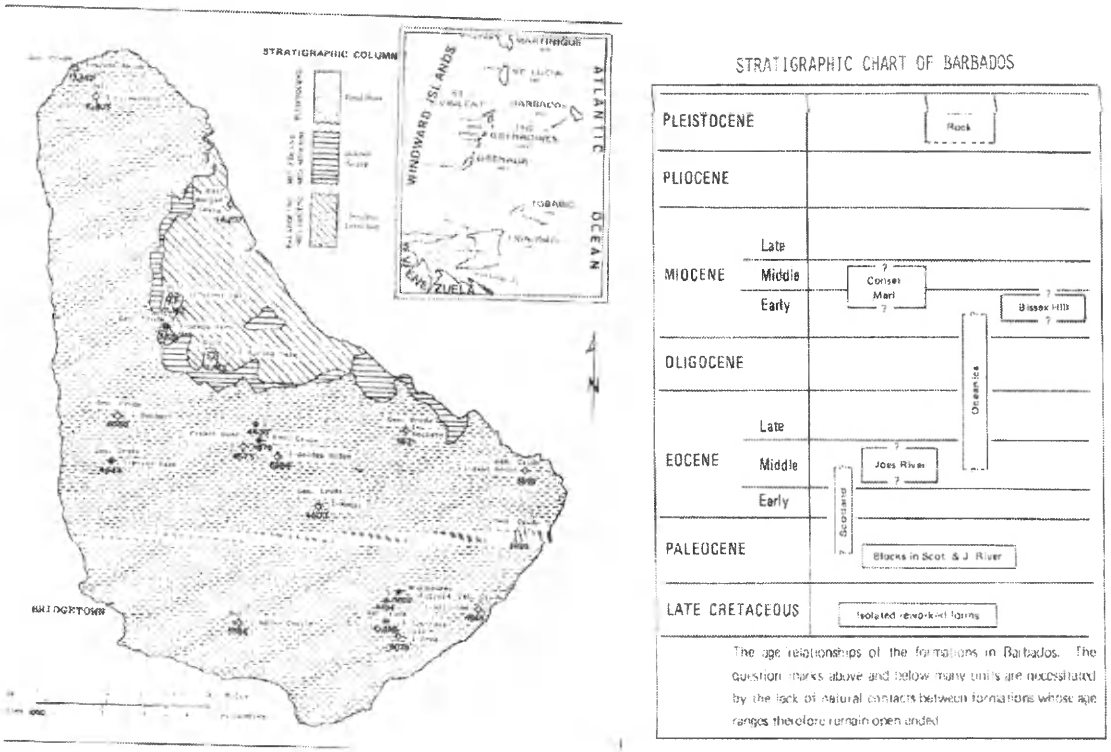


Figure 5: Geological chart of Barbados. Reproduced from: Young and Hosein 1984.

The oceanic formation in Barbados has been extensively studied in regards to stratigraphy (Saunders et al. 1984), foraminifera (Wood et al. 1985), and ostracoda (Steineck et al. 1984) in attempts to understand geological transformations. Because this formation is indicative of a deep oceanic deposit from the Miocene and Eocene Epochs, these studies focused on the fossil remains of marine micro-organisms to understand geological events that occurred millions of years ago. Bronnimann (1949) identified the presence of globigerina and radiolarian marls within the oceanic formation; however micropaleontologists have not yet conducted a detailed analysis of radiolaria in these clays. Nevertheless, radiolarian fossils from the Miocene and Eocene Epochs can be found in the clay in this region. Therefore if clay from this oceanic region is used to manufacture ceramics, these ceramics can potentially contain radiolarian fossils imbedded in the ceramic body.

Phase II Preliminary Investigation

In the summer of 2010, a new batch of samples was collected from The Barbados Museum and Historical Society and transported to The College of William & Mary, Virginia for microscopic analysis. Instead of focusing on a wide range of samples from different historic contexts on the island, two historic period sites were selected for sampling and data collection: Codrington plantation and Pot House. The pilot investigation identified radiolaria within ceramic sherds from Pot House, an archaeological site located in the parish of St. John, which was associated with ceramic production during the early colonial era (Figure 6). Codrington plantation was selected due to its proximity to Pot House. Located about a half-mile away and in the same parish, Codrington plantation was historically known to have produced utilitarian and industrial redware for use on the plantation.

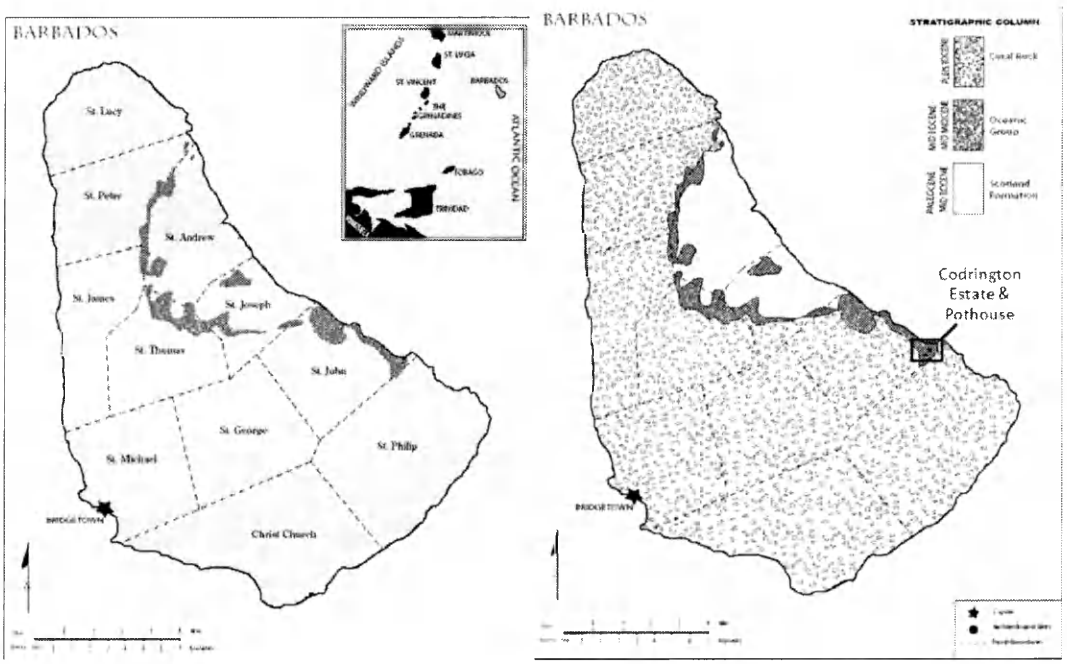


Figure 6: Geological formations on Barbados (Young and Hosein 1984) with locations of Codrington Estate and the Pothouse indicated on the map.

Codrington Plantation

The majority of what can be gleamed from historical documents about the Codrington plantations has been compiled by researchers from the University of California. As part of a two year undertaking, a seminar group conducted a survey through all of the historical documents pertaining to Codrington from manuscripts in the Library of Congress, and microfilms of the complete holdings of the manuscripts of the Society for the Propagation of the Gospel in Foreign Parts, of the Lambeth and Fulham Palace collections, and of the Thomas Bray Associates collection. These highly detailed accounts form a comprehensive source for understanding plantation life in Barbados during the eighteenth and nineteenth centuries. Drawing primarily on these sources, Frank J. Klingberg (1949) compiled an edited volume composed of different aspects of the Codrington estates and their inhabitants titled *Codrington Chronicle: An Experiement in Anglican Altruism on a Barbados Plantation, 1710-1834.* Almost ten years after, J. Harry Bennett Jr. published *Bondsmen and Bishops: Slavery and Apprenticeships on the Condrington Plantations of Barbados, 1710-1838*, providing additional insights from the Codrington manuscripts. These two works help establish the necessary historical context for the microscopic analysis of redware samples.

Christopher Codrington, a wealthy sugar planter in Barbados, was so impressed with the purpose of the Anglican missionary society that in 1703, he willed three sugar plantations to the care and management of the Society for the Propagation of the Gospel to further its missionary program (Klingberg 1949:15). Two of these plantations were located in Barbados and operated as a single unit, referred to as the Codrington estates (Bennett 1958:2). Upon his death in April 1710, Christopher Codrington bequeathed his West Indian plantations to the Society for the Propagation of the Gospel in Foreign Parts to "maintain a convenient Number of Professors and

Scholars" on the estates from the proceeds of sugar. While the Barbadians wished to use these funds for the education of white residents, the Society saw this as the foundation for the Christianization of enslaved Africans (Bennett 1958:1, Klingberg 1949:3). The Society sought to operate a plantation through the use of enslaved labor in order to make money to use for the maintenance of a seminary school that would then attempt to Christianize these enslaved laborers (Klingberg 1949:6).

The Society for the Propagation of the Gospel organized the Codrington plantations into a system of absentee management. In London, most of the responsibility fell on the Barbados Committee who depended on commercial sugar houses in London and Bristol for receiving shipments of sugar from Barbados, arranging for the sugar's sale, and providing supplies for the estate. In the colony, the majority of the duties fell on the town agent and plantation manager. The former was ordinarily a merchant in Bridgetown who stored the produce from the plantations and conducted sales of this produce locally and abroad, while the latter was in charge of planting and harvesting, securing a labor force, and day-to-day operations of the estates (Bennett 1958:3).

The first manager of the Codrington plantations was John Smalridge, who did most of the work in educating the Society on how to run and manage the estates from 1710 to 1731. One of his main tasks was to evaluate the worth of the plantations so that the Society could assess the viability of constructing a college (Bennett 1958:4, Klingberg 1949:30). Smalridge's reported profits took place during an economic boom between 1713 and 1719, and the Society made the mistake of confusing good fortune with regularity. Under the anticipation of high profits the Society went forth with constructing the college and by 1725, a stone structure had been raised near the Consett mansion. Unfortunately, this structure was never completely finished due to the

reduction of available funds in 1718. The College was finally opened in September 1745 under very modest terms, but it failed to meet its missionary purpose during the eighteenth century due to conflicting demands. Some Barbadians wanted Codrington College to become a charity school that trained poor children in accounting and other vocational subjects, while others wanted a grammar school that prepared young gentlemen for English schools and universities. Ultimately, the college came to serve as a classical grammar school for the sons of the gentry and a free school for orphan and other indigent boys who wished to qualify for apprenticeships in the plantation business (Bennett 1958:4-5).

Over the following decades, the Codrington plantations experienced economical crises, which caused the College to close in 1775. It was not until the influence of Sir John Gay Alleyne that the school was reopened in 1789. The college and estates underwent reorganization by the Society in 1813 and on September 9, 1830, Codrington College (Figure 7) was finally opened as a theological seminary and could carry out Christopher Codrington's wishes for the Christianization of enslaved (soon to be emancipated) Barbadians (Bennett 1958:6-7).

The Codrington estates bordered each other in St. John's parish. When the Society took possession of the estates in February 1712, they found that they operated as a single unit. The smaller estate, called the upper plantation, consisted of about 270 acres and produced sugarcane. In 1710, the upper plantation had three stone windmills for crushing the cane it grew, the largest boiling house on the island, a distillery, cooper's shop, a two-story dwelling, and other structures (Bennett 1958:2, Klingberg 1949:43).

Figure 7: Codrington College. Photo: author's collection.

Figure 8: Cart road connecting the Consett estate to Consett Bay. Photo: author's collection.

The lower plantation, sometimes called Consett, was separated from the upper plantation by the eastern edge of the upland region, placing it within the Scotland District of Barbados. Given the steep, rough, and eroded land between the edge of the upland region and the sea, only about 50 of the plantation's 480 acres were planted with sugarcane (Klingberg 1949:43). Another 258 acres of poor soil were used for grazing or let to tenants (Klingberg 1949:63). The Consett estate, despite its lack of cultivatable soil, proved to be highly valuable to the Society. The estate had an outlet to the sea at Consett's Bay where goods could be taken on a small ship down to Bridgetown for international export, rather than carting goods over Barbados's rough terrain (Figure 8). The lower plantation also offered trees and a rock quarry for building materials, clay for pottery manufacture, and a spring that supplied potable water. The estate maintained structures such as a stone mansion, windmill, boiling house, distillery, and a pot house used to make sugar pots and other industrial wares used in manufacturing and storing sugar (Bennett 1958:2).

Christopher Codrington stipulated in his will that 300 enslaved Africans should be kept on the estates at all times. When the plantations were turned over to the Society in 1712, there were only 276, and managers had a difficult time maintaining Codrington's prescribed labor force. According to Bennett (1952:115-116), paying third-party slave owners for the use of their enslaved Africans was a common practice in the British West Indies. This practice added extra strength to a labor force when needed and gave the slave labor economy flexibility with a contract system. Managers typically contracted from a plantation's tenants or employers, job firms organized for the business of hiring out their enslaved Africans, or neighboring estates.

In order to compensate for labor shortages, managers of the Codrington estate engaged in the practice of hiring out enslaved Africans through negotiations with their owners. Sometimes

they were hired out from neighboring plantations, or in the case of manager Grant Elcock (1753-1770), incoming managers brought their own enslaved Africans to work, thus receiving compensation for their managerial work and the labor of their enslaved Africans (Klingberg 1949:47). The Society purchased the Henley estate in 1766 for the purpose of acquiring the enslaved Africans tied to the property. Upon the purchase of the estate, the fully stocked plantation and property was to be resold but the labor force retained. The property was sold to Gedney Clarke who unfortunately could not make the payments and the estate was ultimately seized, which proved financially disastrous to the Society (Klingberg 1949:56).

There were two villages or yards that housed Codrington's enslaved Africans in the eighteenth century. One was situated near the mansion house at Consett, and the other on the higher ground of the upper plantation. The Consett settlement was twice the size of the settlement at the upper plantation due to the availability of land not used for sugarcane, although the majority of the workforce labored on the upper plantation. This was corrected in 1767 when the manager relocated all who labored on the upper estate, which was about two-thirds of the whole Codrington population, in a village uphill (Bennett 1958:32).

In 1719, Smalridge noticed that considerably less pottery was being produced at the estate's pot house than expected, and he placed the blame on lack of a good potter. Christopher Codrington had employed a young enslaved African as an apprentice under one of the aged craftsmen, but the apprentice died before training could be completed. Smalridge turned the pot house over to outsiders until he could train some of the Society's own slaves in the craft (Bennett 1958:19). In addition to the difficulty of keeping sufficient numbers of enslaved Africans that were able to labor on the Codrington estate, there was a lack of skilled artisans due to the necessity of allocating the majority of the labor force to the cultivation of sugarcane. By 1762,

the enslaved Africans who had learned trades under the ownership of Christopher Codrington had all died and their skills had not been passed on to younger members of the labor force. Upon this realization, recommendations were made that twenty-five enslaved Africans would be trained for artisan work and constantly retained in the pot house, regardless of the need for other work (Klingberg 1949:48). Gradually a fairly full workforce of skilled enslaved Africans was assembled, but not all were properly trained. Of the three potters at work on the estates in 1775, one soon died and another was moved into one of the field gangs; Cudjoe Potter alone was left in the pot house by 1783 (Bennett 1958:20).

The Codrington estate produced sugar pots and molds used for draining molasses at Consett and occasionally made pots for the local market. Given the difficulty in maintaining a labor force, however, it was difficult to keep the pot house staffed and it rarely operated at its full potential (Klingberg 1949:69). Redware sherds were analyzed microscopically from the pot house associated with the Consett estate. The majority of the samples represented industrial redware including bricks, tiles, and vessels associated with sugar manufacture. Enslaved peoples operated pottery wheels in order to construct these wares for both use on the Codrington estates as well as for sale, and clay was likely obtained from a source near the pot house.

Pot House

Documentary evidence is very limited in regards to the Pot House context and the people that would have lived and worked there. It is known from archaeological evidence and oral accounts that three kilns were located on the site and that the people there produced pottery during the early colonial era. In an attempt to better understand the historic context of Pot House, I will draw upon several different lines of evidence in order to interpret the organization

of this redware manufacturing operation. These different lines of evidence relate to the potential ownership of the entire operation as well as the individuals who participated in this artisan craft. Pot House's close proximity to the Codrington estates may also help to contextualize its presence in a clay working industry.

One plausible interpretation of the organization of Pot House is that the pottery operation was owned and controlled by a white slave owner who tasked his enslaved Africans with pottery production. Kevin Farmer (2011) conducted a preliminary examination of documentary and archaeological evidence of a pottery operation in St. Philip, Barbados. The Thickets estate in St. Philip was owned by John Frere and consisted of 544 acres and 244 enslaved Africans. Out of that labor force there were seventeen men and women engaged in pottery production, often as secondary role. Farmer discovered a deed transferring Frere's property to the Lascelles family, including a pot house and pot kiln. The deed also detailed another property owned by Frere in St. Philip that was solely engaged in pottery manufacture. The property comprised seventy-two acres and maintained the operation of three kilns. There were only nine kilns in all of St. Philip in 1716. The redware ceramics produced at this site were likely sold to neighboring plantations, particularly in regard to industrial wares used in sugar production.

Another potential scenario for Pot House is that it was owned and operated by free blacks. Jerome S. Handler (1974), who also examined the free black population in Barbados, noted that prior to emancipation, the free black population was the minority population on the island, considerably smaller than the white population. Throughout the eighteenth century, enslaved Africans continued to learn skills---often from one another---which resulted in pressures upon the job market of the white working class. If freed, they competed for and occupied skilled labor jobs. Some of these free blacks became self-employed, found

employment in established enterprises, or continued to work on plantations as tradesmen (Handler 1974:123-125). The majority of the free black population was concentrated near urban centers such as Bridgetown or Speightstown, but some were spread amongst other parishes and remained in rural areas (Handler 1974:16). Given this line of evidence, it seems plausible that Pot House could have been owned and operated by free blacks. Taking into consideration, however, the size of the operation as indicated by the three kilns that would have been in use, this may be the least likely of the scenarios. A large labor force would have been needed to create a demand for three kilns, which may suggest the presence of a small village invested in pottery production that shared these kilns, or a more consolidated economic enterprise in which free blacks would have employed or enslaved laborers.

The last possible explanation for the occupation and management of Pot House could have involved the poor white population on the island. Prior to the 1640's, indentured servitude made up the primary labor force in Barbados. These servants brought technical skills from Europe, which were adapted to meet planters' needs on sugar plantations. Indentured servitude became a method of transferring technological skills (Beckles 1989:115, Handler 1963b). As planters shifted to a sugar monoculture, the majority of indentured labor was replaced by enslaved labor. Enslaved Africans first dominated field labor then eventually moved into artisan and craft production (Menard 2006:47). This labor transition created a condition of unemployment, forcing these formerly indentured servants into emigration or destitution (Handler 1974:124). Many of these poor whites moved to the Scotland District where land was the cheapest and a poor white population still exists in these regions today. Extrapolating from this movement of poor whites and their potential retention of specialized craft production, it is possible that Pot House was operated by a poor white community. Displaced from the plantation

complex, poor whites attempted to continue to practice these skills to an ever-decreasing extent (Sheppard 1977:25). Pot House may have served as a small niche in which poor whites were able to make a living.

Finally, the location of Pot House in relationship to the Codrington estates may help to further contextualize Pot House's existence. Because Codrington's pot house was rarely operated at its complete potential, ceramic wares needed on the plantation had to be purchased from an outside source. While some of these wares were imported from England, Codrington's proximity to Pot House makes Pot House a reasonable and likely source for the purchase of industrial wares. It is likely that Pot House met the demand for surrounding plantations that could not clear enough of their own redware. Moreover, there were hundreds of estates on the island and very few produced pottery, which left a fairly big market for local potters.

Archaeological excavations at Codrington and Pot House were conducted by applying arbitrary ten-centimeter depths for each layer of test units. Fifteen redware sherds were analyzed from the first layer at the Codrington plantation excavation. Redware sherds from Pot House represented the third and sixth layers of excavation with eight and fifteen samples, respectively. Building upon the methodological standards of the pilot study, ceramic sherds from Codrington plantation and Pot House were analyzed using a Hitachi S-570 scanning electron microscope. The samples were prepared by breaking off a small portion of the ceramic, no larger than twenty millimeters in diameter, in order to reveal a cross-section of the body not exposed to external elements. While sputter-coating with gold-palladium greatly enhanced image resolution of the sample in the pilot investigations, radiolaria were still identifiable without coating. Therefore in order to conserve time and resources in sample preparation, samples went uncoated and were exposed to an electron beam current of 15 keV (Figure 9). Additionally, a Phenom scanning

electron microscope provided by the Applied Research Center at Jefferson Lab in Newport News, Virginia was used for some samples to further improve image quality (Figure 10). The Phenom operates and produces images with greater efficiency than the Hitachi S-570.

The results from this preliminary investigation showed radiolaria to be present in some of the samples analyzed. Samples from Codrington plantation showed no evidence of radiolaria. Layer Three from Pot House contained three samples and Layer Six contained twelve samples that tested positive for radiolaria. This preliminary data suggest that people from Codrington plantation and Pot House were obtaining clays from different sources. Pot House was a local pottery manufacturing operation; therefore clays represented in the ceramics at that site must represent Barbadian clays. On the other hand, the Codrington plantation context is not necessarily tied to local clays. Although the plantation maintained and operated a pot house, samples from this collection could also represent imported wares from England. Therefore the presence of radiolaria suggests local redware manufacture, while the absence of radiolaria suggests clays were obtained outside of the radiolarian-enriched oceanic region on Barbados, or from England. In order to discern the local clay typology Codrington plantation's pot house would have been using, it was necessary to examine redware ceramics associated with their kiln rather than redware associated with random spots on the plantation.

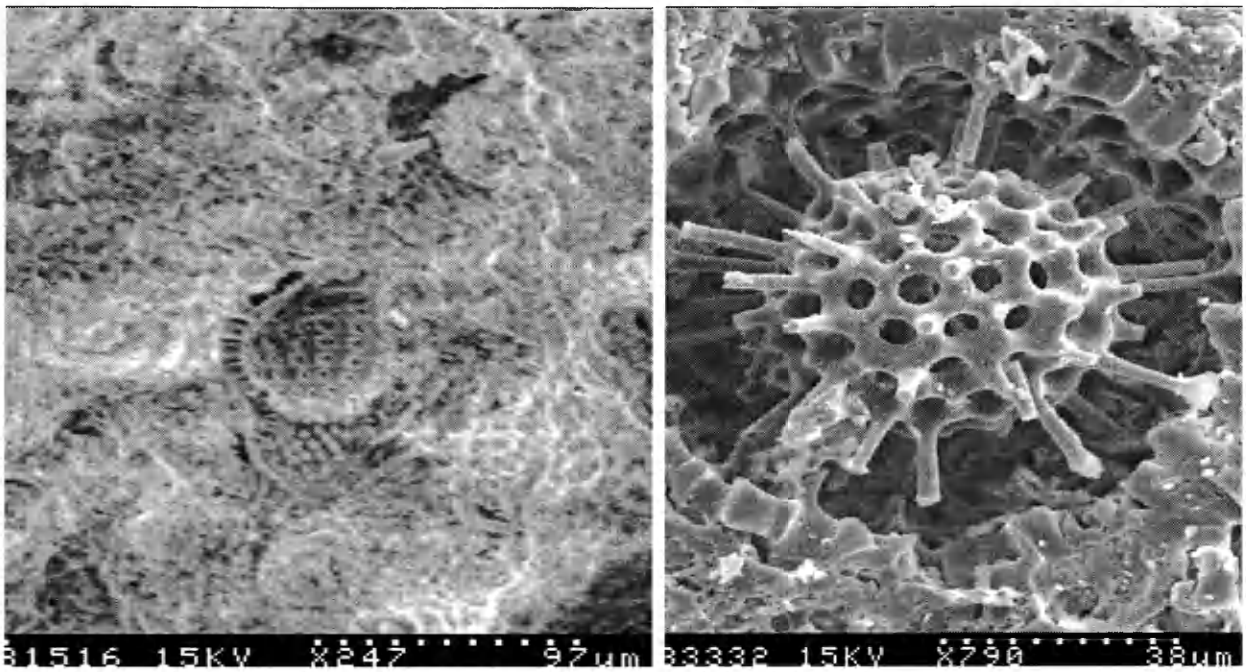


Figure 9: Images of radiolaria produced by Hitachi S-570. Image on the left is uncoated. Image on the right is coated with gold-palladium.

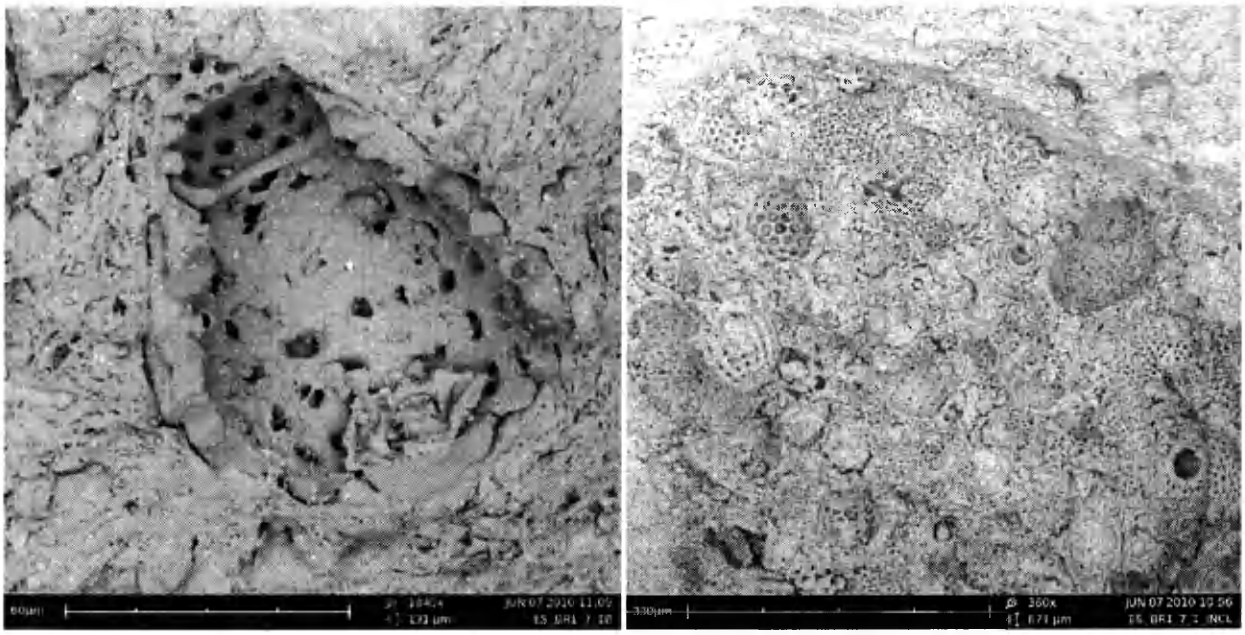


Figure 10: Images of radiolaria produced by Phenom scanning electron microscope.

Phase III Primary Investigation

In the summer of 2011, the author traveled to The Barbados Museum and Historical Society to collect a more representative sample from Codrington plantation and Pot House. Artifacts from the Codrington Pot Kiln excavations were selected for sampling with the idea that these redware sherds would represent local Barbadian clays. Redware ceramics from both sites were carefully collected for transportation back to the United States for microscopic analysis with permission from the Barbados Museum and Historical Society. A total of ten redware ceramics were selected at random from each contextual layer present at these two archaeological sites. These layers were assigned in increments of ten centimeters. Codrington Pot Kiln consisted of four layers, and Pot House consisted of six layers. Although these contexts are representative of sequential deposition through time, terminus post quem dates could not be assigned to individual layers. It is estimated that this sample is representative of about five percent of the entire population of redware ceramics uncovered per contextual layer. These samples represented a wide variety of vessel types including sugar molds, bricks, tiles, domestic glazed and unglazed forms, and waster clay (Figure 11).

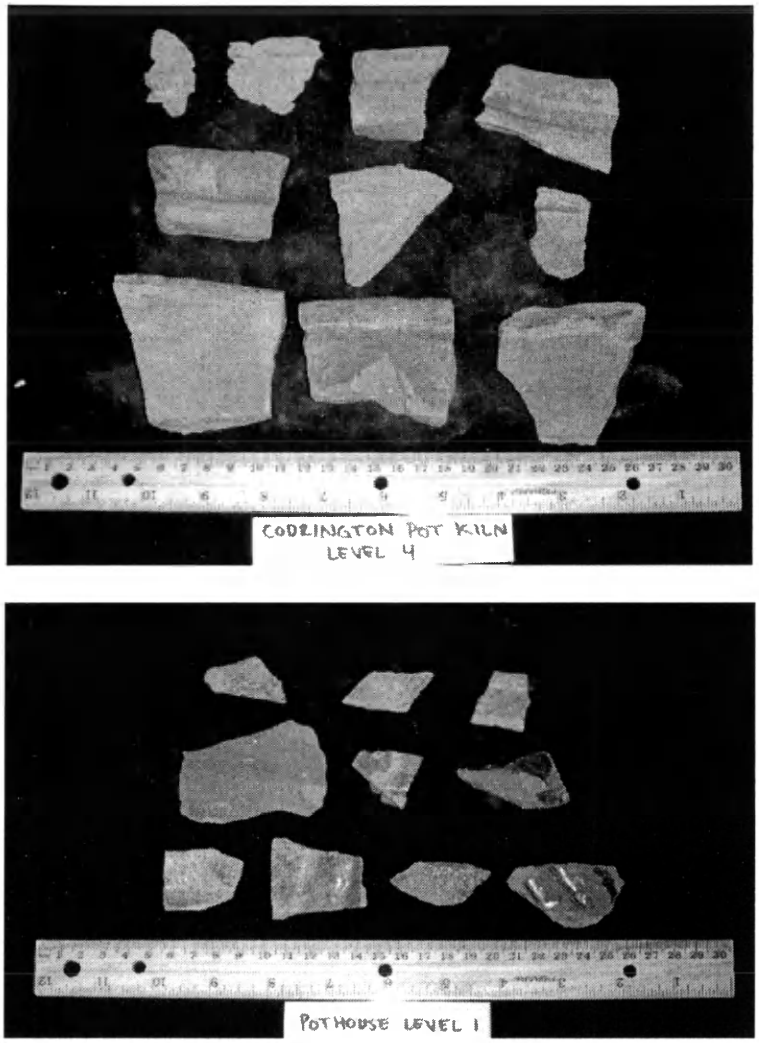


Figure 11: Redware sample sherds representing different ceramic forms.

Samples were prepared for analysis by separating a small portion of the ceramic sherd from the whole sherd. This revealed a cross-section of the sample and made it small enough to fit into the scanning electron microscope. In some cases, after the sample had been separated from its larger whole, the sample was broken down further in order to achieve the flattest cross-section possible. Additionally, sample stages were augmented to level ceramic samples; this included the use of angled sample stages and the manipulation of carbon tape. Sample sizes ultimately depended on fracture pattern, but none exceeded twenty millimeters in diameter.

A Phenom scanning electron microscope housed in the Applied Research Center at Jefferson Lab in Newport News, Virginia was used for all of the ceramics analyzed for this investigation. After the optimal size and shape were obtained, ceramic samples were mounted to a sample stage using double-sided carbon tape. The stage was then placed into a variable pressure holder, which allows non-conductive samples to be viewed without the application of a conductive coating. The working distance in this particular holder was maintained between one and two millimeters and the electron beam current was set at 15 keV. Scanning electron microscopy was used to view sample surfaces at about 300x magnification. This level of magnification enabled the user to view a relatively wide scope of the surface while allowing for the recognition of radiolaria when present. When anomalous features within the clay body were observed (such as inclusions or different clay colors), these features were specifically analyzed in attempts to determine if radiolarian-enriched clays may have been added. Further, these anomalies were analyzed in order to determine if particular inclusions shared visual similarities over multiple samples, which could have indicated the potential for another diagnostic feature.

Sample	Context	Level	Description	Radiolaria
ES-BR1-25-1	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-25-2	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-26-1	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-26-2	Codrington	1	Architectural, Brick Frag.	Negative
ES-BR1-27-1	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-27-2	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-28-1	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-28-2	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-29-1	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-29-2	Codrington	1	Architectural, Tile Frag.	Negative
ES-BR1-60-1	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-60-2	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-61-1	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-61-2	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-62-1	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-62-2	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-63-1	Codrington	2	Architectural, Brick Frag.	Negative
ES-BR1-63-2	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-64-1	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-64-2	Codrington	2	Architectural, Tile Frag.	Negative
ES-BR1-65-1	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-65-2	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-66-1	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-66-2	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-67-1	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-67-2	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-68-1	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-68-2	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-69-1	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-69-2	Codrington	3	Architectural, Tile Frag.	Negative
ES-BR1-70-1	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-70-2	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-71-1	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-71-2	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-72-1	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-72-2	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-73-1	Codrington	4	Waster	Negative
ES-BR1-73-2	Codrington	4	Waster	Negative
ES-BR1-74-1	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative
ES-BR1-74-2	Codrington	4	Industrial, Sugar Mold Rim Frag.	Negative

Sample	Context	Level	Description	Radiolaria
ES-BR1-55-1	Pot House	1	Domestic, Green Glaze	Negative
ES-BR1-55-2	Pot House	1	Domestic, Green Glaze	Negative
ES-BR1-56-1	Pot House	1	Domestic, Clear Glaze	Negative
ES-BR1-56-2	Pot House	1	Domestic, Green Glaze	Negative
ES-BR1-57-1	Pot House	1	Domestic, Green Glaze	Positive
ES-BR1-57-2	Pot House	1	Domestic, Rim Sherd, Green Glaze	Positive
ES-BR1-58-1	Pot House	1	Domestic, Green Glaze	Negative
ES-BR1-58-2	Pot House	1	Domestic, Green Glaze	Positive
ES-BR1-59-1	Pot House	1	Domestic, Green Glaze	Negative
ES-BR1-59-2	Pot House	1	Domestic, Green Glaze	Negative
ES-BR1-30-1	Pot House	2	Architectural, Brick Frag.	Negative
ES-BR1-30-2	Pot House	2	Domestic, Burnished	Negative
ES-BR1-31-1	Pot House	2	Unidentified, Dark Gray	Negative
ES-BR1-31-2	Pot House	2	Unidentified, Burnished	Positive
ES-BR1-32-1	Pot House	2	Unidentified, Burnished	Negative
ES-BR1-32-2	Pot House	2	Architectural, Tile Frag.	Positive
ES-BR1-33-1	Pot House	2	Architectural, Brick Frag.	Negative
ES-BR1-33-2	Pot House	2	Unidentified, Burnished	Negative
ES-BR1-34-1	Pot House	2	Architectural, Tile Frag.	Positive
ES-BR1-34-2	Pot House	2	Architectural, Tile Frag.	Negative
ES-BR1-35-1	Pot House	3	Unidentified	Positive
ES-BR1-35-2	Pot House	3	Industrial, Rim Sherd	Positive
ES-BR1-36-1	Pot House	3	Architectural, Tile Frag.	Positive
ES-BR1-36-2	Pot House	3	Industrial, Sugar Mold Frag.	Positive
ES-BR1-37-1	Pot House	3	Industrial, Sugar Mold Frag.	Positive
ES-BR1-37-2	Pot House	3	Architectural, Brick Frag.	Positive
ES-BR1-38-1	Pot House	3	Unidentified, Burnished	Positive
ES-BR1-38-2	Pot House	3	Unidentified, Burnished	Positive
ES-BR1-39-1	Pot House	3	Unidentified, Burnished	Positive
ES-BR1-39-2	Pot House	3	Unidentified, Burnished	Positive
ES-BR1-40-1	Pot House	4	Unidentified, Burnished	Negative
ES-BR1-40-2	Pot House	4	Unidentified, Burnished	Positive
ES-BR1-41-1	Pot House	4	Unidentified, Burnished	Negative
ES-BR1-41-2	Pot House	4	Unidentified, Burnished	Positive
ES-BR1-42-1	Pot House	4	Unidentified, Burnished	Negative
ES-BR1-42-2	Pot House	4	Unidentified, Burnished	Negative
ES-BR1-43-1	Pot House	4	Unidentified, Burnished	Positive
ES-BR1-43-2	Pot House	4	Unidentified, Burnished	Positive
ES-BR1-44-1	Pot House	4	Unidentified, Burnished	Positive
ES-BR1-44-2	Pot House	4	Unidentified, Burnished	Negative
ES-BR1-45-1	Pot House	5	Industrial, Sugar Mold Frag.	Negative
ES-BR1-45-2	Pot House	5	Industrial, Sugar Mold Frag.	Negative

ES-BR1-46-1	Pot House	5	Inudstrial, Sugar Mold Frag.	Negative
ES-BR1-46-2	Pot House	5	Industrial, Sugar Mold Frag.	Negative
ES-BR1-47-1	Pot House	5	Industrial, Sugar Mold Frag.	Negative
ES-BR1-47-2	Pot House	5	Industrial, Sugar Mold Frag.	Negative
ES-BR1-48-1	Pot House	5	Industrial, Sugar Mold Frag.	Negative
ES-BR1-48-2	Pot House	5	Waster	Negative
ES-BR1-49-1	Pot House	5	Industrial, Sugar Mold Frag.	Negative
ES-BR1-49-2	Pot House	5	Unidentified	Negative
ES-BR1-50-1	Pot House	6	Industrial, Sugar Mold Rim Frag.	Positive
ES-BR1-50-2	Pot House	6	Industrial, Sugar Mold Rim Frag.	Positive
ES-BR1-51-1	Pot House	6	Industrial, Sugar Mold Rim Frag.	Positive
ES-BR1-51-2	Pot House	6	Industrial, Sugar Mold Rim Frag.	Positive
ES-BR1-52-1	Pot House	6	Industrial, Sugar Mold Frag	Negative
ES-BR1-52-2	Pot House	6	Architectural, Brick Frag.	Positive
ES-BR1-53-1	Pot House	6	Industrial, Sugar Mold Rim Frag.	Positive
ES-BR1-53-2	Pot House	6	Industrial, Sugar Mold Rim Frag.	Positive
ES-BR1-54-1	Pot House	6	Industrial, Sugar Mold Frag.	Positive
ES-BR1-54-2	Pot House	6	Industrial, Sugar Mold Frag.	Positive

Figure 12: Results.

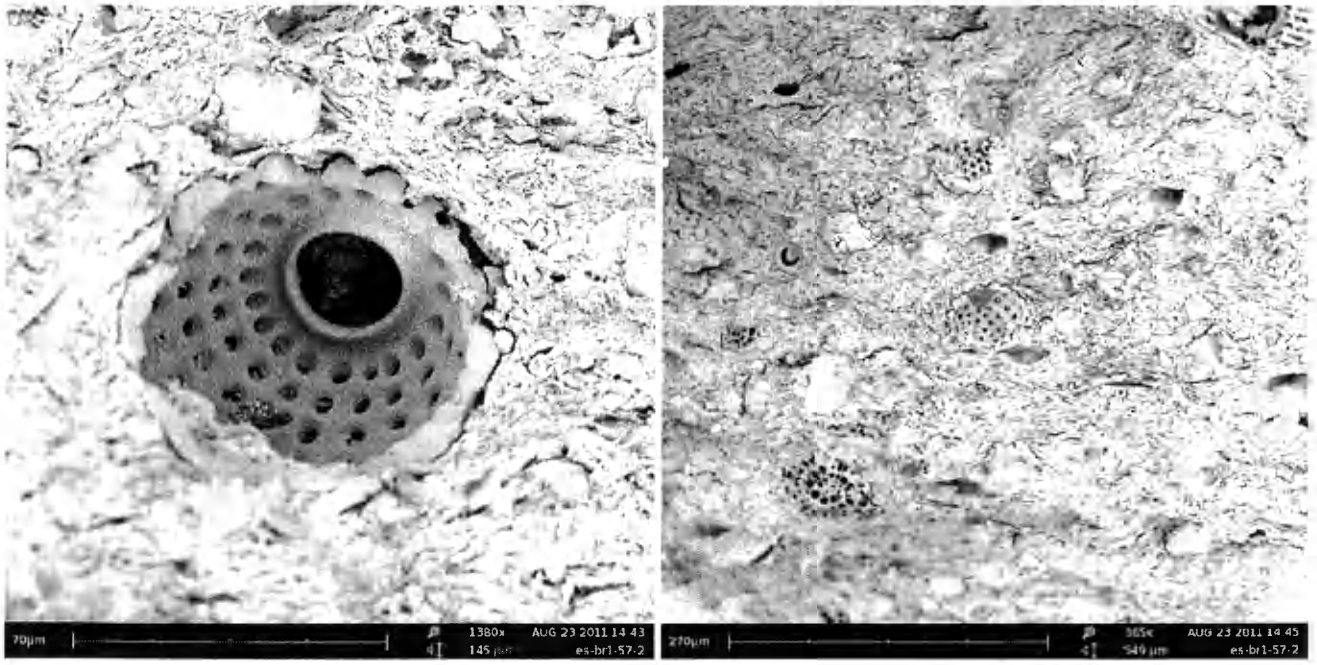


Figure 13: Radiolaria in redware samples from Pot House, layer 1.

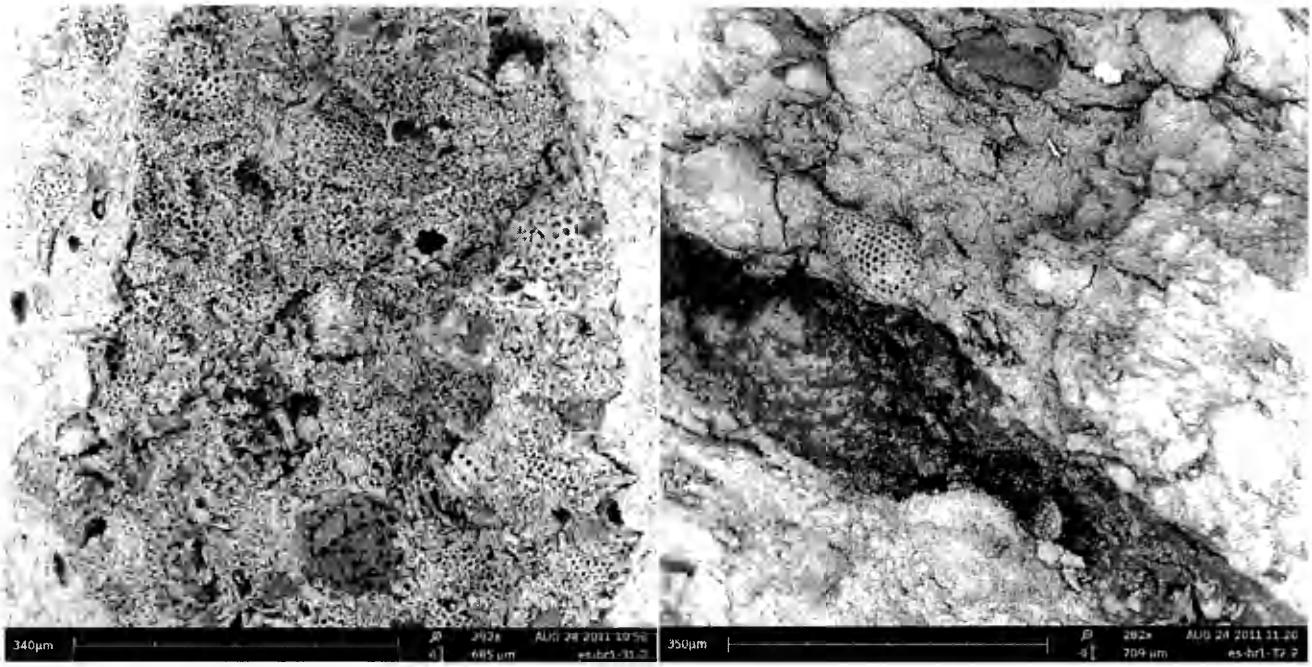


Figure 14: Radiolaria in redware samples from Pot House, layer 2.

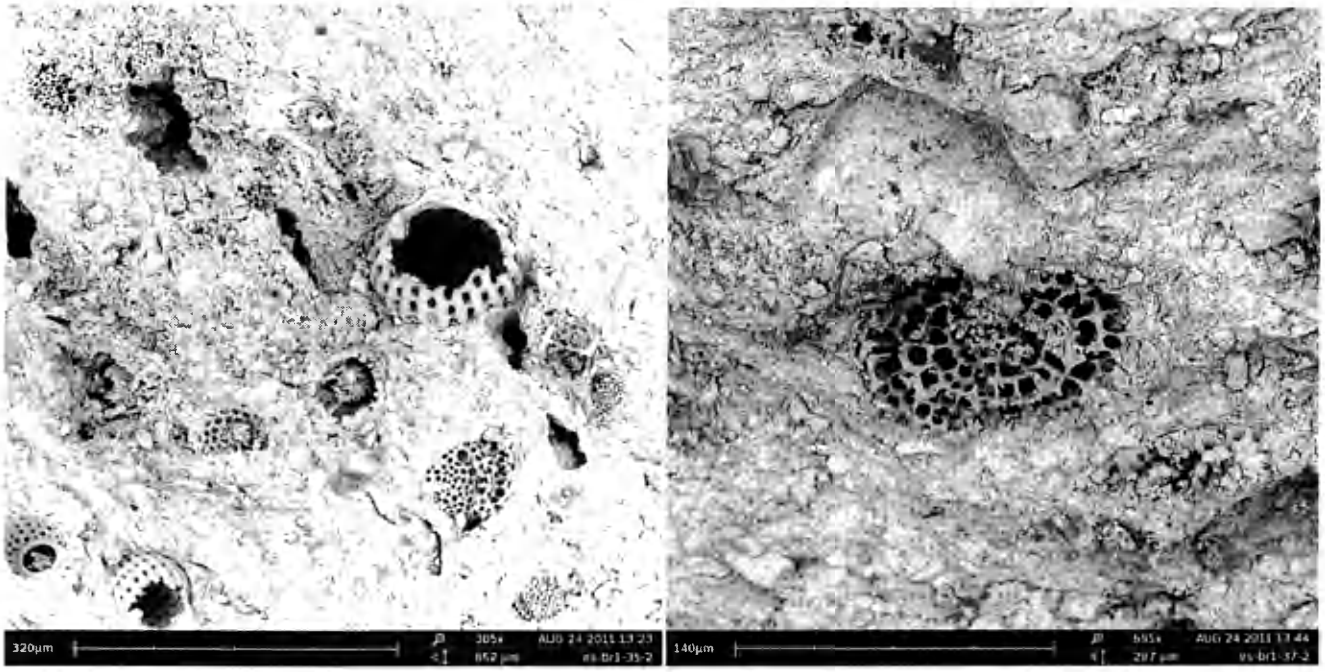


Figure 15: Radiolaria in redware samples from Pot House, layer 3.

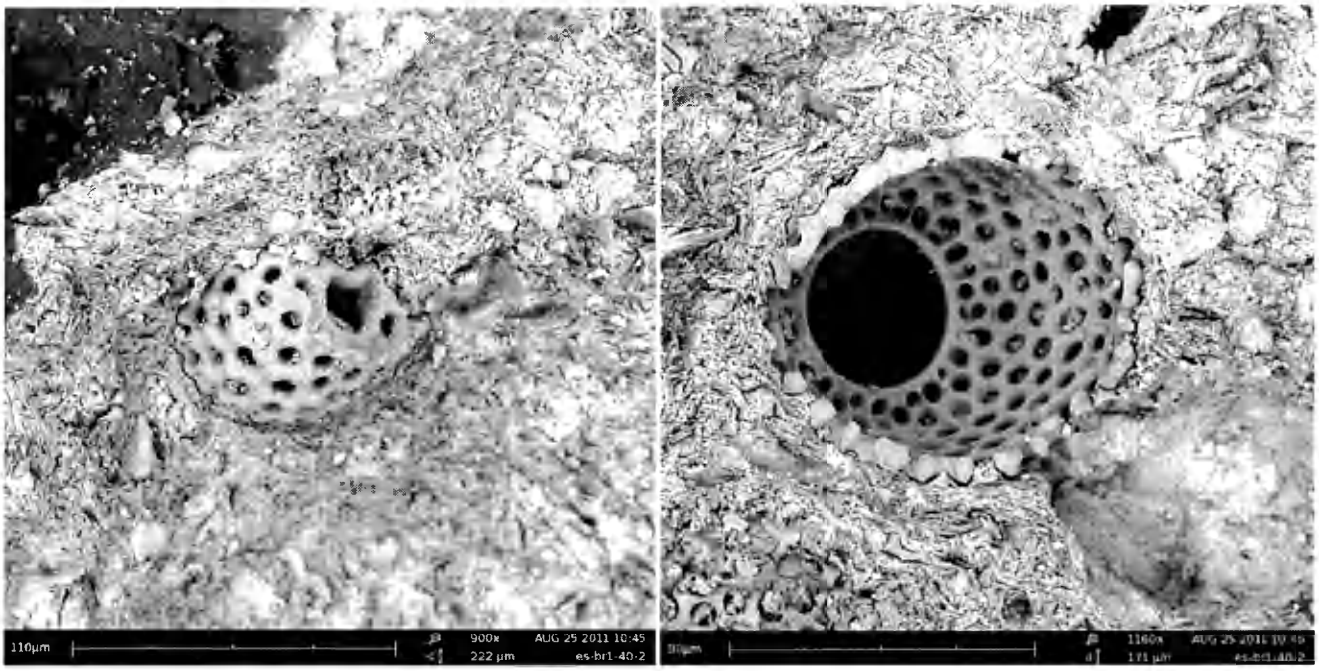


Figure 16: Radiolaria in redware samples from Pot House, layer 4.

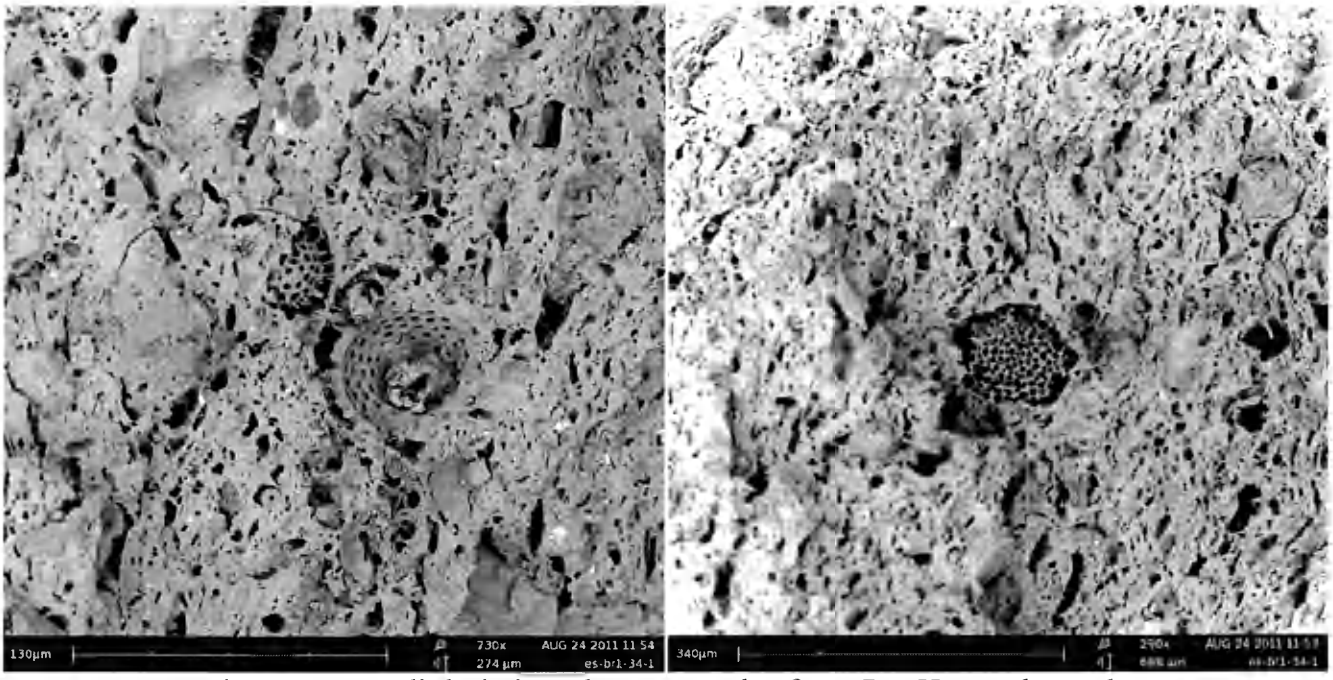


Figure 17: Radiolaria in redware samples from Pot House, layer 6.

Interpretation

The primary goal of this project was to use archaeometric techniques to distinguish Barbadian-made red earthenware from imported English wares. Evidence of local production within industrial contexts in Barbados would help shed light on the role of imported versus locally made ceramics, reflecting both social and economic decisions made by the planters. The presence of radiolaria in the body of redware ceramics is clearly one diagnostic marker of local Barbadian production. The results from this study pose more questions about the efficacy of such a diagnostic marker and warrant further discussion, especially regarding sample collection and understanding local clays on the island. The geographical locations of the Codrington Pot Kiln and Pot House in relation to radiolarian-enriched clays also require further exploration.

Judging from contemporary and historic geographical maps, Codrington Pot Kiln and Pot House appear to have been located within the oceanic region on the eastern side of Barbados, with Codrington further east, closer to the border towards the Scotland District. Relying on these maps however presents two problems. Although most maps identify the location of the Codrington estate, they rarely differentiate between the upper and lower plantations. Clay sources used for making ceramics would have been exploited away from the pot house, further complicating the issue of pinpointing their clay typology on a map. These factors could create hundreds of acres in measurement error depending on the specificity and accuracy of the map. The second problem presented in overlaying maps is the accuracy of the geological and soil maps, specifically the borders they present for different regions. These maps are typically created by geologists or soil scientists with specific goals or research interests. Although some of these maps were made for general or lay knowledge, many of these maps were created during geological investigations for agricultural or industrial development. Therefore it can be

reasonably assumed that the accuracy of land or soil forms represented on the map varies, depending on the researcher's focus. While the borders for the oceanic region are clearly indicated on the map, it can reasonably be assumed that there is some measurement of error. The results of this investigation suggest that the clays fired at Codrington Pot Kiln originated outside of the oceanic region due to the absence of radiolaria in the ceramics produced, codifying the problems presented in strictly relying on maps.

Clay homogeneity may account for the variation in the presence of radiolaria in the Pot House context. Evidence of radiolaria within ceramic samples appeared to be homogenous; there was a consistent amount of siliceous skeletons found throughout sample imaging. Based on this line of evidence, radiolaria would definitively show if the ceramic was constructed from radiolarian clay beds. However, this homogeneity does not account for the composition of an entire clay pit. The oceanic formation includes a great diversity of geological materials. Radiolarian marls are interbedded with globerigina and volcanic marls, and up to four different soil sub-groups characterize this region (Ahmad 1973:106, Bronnimann 1949:26). Different depths within a single clay pit might account for why radiolaria is present within some ceramics and absent in others, if these different depths reflect different clay marls.

Different geographical locations for source clays would also account for the inconsistency of radiolaria within ceramics analyzed from Pot House. Potters would have exploited different clay pits over time in response to factors such as clay availability or personal preferences. The presence of radiolarian marls within one clay pit may drastically differ from a clay pit nearby. It is difficult to control for a factor like this given that historic clay sources would have to be located and tested. The variation of radiolaria presented by the geological composition of the oceanic formation informs questions of statistical significance.

The discussion thus far has shown that while the presence of radiolaria within redware ceramics is indicative of clays found in the oceanic region, its absence does not exclude the possibility that clays from within this region were being used to produce pottery. This poses a question of statistical significance in considering how to interpret the presence of radiolaria in some ceramics---and its absence in others---on sites unrelated to pottery production. It is clear that more work needs to be done in order to definitively identify local-Barbadian redware. This study has produced at least one diagnostic marker for local production, indicative of a specific region on the island. Although the absence of radiolaria does not rule out oceanic clays or other clays on the island, the presence of radiolaria within Barbadian redware has proven to be indicative of local production.

IV. THEORY

Archaeometry, sometimes considered archaeological science, is a rapidly advancing field that consists of the application of scientific techniques to archaeological material. Many of these studies focus on the use of highly scientific methods and particular instrumentation, using relatively small samples sizes from archaeological contexts. Methodology appears to be the primary focus of archaeometric studies; the application of archaeometric techniques tends to be more diagnostic than interpretive when investigating archaeological evidence. Broader cultural implications of archaeometric studies are often overshadowed by the emphasis on method. Further, the scientific techniques used in archaeometric examinations tend to emphasize an objective consideration of material remains by focusing strictly on the chemical composition of artifacts, rather than the conscious or unconscious decisions made by the people constructing these objects. Drawing on archaeometric analysis of red earthenwares from Barbados, I seek to show that archaeometric studies can and should pursue deeper theoretical questions and bridge the gap between scientific and interpretive approaches.

In the following chapter, I aim to understand the presence of radiolaria within Barbadian-made redware ceramics within an interpretive theoretical framework. Prior to developing this theoretical foundation, I will first briefly outline the emergence of archaeological theory as it pertains to considerations of archaeometry. Following that I will reiterate some of the historical processes involved in redware ceramic manufacture in Barbados and how these processes can be interpreted in conjunction with the results produced by this archaeometric study. I will ground these interpretations within a theoretical framework adapted from Clifford Geertz's notion of "thick description." Moreover, I draw on landscape theory as it pertains to the retrieval of clays

that are used to manufacture redware ceramics. This approach offers a foundation for theoretical applications to archaeometric studies.

Patty Jo Watson (1995) explored the concept of culture and the disparity between its uses by archaeologists and anthropologists in the development of archaeology as a discipline. According to Watson, North American archaeology developed around a culture-historical approach, where the term culture was applied to groups of sites containing distinctive artifact assemblages. Archaeologists in the 1930's and 1940's were not interested in human behavior, function, or ecology; but rather concerned themselves with classification. Classifying units were implicitly understood as cultural units (Watson 1995:684). Franz Boas (1920) characterized the importance of collection and classification of cultural material:

> "American scholars are primarily interested in the dynamic phenomena of cultural change, and try to elucidate cultural history by the application of the results of their studies; and that they relegate the solution of the ultimate question of the relative importance of parallelism of cultural development in distant areas, as against worldwide diffusion, and stability of cultural traits over long periods to a future time when the actual conditions of cultural change are better known" (123).

He defined cultural history as a historical problem of trying to solve the mystery of not only how things are, but how things came to be. As such, he posited the importance of the exhaustive collection and classification of materials until later scholars are able to interpret their meaning (Boas 1920:124). Another characteristic of culture history is that with its emphasis on collection, it is void of theory. Culture-historians associated culture with a normative view: artifacts are expressions of cultural norms and those norms define what culture is (Johnson 2010:17). These views dominated North American archaeology up to the 1960's.

Following this period of culture history, Watson (1995:686) credits Lewis Binford's 1962 article entitled *Archaeology as Anthropology* with initiating a paradigmatic shift in archaeology to processualism, or "the New Archaeology". According to Binford (1962:217), material culture represents the structure of the total cultural system, and that explanations of the differences and similarities between certain classes of material culture are as inappropriate and inadequate as explanations for such observations within other classes of items. Instead, Binford contended that change in the total cultural system must be viewed in an adaptive context to social and environmental factors. He attempted to account for a theoretical basis of understanding the appearance and changing utilization of native copper in eastern North America using a systemic approach. Within this approach, Binford assigned functional meanings to certain classes of artifacts: technomic objects function to cope with the environment; socio-technic objects represent extra-somatic adaptations within social subsystems; and ideo-technic objects represent ideological components of the social system (Binford 1962:219). He concluded his article with a particularly telling passage that highlights New Archaeology:

> "Archaeologists should be among the best qualified to study and directly test hypotheses concerning the process of evolutionary change, particularly processes of change that are relatively slow, or hypotheses that postulate temporal-processual priorities as regards total cultural systems" (224).

Processual archaeology emphasizes hypothetical-deductive models in order to interpret archaeological material. As indicated by Binford, processualists used systems thinking as well as a reliance on the scientific method to construct and challenge theories that would improve archaeological methods. Additionally, processual archaeology was predicated on objectivity. Binford (1984:128) also reconciled objectivity with individual paradigms: objectivity rested on

the design characteristics of a methodology and the procedures, rather than view of the individual. Middle-range theory, the examination of the data in the archaeological record and the processes by which they appear in the archaeological record, is perhaps the most famous theoretical framework developed by Binford and embraced by processual archaeologists. To reemphasize, processual archaeology can be characterized by a devotion to apply scientifically informed theories to interpret the archaeological record.

A postmodernist or postprocessualist perspective developed in the late 1970's and 1980's to counter the detached and objective nature of New Archaeology (Watson 1995:686). The most influential proponent of post-processual archaeology was Ian Hodder, whose views were in stark contrast to Binford's. While Binford defined culture as humankind's extra-somatic means of adaptation, Hodder was committed to a fluid, semiotic version of culture in which material items played a role in symbolic representation. Hodder developed a mentalist concept of culture and placed emphasis on the archaeological record as the center of symbolic-structuralist inquiry. Peter Kosso (1991:621-22) argued that their two methodological approaches---Binford's treatment of objectivity as the methodological goal of archaeology and treatment as a natural science, and Hodder's advocacy for the interpretation of artifacts within the context of the ideas and norms during their manufacture and use---are very similar. Although these two theories are often contrasted, Kosso asserted that both theories share the support between evidential claims about systems and claims about structures. Further, Kosso described the circularity between theory and observation, which help form and reinforce one another. Ultimately, Kosso posited that the two different theories of contextual archaeology and the middle range are in a similar epistemic predicament that calls for a shared method (Kosso 1991:625). Clearly, post-processual

archaeology moved away from a strictly objective and scientific paradigm into an interpretive and more reflexive approach.

These three stages of theoretical development---culture history, processualism, and post-processualism---are represented in some way within archaeometric studies. Understanding the theoretical foundations of these paradigmatic approaches is necessary for situating archaeometry within the broader trajectory of archaeological theory. The culture historians of early North American archaeology were primarily concerned with the classification of archaeological remains. Their means of classification draw a distinct parallel to the elemental or scientific characterization of archaeological material used in archaeometric studies. While the composition of an artifact is identified for the diagnosis of age or origin, little emphasis is placed on human behavior or human conception of function or the environment. For example, the presence or absence of radiolaria as a diagnostic marker for Barbadian-made redware contributes very little to understanding human behavior. Although there is great potential in this classification technique, the results require more of an interpretative framework to recognize the broader cultural implications of their presence in Barbadian redwares.

The conflation of the scientific method and objectivity with processual archaeology is particularly relevant to archaeometric studies as well. In their critique of culture history, Julian Steward and Frank Seltzer (1938) commented that "Often, ten pages are devoted to the minutiae of pottery temper, paste, and so on, while one page or less describes subsistence and the relationship of culture to the geographical environment" (7). Archaeometric studies are equally guilty of this charge. The in depth descriptions of artifacts in archaeometric studies often lack mention of the people that created them, and their conscious decisions are portrayed as no more than a reflection of adaptation to their surroundings. Although archaeometric techniques

enhance our understanding of the archaeological record, especially at a descriptive level, archaeometric studies need to place a greater emphasis on human behavior and cognition. In short, the scientific approach and proclaimed objectivity of processual archaeology suffers from many of the same shortcomings as archaeometric studies.

The rigorous application of the scientific method in processual archaeology prescribes very little agency, if any, to people. Similarly, models of cultural evolution and cultural ecology defined culture as humankind's extra-somatic means of adaptation, largely in response to environmental factors. Leslie A. White (1943) used laws of thermodynamics to argue for the evolution of culture. He incorporated mathematical equations complete with symbols for energy, technology, and environmental factors, in order to show how cultures evolved through the harnessing of energy. This highly materialist argument hinged on the misuse of scientific equations in order to account for human evolution, and portrayed people as unconscious and uncreative automatons merely adapting to their surroundings.

The relationship between sophisticated material goods and cultural evolution is highly problematic, especially in terms of the current archaeometric study at hand. For instance, consider that the presence of radiolaria within certain clays on Barbados added plasticity to the clay and allowed for more efficient ceramic construction, using wheel-thrown technology. This does not make Barbadian potters any more culturally evolved than the native Taino, who employed hand-made technology for ceramic construction. The use of highly scientific instrumentation allows us to understand artifacts in more nuanced and detailed ways. The data produced by these instruments shed light on the chemical differences between artifacts in such a way that challenge contemporary evolutionary interpretations that would incorrectly suggest the superiority of one artifact or another. As such, we must be careful in ascribing meanings of

technological superiority or inferiority of one cultural tradition over another through our physical or chemical understandings of an artifact. Here, objectivity becomes a point of contention.

An important aspect of the scientific method is the objectivity it is thought to produce, namely through the incorporation of variables or numbers that can be reworked and applied to human adaptability. The fallacy in this position is that numbers, as well as the science behind them, are highly subjective. Michael Blakey (1996:65) argued that biological anthropology is politically sensitive in relationship to social importance. As such, biometric methods were used with a great deal of flexibility in order to form data into theories. While science is portrayed as an objective tool to understand human life, it is often couched in biologically deterministic frameworks. Ideas posited by cultural evolutionists were often unilinear, locating Europeans at the apex of evolution due to their perceived technological superiority. As with archaeometry, we should be reflexive about our assumptions of objectivity and the scientific instrumentation used to produce such assumptions. New insights into artifacts generated by archaeometric studies should not be considered superior to past people's perceptions of their material world. Further, one must consider the implications of the numeric data generated by archaeometric techniques.

Jonathan Marks (2003) took a well-known natural fact pertaining to genetics and showed it to be a construction of the social and cultural order. He contended that the proclaimed 98% genetic similarity between humans and chimpanzees was only true due to the way the data was interpreted. Marks argued that the utilization of numeric data appears to strengthen any claim within the realm of scientific inquiry, but that these data need to be interpreted more critically (Marks 2003:132). In Marks's study, the genetic similarity between humans and chimpanzees was strictly relational in the way geneticists interpreted similarities in their DNA sequencing. This is particularly relevant to the application of archaeometric techniques,

especially when interpreting chemical compositional data. Popular instruments used to determine the chemical composition of archaeological materials such as x-ray fluorescence, instrumental neutron activation analysis, and energy-dispersive x-ray spectroscopy all detect the relative abundance of elements within the sample. These results are affected by countless factors such as the homogeneity of sample surfaces, depth of scan, relative error, and machine error. Taking these factors into consideration, one would be hard pressed to argue for the complete objectivity of these techniques. Although these archaeometric techniques allow for valuable insight into the compositional and chemical nature of the material record, these data should be interpreted critically.

Culture history and processual archaeology have provided a unique backdrop for understanding how archaeometric studies could fit within archaeological theory. Moreover, positioning archaeometry within these theoretical concepts has further demonstrated how one should think critically about applying the results of such studies. While archaeometry contains processual undertones with the application of scientific techniques and perceived objectivity, their case study basis and highly specific sample base have prevented their incorporation into a greater theoretical framework of cultural evolution or adaptation. Although these studies are relatively benign as they stand, archaeometry can be incorporated into archaeological theory in a useful way. Using an interpretive post-processual framework, I explore ways in which the results of archaeometric studies can be incorporated into a greater body of theory. I argue that Clifford Geertz's "thick description" provides a useful starting point for the integration of the current radiolarian study within a post-processual perspective. Using the results gathered thus far, the following section will tease out how archaeometric techniques can shed new light into

cognition and perceptions of landscapes as they pertain to Barbadian potters and ceramic construction.

In *Thick Description: Towards an Interpretive Theory of Culture*, Clifford Geertz (1977) applied Gilbert Ryle's interpretation of thick description to ethnography. Ryle demonstrated how the twitching of one's eye and the act of winking represent both physical and symbolic behaviors. Extrapolating from this, Geertz contended that thick description should be incorporated into ethnography as a stratified hierarchy of meaningful structures in terms of which twitches, winks, fake-winks, parodies, and the rehearsal of parodies are produced, perceived, and interpreted. In anthropological writings, Geertz argued that what we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to. To him, culture is the context to which social events, behaviors, institutions, or processes can be attributed, and is made up of interworked systems of construable signs. Culture is most effectively treated as a symbolic system by isolating its elements, specifying the internal relationships among those elements, and then characterizing the whole system in some general way (Geertz 1977:6-17). Although Geertz employed thick description in the construction of ethnography in the form of recording and interpreting human behavior, the symbolic layering of human action can also be applied to the interpretation of material culture.

Beaudry et al. (1991:152-53) advocate the blending of an interpretive approach, normally applied to symbolic aspects of culture, with the archaeologist's necessary focus on material and particular things. Their approach to the archaeological record attends to its substantive and functional roles, as well as its ideological role. The authors argue for a focus on archaeological, historical, institutional, and behavioral contexts, while avoiding the tendency to treat meaning and context as static. Their treatment of the material record closely parallels Geertzian notions

of thick description in a several important ways. Generally speaking, material objects contain many layers of meanings or representations, whether they are ideological or functional. Further, as Beaudry et al. point out, these multiple layers of meaning can be expressed in a variety of ways or contexts. The archaeologist, then, should use thick description to uncover the stratified hierarchy of meaningful structures that are manifested within material objects. What we call our data that we apply to artifacts, are really our own interpretations of other people's interpretations of their own objects. As such, archaeological data, whether it be carefully measured, categorized, or chemically characterized, should be carefully deconstructed layer by layer in order to fully understand the multiple meanings conveyed by single objects. These layers will be explored in conjunction with the data produced by this radiolarian study.

The method of interpretation can be applied to redware ceramics found on archaeological sites in Barbados, like conical sugar molds. Red earthenware manufacture developed within the context of an emerging sugar industry, which emphasized a high degree of efficiency in order to maximize capital gain. Once cane juice was extracted from sugarcane and purified, the juice was transferred to red earthenware molds where the cane juice cooled and crystallized to form sugar. Juice that did not crystallize drained out of the bottom of the earthenware sugar mold and formed molasses (Smith 2005:43). This initial drying process lasted forty-eight hours from which the end product was a still-wet dark brown sugar called muscavado (Dunn 1972:195). After the sugar was removed, any remaining residue from sugar crystallization was transported to the still house for use in the production of rum (Handler et al. 1986:414; Smith 2005: 17-20). Claying, a common practice in Barbados, was employed in order to better refine this muscavado. This process entailed capping the top of the conical red earthenware sugar mold with wet clay so that water would percolate down the cone and through the sugar, bringing the impurities along with

it. This created a spectrum within the sugar mold with lighter, purified sugar at the top and muscavado at the bottom (Menard 2006:76). Ultimately, sugar production could be characterized by a high degree of efficiency through the conversion of waste products into marketable goods, such as molasses and rum, as well as the production and use of industrial red earthenware sugar molds. Now that the functional layer of a redware sugar mold has been contextualized, it is important to understand the people who constructed these vessels. Although sugar molds were produced in both England and Barbados, I will focus on Barbadian potters.

James Petersen et al. (1999:164) chose to focus on pottery traditions as a means of identifying the people involved in the construction of redware ceramics. By designating the terms Afro- and Euro-Caribbean wares to pottery found on historic sites in the Caribbean, Petersen et al. was able to explore the fusion of African and European knowledge through a creolization model. The technologies employed in the construction of hand-built, low-fired wares; or wheel-thrown, kiln-fired wares make up yet another layer of meaning to the presence of redwares on historic sites. This presence reflects the conscious expression of knowledge by the people who made them in order to meet substantive, functional, or ideological needs. Archaeological evidence of a sugar mold represents not only the means to a functional end, but embodies a specific set of skills influenced by the convergence of knowledge between people. In the case of Barbadian redware, Loftfield (2001:227) argues for the importance of the idea that English potters taught Africans English ceramic technology. Pottery constructed through the synthesis of European and African knowledge provides evidence of cultural preferences in manufacture and use. Therefore, archaeologically recovered redwares represent an interface for cultural exchange embodied in a creolization model. While the designation of European or

African pottery traditions dominate the discussion of local redware production, it is important to consider some of the people who may have practiced these traditions.

Handler and Lange (1978:26-27) caution the use of historical sources to infer precise cultural indicators about Africans that were abducted into the transatlantic slave trade. Although Europeans recognized cultural variants among imported Africans, they employed simplified cultural nomenclature or typologies that had a homogenizing affect on the great diversity of African cultures represented in the enslaved population. This creates a great deal of uncertainty in identifying ethnicities of enslaved Africans in Barbados, but historical sources allow us to determine geographical origin with some confidence. Up until the 1660's, the Dutch supplied the majority of enslaved Africans to Barbados. These Dutch traders operated in the western parts of the Bight of Benin and the Gold Coast. The Dutch were supplanted by the Royal African Company during the late seventeenth to mid eighteenth century. The Royal African Company's forts and trading posts were dispersed along the western coast of Africa, but their major activities were concentrated along the Gold Coast during this period. Historical evidence indicates that the majority of enslaved Africans transported to Barbados came from the Gold Coast and the Bight of Benin, which comprised people who came from cultural-linguistic groups that originated in present-day Ghana, Togo, Dahomey, western Nigeria, and neighboring areas. Some of the ethnographically better known groups include the Adangme, Ashanti, Dahomeans, Edo, Fanti, Ga, Ibibio, Igbo, and Yoruba (Handler and Lange 1978:23-27). These general observations based on geographical region provide a broad idea of the diversity of enslaved Africans in Barbados.

Ascribing ethnicity to European potters practicing in Barbados proves to be problematic as well. Handler (1963b:133-135) identified regions in England with pottery production from

which indentured servants may have immigrated to Barbados. These regions included Wincanton in Somerset, Nottingham, Brislington, and parts of Staffordshire. Indentured servants emigrated from Ireland as well as England. Stephen Brighton (2009) explored the Irish diaspora with mention to the role of Barbados (See also Beckles). Indentured servitude in the West Indies and North America was presented to poor Irish Catholics as the only means for economic improvement. In return for their labor, they were promised the cost of passage, food, clothing, and shelter, as well as a plot of land at the end of their tenure. In Barbados, Irish Catholics were seen as a potential threat to English landowners. In order to maintain the social hierarchy, indentured servants were treated as harshly as enslaved Africans, working under similar conditions with little opportunity for upward mobility (Brighton 2009:42; also, see Beckles 1989 and Puckrein 1984). Prior to the replacement of indentured servants with enslaved labor, some of these Irish men and women may have participated in pottery manufacture on plantations. At the end of their tenure however, much of the available land had already been parceled out and divided amongst English planters. As a result, many of these formerly indentured servants were forced into the Scotland District where land was cheap. As previously discussed, pottery production flourished in this region due to the ready availability of clays. It is likely that these Irish Catholics continued to throw pots, though probably to an ever-decreasing extent (Sheppard 1977:24-25).

Pottery traditions as described by Petersen et al. (1999) not only inform different socio-cultural groups of Europe and Africa, but also help inform gender roles within pottery manufacture in Barbados. Ceramics associated with the Afro-Caribbean tradition are largely influenced by African-derived production in that they are hand-built and low-fired. African traditions may have also dictated that women were the active agents who produced these ceramic

vessels. Examples of this form of manufacture still exist in the Caribbean on islands such as Antigua, Jamaica, Nevis, and St. Lucia. On the other hand, wheel-made, kiln-fired pottery was typically produced by men, and although some female potters were present in at least one pot house, the majority of the potters appear to have been male (Browne 2010:4, Farmer 2011:1, Petersen et al. 1999:162-164). This division is reflective of the influence of European gender expectations during the early colonial era. Given that enslaved males were often tasked with specialized craft production on plantations, this trend would have continued in pottery manufacture despite existing skills practiced by African women. Although men dominated wheel-thrown vessel construction in Barbados, women did participate in secondary roles within the pot house operation. Kevin Farmer (2011:4) argued that in order to meet the necessary output for earthenware vessels on plantations in Barbados, gender expectations were broken to allow women to help with gathering and curing clays. Handler's ethnographic analysis of Chalky Mount's cottage pottery industry provides contemporary evidence of female participation in secondary roles of pottery production (Handler 1963a). Taking all of this into consideration, the archaeological presence of sugar mold fragments found on historic sites in Barbados signifies the importance of the development of gender roles within pottery production during the early colonial era.

Applying Geertzian notions of thick description, multiple interpretive layers of redwares associated with historic sites in Barbados have been discussed thus far through the example of sugar molds. The functional interpretation of archaeologically recovered sugar molds signifies their importance associated with sugar production. In order to meet this functional need, sugar molds can also be interpreted as the sum of particular skill sets formulated by different pottery traditions. Sugar molds can then be interpreted as representative of the people that practiced

within these traditions. Now that I have shown how historical evidence can be used to tease out different interpretive layers imbedded within an artifact type, I will now interpret how the archaeometric results produced by this study contribute to yet another layer of meaning.

Microscopic and chemical characterization of archaeological material creates an additional layer of meaning when it comes to the interpretation of artifacts. This data is reflective of the conscious decisions made by the people who constructed and used these materials, but interpreted in a different way. In the case of Barbadian redware, some of the samples analyzed contained radiolaria, which is indicative of local production on the island. Potters would have been unaware that the clays they chose for pottery production contained these microscopic skeletons, but would have been able to identify different properties of clay that made some clay more desirable than others. Barbadian redwares were constructed from sedimentary clay that predominantly consists of silicon and aluminum, as well iron oxide (hence the reddish color). This type of clay contains organic materials, which contribute to the clay's plasticity. Some clays have to be blended with different source clays in order to achieve an appropriate plasticity for constructing ceramic vessels (Conrad 1973:10). Jerome S. Handler (1963a) extensively studied pottery-making at Chalky Mount, located in St. Andrew's Parish in the Scotland District and while he identified multiple curing processes to enhance the clay's plasticity, none of these processes included the addition of different clays. Clay used in traditional wheel-thrown ceramics must have a higher plasticity to allow the clay to be manipulated as it is spun on a wheel. Chemical characterization of Barbadian redwares suggested that samples containing radiolaria had elevated silicon to aluminum ratios, likely due to the fact that radiolarian skeletons are primarily siliceous. This may have enhanced the clay's plasticity, making it an ideal clay for wheel-thrown construction.

Porosity is another ceramic characteristic that may have been affected by the presence of radiolaria. If radiolarian skeletons created microscopic gaps in the clay, the ceramics produced using these clays would be more porous. This may have presented a desirable characteristic especially in terms of shock resistance. Vessels made from this clay would have been more durable and able to withstand repeated use. Further, the porous nature of sugar molds may have positively affected the cooling and drying processes during sugar production.

Pottery manufacture developed in the Scotland District due, in part, to the unique properties of the clay in that region. In appropriately assigning agency to both enslaved and indentured potters, it is important to note that pottery manufacture developed in this region because potters understood the superiority of this clay source for wheel-thrown ceramic production, and deliberately constructed their workshops in this region. Given that this industry developed within a particular landscape in Barbados, it would be amiss to ignore aspects of landscape theory as another paradigmatic approach which adds yet another interpretive layer that can be incorporated into a Geertzian framework. Christopher Tilley (1996) defined landscape as a set of relationships between locales, emphasizing specific physical settings for social interaction. This definition of landscape is useful when considering the unique nature of clay in the Scotland District. Pottery manufacture emerged in areas where good clays were abundant and easily accessible. In return, redware ceramic production was restricted to this region but vessels were moved out of this region via internal exchange networks and social interaction. The presence of Barbadian redwares containing radiolaria outside of this region should be interpreted as the movement of people through space and the deliberate action of exchange. Further, different motivations for exchange should be considered such as enslaved African participation in internal markets, or planters trading with each other. Redware ceramics could be interpreted

as a locus for human interaction, and the knowledge of origin for these ceramics undoubtedly enhances this interpretation. The Scotland District was poorly suited for sugarcane cultivation, causing landowners to assign very little value to the land. As a result, this was the only land poor whites could afford to live on after their indenture was fulfilled. The inability to grow sugarcane also allowed for small craft industries, like pottery production, to flourish. These craft industries provided an economic market that met the needs of plantations operating nearby.

To sum up, this chapter was constructed in attempts to create a theoretical framework that incorporates groundbreaking results produced by archaeometric studies. In order situate these studies within archaeological theory, the major theoretical movements of culture history and processualism were used as a backdrop to better understand how archaeometry could fit within already established paradigms. In doing so, biases and potential inadequacies for the use of archaeometric results were teased out in conjunction with many of the popular critiques of culture history and processualism. This thesis seeks to develop a new theoretical approach that resonates within the post-processual school of archaeology. By expanding upon Geertz's use of thick description, material culture can be interpreted as having multiple symbolic layers. These layers of meaning have been ascribed by both peoples from the past as well as our interpretations of these people's perceptions. The results produced by archaeometric studies contribute to an additional symbolic layer of knowing. Moreover, these results can be used to mediate through, and better understand, the different symbolic layers of material culture. Material science and chemical characterization offer a great deal to our understanding of material culture, but these understandings should be applied in an historical and cognitive context that recognizes that these scientific results correlate with human experience. In the end, the continued development of a

theoretical framework that incorporates the data produced by archaeometric techniques will greatly enhance the value of these studies as they apply to people in the past.

V. Conclusion

The ubiquity of red earthenware found on historic sites in Barbados attests to the importance of pottery production during the early colonial era. While many of these redware vessels were imported from England, a local pottery industry emerged in the eastern parishes of Barbados during the latter half of the seventeenth century that helped subsidize domestic, industrial, and architectural ceramics needed on sugar plantations. Both European- and Barbadian-made pottery was constructed using wheel-thrown and kiln-fired technologies, making it nearly impossible to distinguish origin of manufacture within the archaeological record. Drawing upon previous archaeological research in the Caribbean, the application of archaeometric techniques, and considerations of broader theoretical frameworks, this thesis has developed a comprehensive approach to the treatment of archaeological recovered Barbadian redware.

Locally made Barbadian redware represents a unique element of material culture. Archaeologists tend to situate the presence of locally produced wares within particular pottery traditions that characterize the process of production in association with the geographical origin of these processes. The majority of locally produced pottery in the Caribbean has been associated with Afro-Caribbean traditions that utilize hand-built and low-fired practices. These ceramics have been partly designated as African because enslaved Africans constructed and used these vessels. The investigation of these practices along with vessel form typologies has dominated discussions of ethnicity and creolization. On the other hand, Barbadian-made redware can be characterized by Euro-Caribbean practices, which used wheel-thrown and kiln-fired technologies that originated in Europe. Although enslaved Africans primarily produced these vessels during the early colonial era, Euro-Caribbean practices dominated in Barbados and

there is scant evidence at best that wares were constructed using Afro-Caribbean practices. These similarities in European and Barbadian methods of pottery production make it difficult to infer anything about the presence of redware ceramics and the people that produced them.

In order to address this problem of distinguishing origin, this thesis employed several archaeometric techniques that helped microscopically and chemically characterize redwares found on historic sites in Barbados. The culmination of data over three phases of investigation showed that scanning electron microscopy allowed for the identification of radiolaria within the clay of some of the samples analyzed. Radiolaria can be linked to clay sources unique to a specific geographical region in Barbados. Therefore the presence of these radiolarian-fossils within redware ceramics suggests local production within the oceanic region, surrounding the Scotland District. Drawing upon historical and ethnographical evidence in addition to the data produced by this study, locally made redwares were also constructed using clays that did not contain radiolaria. In terms of a diagnostic marker for Barbadian production, the presence of radiolaria indicates production in a certain region of Barbados, but the absence of radiolaria is not exclusive to imported redwares. While the use of radiolaria as a diagnostic marker for local production has proven to be an important step towards the characterization of Barbadian redware, more work needs to be done in order to distinguish between English redwares and Barbadian redwares that do not contain radiolaria.

The final component of this thesis established a foundation for the incorporation of this archaeometric study into a broader theoretical framework. By expanding upon Geertz's use of thick description, material culture can be interpreted as having multiple symbolic layers of meaning. The results produced by archaeometric studies contribute an additional symbolic layer of meaning through the physical and chemical characterization of archaeological material.

Although this suite of technology allows for a contemporary understanding of the composition of artifacts, these understandings should be applied in an historical and cognitive context that recognizes that these scientific results correlate with human experience. It is my final contention that while archaeometry is a powerful tool that can be applied to understanding the archaeological record, the results produced from these analyses must be interpreted in conjunction with historical and ethnographic evidence. Results from these studies are only useful when situated within appropriate historical contexts that emphasize human perception and expression of knowledge.

BIBLIOGRAPHY

Ahmad, N.
1973 Soils of Barbados. Caribbean Food Crops Society, Eleventh Annual Meeting Proceedings, Barbados XI.

Anderson, O. Roger
1983 Radiolaria. New York: Springer-Verlag.

Beaudry, Mary C. Lauren J. Cook, and Stephen A. Mrozowski.
1991 Artifacts and Active Voices: Material Culture as Social Discourse. *In* The Archaeology of Inequality. Randall H. McGuire and Robert Paynter, eds. Pp. 150–191. Oxford: Basil Blackwell.

Beckles, Hilary
1989 White Servitude and Black Slavery in Barbados, 1627 – 1715. Knoxville: University of Tennessee Press.

2006 A History of Barbados: From Ameridian Settlement to Caribbean Single Market. Cambridge: Cambridge University Press.

Bennett, J. Harry Jr.
1952 The Problem of Slave Labor Supply at the Codrington Plantations. The Journal of Negro History 37(2):115-141.

1958 Bondsmen and Bishops: Slavery and Apprenticeships on the Codrington Plantations of Barbados, 1710 – 1838. Berkeley and Los Angeles: University of California Press.

Binford, Lewis
1962 Archaeology as Anthropology. American Antiquity. 28(2):217-225.

1982 Objectivity – Explanation – Archaeology. *In* Theory and Explanation in Archaeology. Pp. 125-138. Academic Press, Inc.

Blakey, Michael
1996 Skull Doctors Revisted. *In* Race And Other Misadventures: Essays In Honor Of Ashley Montagu In His Ninetieth Year. Larry T. Reynolds and Leonard Lieberman, eds. Pp. 64-95. Rowman & Littlefield.

Boas, Franz
1920 Methods of Ethnology. *In* Anthropological Theory: An Introductory History. R. Jon McGee and Richard L. Warms, eds. Pp. 121-128. San Marcos: Texas State University.

Brighton, Stephen
2009 Historical Archaeology of the Irish Diaspora: A Transitional Approach. Knoxville: University of Tennessee Press.

Bronnimann, P.
1949 Notes on the Ecological Interpretation of Fossil Globigerina Oozes from the West Indies. The Micropaleontologist 3(2):23-27.

Browne, Sandra
2010 Contributing to the Preservation and Promotion of Barbados Cultural Heritage: Pottery-Making, Special Reference to the Monkey Jar. Paper presented at the History Forum, University of the West Indies Cave Hill Campus.

Conrad, John W.
1973 Ceramic Formulas: The Complete Compendium. New York: MacMillan Publishing Company.

Cultrone, G., E. Molina, C. Grifa and E. Sebastian
2011 Iberian Ceramic Production from Basti (Baza, Spain): First Geochemical, Mineralogical, and Textural Characterization. Archaeometry 53(2):340-363.

Dunn, Richard S.
1972 Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624-1713. Chapel Hill: The University of North Carolina Press.

Farmer, Kevin
2011 Women Potters? A Preliminary Examination of Documentary and Material Culture Evidence from Barbados. History in Action 2(1):1-8.

Ferguson, Leland
1992 Uncommon Ground: Archaeology and Early African America, 1650-1800. Washington D.C. and London: Smithsonian Institution Press.

Geertz, Clifford
1977 The Interpretation of Cultures. New York: Basic Books.

Gill, Maninder Singh and Thilo Rehren
2011 Materials Characterization of Ceramic Tile Mosaic from Two Seventeenth-Century Islamic Monuments in Northern India. Archaeometry 53(1):22-36.

Haeckel, Ernst
2005 Art Forms from the Ocean: The Radiolarian Atlas of 1862. Introductory Essay by Olaf Breidbach. London: Prestel.

Handler, Jerome S. and Frederick W. Lange
1978 Plantation Slavery in Barbados: An Archaeological and Historical Investigation. Lincoln: toExcel.

Handler, Jerome S.
1963a Pottery Making in Rural Barbados. Southwestern Journal of Anthropology 19(3):314-334.

1963b A Historical Sketch of Pottery Manufacture in Barbados. The Journal of the Barbados Museum and Historical Society 30(3):129-153.

1974 The Unappropriated People: Freedmen in the Slave Society of Barbados. Baltimore: The John Hopkins University Press

Hauser, Mark
2008 An Archaeology of Black Markets: Local Ceramics and Economies in Eighteenth-Century Jamaica. Gainesville: University Press of Florida.

Hauser, Mark and Douglas V. Armstrong
1999 Embedded Identities: Piecing Together Relationships through Compositional Analysis of Low-Fired Earthenwares. In African Sites Archaeology in the Caribbean. Jay B. Haviser, ed. Pp. 65-93. Princeton: Markus Wiener Publishers.

Heath, Barbara J.
1988 Afro-Caribbean Ware: A Study of Ethnicity on St. Eustatius. Ph.D. dissertation, Department of Anthropology, University of Pennsylvania.

199 Yabbas, Monkeys, Jugs, and Jars: A Historical Context for African-Caribbean Pottery on St. Eustatius. *In* African Sites Archaeology in the Caribbean. Jay B. Haviser, ed. Pp. 196-218. Princeton: Markus Wiener Publications.

Isendoorn, A.J. Daan, Corinne L. Hofman, and Mathijs Booden
2008 Back to the Source: Provenance Areas of Clays and Temper Materials of Pre-Columbian Caribbean Ceramics. Theme issue, "An Exploratory Study into the Characterization of Caribbean Ceramics, in Memory of James B. Petersen," Journal of Caribbean Archaeology, Special Publication 2:15-23.

Johnson, Mathew
2010 Archaeological Theory: An Introduction. Malden: Wiley-Blackwell.

Kelly, Kenneth G., Mark W. Hauser, Christophe Descantes and Michael D. Glascock
2008 Compositional Analysis of French Colonial Ceramics: Implication for Understanding Trade and Exchange. Theme issue, "An Exploratory Study into the Characterization of Caribbean Ceramics, in Memory of James B. Petersen," Journal of Caribbean Archaeology, Special Publication 2:85-107.

Klingberg, Frank J.
1949 Codrington Chronicle: An Experiment in Anglican Altruism on a Barbados Plantation, 1710-1834. Los Angeles and Berkley: University of California Press.

Kosso, Peter
1991 Method in Archaeology: Middle-Range Theory as Hermeneutics. American Antiquity. 56(4):621-627.

Loftfield, Thomas C.
2001 Creolization in Seventeenth-Century Barbados: Two Case Studies. *In* Island Lives: Historical Archaeologies of the Caribbean. Paul Farnsworth, ed. Pp. 207-233. Tuscaloosa: University of Alabama Press.

Ligon, Richard
1670 A True & Exact History of the Island of Barbadoes. London.

Marks, Jonathan
2003 98% Chimpanzee and 35% Daffodil: The Human Genome in Evolutionary and Cultural Context. *In* Genetic Nature/Culture. Alan H. Goodman, Deborah Heath, M. Susan Lindee eds. Pp. 132-153. Berkley: University of California Press.

Menard, Russell
2006 Sweet Negotiations: Sugar, Slavery and Plantation Agriculture in Early Barbados. Charlottesville: University of Virginia Press.

Minc, L. D. and R. J. Sherman
2011 Assessing Natural Clay Composition in the Valley of Oaxaca as a Basis for Ceramic Provenance Studies. Archaeometry 53(2):285-328.

Mintz, Sidney W. and Richard Price
1976 The Birth of African-American Culture: An Anthropological Perspective. Boston: Beacon Press.

Petersen, James B., David R Watters, and Desmond V. Nicholson
1999 Continuity and Syncretism in Afro-Caribbean Ceramics from the Northern Lesser Antilles. *In* African Sites Archaeology in the Caribbean. Jay B. Haviser, ed. Pp. 157-195. Princeton: Markus Wiener Publishers.

Puckrein, Gary
1984 Little England: Plantation Society and Anglo-Barbadian Politics, 1627-1700. New York: New York University Press.

Saunders, John B., Daniel Bernoulli, Edith Muller-Merz, Hedi Oberhansli, Katherina Perch-Nielsen, William R. Riedel, Annika Sanfilippo, Rudolph Torrini, Jr.
1984 Stratigraphy of the Late Middle Eocene to Early Oligocene in the Bath Cliff Section, Barbados, West Indies. Micropaleontology 30(4):390-425.

Scarlett, Timothy James, Robert J. Speakman, and Michael D. Glascock
2007 Pottery in the Mormon Economy: An Historical, Archaeological, and Archaeometric Study. Historical Archaeology 41(4):72-97.

Schomburgk, Robert H.
1848 The history of Barbados Comprising a Geographical and Statistical Description of the Island, a Sketch of the Historical Events Since the Settlement and an Account of its Geology and Natural Productions. London.

Sheppard, Jill
1977 The Redlegs of Barbados: Their Origins and History. New York: KTO Press.

Smith, Frederick
2005 Caribbean Rum: A Social and Economic History. Gainesville: University Press of Florida.

Steineck, Lewis P., Marshall Breen, Nancy Nevins, Patricia O'Hara
1984 Middle Eocene and Oligocene Deep-Sea Ostracoda from the Oceanic Formation, Barbados. Journal of Paleontology 58(6):1463-1496.

Steward, Julian and Frank M. Setzler
1938 Function and Configuration in Archaeology. American Antiquity. 4(1):4-10.

Tilley, Christopher
1996 The Power of Rocks: Topography and Monument Construction on Bodmin Moor. World Archaeology. 28(2):161-176.

Watson, Patty Jo
1995 Archaeology, Anthropology, and the Culture Concept. American Anthropologist. 97(4):638-694.

White, Leslie
1943 Energy and the Evolution of Culture. *In* Anthropological Theory: An Introductory History. R. Jon McGee and Richard L. Warms, eds. Pp. 121-128. San Marcos: Texas State University.

Wood, Karrie Champneys, Kenneth G. Miller, G. P. Lohmann
1985 Middle Eocene to Oligocene Benthic Foraminifera from the Oceanic Formation, Barbados. Micropaleontology 31(2):181-196.

Young, Victor and Fazal Hosein
1984 Barbados Field Trip. The Geological Society of Trinidad & Tobago Newsletter 8 (September).