Pottery Exchange and Interaction at the Crystal River Site (8CI1), Florida

by

Kassie C. Kemp

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University of South Florida

Major Professor: Thomas J. Pluckhahn, Ph.D.
Brent R. Weisman, Ph.D.
Robert H. Tykot, Ph.D.

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DEDICATION

I dedicate this thesis to my professors, coworkers, family, and friends who supported me throughout my academic endeavors. A special thanks to my wolf pack for keeping me motivated throughout this project. I would especially like to thank my Mom, Daddio, and sister, Jordan, for always believing in me and supporting me with their love and encouragement. You are without a doubt the best family a gal could ask for, I love you all. I am also grateful to Roxie and Disco Lady who kept me company during those long study sessions. Most of all I would like to thank Joe who packed up his whole life and moved across the country to allow me to pursue my dream. I never would have made it through this adventure without his support.

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ABSTRACT

The Crystal River site (8CI1) is a Woodland-period mound (ca. 1000 BC to AD 1050) complex located on the west-central Gulf coast of Florida. Links to the Hopewell Interaction Sphere suggest that the people of Crystal River had connections with a broad range of communities, yet little is known concerning the role the site played in local, regional, or long-distance exchange networks. Pottery traditions vary amongst different communities of practice, therefore the level of interaction at Crystal River can be measured by looking at variation in the ceramic assemblage. I combine type/attribute, vessel form and function, gross paste, and chemical analyses to determine the amount of variability present in the pottery assemblage. These analyses show that Crystal River has a high level of ceramic variation with some spatial and temporal patterning. To determine Crystal River's membership in and potential role within a sphere of interaction, I compare these patterns to three community types with diverse social interfaces. This research suggests that Crystal River may have started out as a homogenous, residential community but through time began to interact with a number of diverse, regionally associated communities drawn to the site for special occasions.

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CHAPTER 1:

INTRODUCTION

Since C. B. Moore (1900) initially documented the site in the early twentieth century, Crystal River (8CI1), on Florida's west-central Gulf Coast (Figure 1-1), has confounded archaeologists (Bullen 1951a, 1953, 1966; Greenman 1938; Moore 1900, 1903, 1907, 1918; Pluckhahn et al. 2009; Smith 1951; Weisman 1987, 1995; Willey 1948, 1949; Willey and Phillips 1944). It is now commonly understood that the site dates to the Middle and Late Woodland periods (ca. 300 BC to AD 1050). But the reason for the site's centrality in regional and extra-regional trade and interaction networks, as evidenced by Moore's recovery of elaborate artifacts of bone, stone, shell, minerals, and metals has yet to be deciphered.

Ceramic analysis can help to place the Crystal River site into a contextual framework for understanding the scale and nature of interaction. Pottery production and dispersal is directly affected by the sociality of its creators and thus ceramic studies provide a conduit for observing interaction. In this thesis, I use a number of ceramic analyses to determine the scale of interaction at the Crystal River site.

Research Design

The Crystal River site is known for its extensive mound architecture and artifact assemblage. Early researchers at the site noted that many artifacts had Hopewellian traits

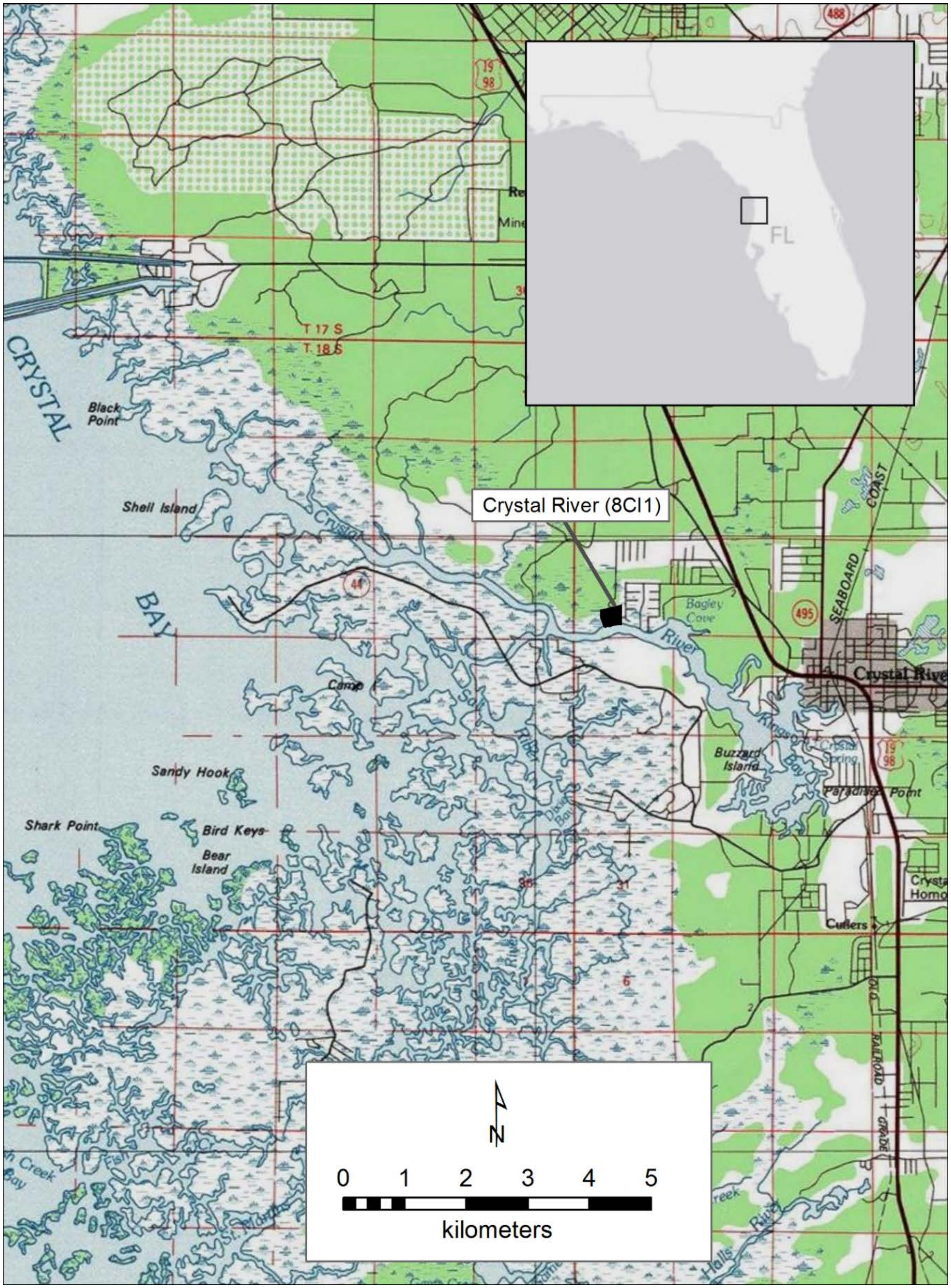

Figure 1-1. Location of the Crystal River Site.

(Greenman 1938; Moore 1900, 1903, 1907, 1918; Sears 1962). Hopewell refers to a specific type of artifact assemblage found during the Middle Woodland period ca. 100 B.C. to 400 A.D. The Hopewell sphere is focused in the eastern part of North America, specifically Ohio, Illinois, Indiana, and also into southern regions such as Florida. Sites within this sphere have assemblages that usually include large earthworks, complex burial grounds, exotic and locally made artifacts, and non-utilitarian grave goods (Bolnick and Smith 2007: 628; Braun 1979; Brose 1979, 1994; Schortman 1989). Hopewellian artifacts are exotic goods such as mica and copper that share similar traits and are shared in numerous types of long-distance interactions. Little is known about the placement of the Crystal River site in any form of exchange network, whether that be local, regional, or to sites farther north. Recent research by Pluckhahn and others (Pluckhahn and Thompson 2009; Pluckhahn et al. 2009, Pluckhahn et al. 2010a, 2010b, 2015; Thompson and Pluckhahn 2010; Weisman et al. 2007) has attempted to place the site into a contextual framework of interaction. My project is being conducted in association with this current research, and focuses on using ceramics to create this interaction framework for Crystal River.

With all of the Hopewell associations, it is surprising that Crystal River's ceramic assemblage has few of these traits, apart from a few vessels recovered by Moore (Greenman 1938; Shetrone 1930; Weisman 1995; Willey and Phillips 1944; Willey 1948). Does this mean that the exotic Hopewellian artifacts were shared through long-distance connections but the pottery was not? If that was the case, is all of the pottery locally made or was it shared regionally? The variation in the ceramic collection at Crystal River has been previously established (Moore 1900, 1903, 1907, 1918; Greenman 1938; Weisman 1995; Willey 1948, 1949; Willey and Phillips 1944). Pottery is vastly affected by social interactions and the variety within an assemblage created by these interactions can help archaeologists study the contributing communities (Bourdieu 1977; Braun 1983; Clark 1968; Giddens 1984; Pauketat 2000; Plog 1980; Rice 1984, 1987; Shepard 1961; van der Leeuw 1984). Different communities of practice may have interacted to create these ceramic differences. A large mound complex such as Crystal River would most likely attract people from distance areas and the diverse ceramic assemblage suggests that some form of pottery exchange occurred even if that exchange was not to sites as far afield as Ohio. However, little research has focused on the assemblage and current data is coarse. In order to answer these questions, I use a number of ceramic analyses to better our understanding of the assemblage.

This research seeks to understand the scale of social interaction at Crystal River. To do this, I discuss the results in terms of Carr's (2006b) three types of Hopewellian centers: residential, sustainable, and symbolic. Does the variability in ceramics decrease through time, as would be the case in a residential community, or is it constant throughout the occupation sequence as in a sustainable community? A residential community would most likely interact on a small scale and have the ability to assimilate new members into the community rapidly. A sustainable center on the other hand would have a very large interaction sphere where people may come and go on a regular basis. Once I have determined what type of center the Crystal River site was, I can speculate on whether interaction occurred on a local, regional, or much larger scale.

Organization of Thesis

In Chapter 2, I discuss the geographical setting for the Crystal River site and provide an overview of its archaeological and historical background. I also give a detailed review of the ceramic research previously completed at the site. Chapter 3 outlines the theoretical frameworks utilized in this project including community of practice theory. This chapter also further outlines the three interaction centers used as hypothetical frameworks for Crystal River and suggests that one may be more suitable than the others.

In Chapter 4, I describe the first ceramic analysis employed in this research, a type/attribute analysis. This analysis offers information on cultural historical context and provides a foundation for subsequent analysis. I provide the methods and results of this analysis and the relation the results have with the three center hypotheses. Chapter 5 summarizes the methods and results of the vessel form and function analysis. This can help to determine the types of activities that occurred at the site. In Chapter 6, I outline the chemical and gross paste analyses conducted as part of this research project. I provide methods for each analysis and discuss how the results of each compare to one another. This chapter allows for observations on the scale of interaction. Finally, Chapter 7 discusses and compares the results of these analyses to make a determination on the type of center Crystal River may have functioned as. This chapter also details the limitations of the study and suggestions on future research. The benefits of this research project are also provided.

CHAPTER 2:

CRYSTAL RIVER AT A GLANCE

Geographic Setting

The Crystal River site is located in west-central Florida, on the northern side of the river for which it is named. The Crystal River runs from Kings Bay northwest into the Gulf of Mexico. The site sits along the coast in a lowland zone on the largest plain in Florida, known as the Pamlico terrace (Cooke 1945; White 1970). Not unexpected given the low-lying topography, swampy areas predominate (Cooke 1945; White 1970).

The Palmico terrace is characterized by a thin layer of poorly drained sand with clay over limestone (Cooke 1945). A total of eight soil types cover the area, most of which are poorly drained. Quartzipaments, 0 to 5 percent slope, is the most frequently occurring type and is moderately well drained (Pliny et al. 1988). The amount of poorly drained soils is evident in the recurrent flooding of the Main Burial Complex and plaza features in the rainy season (Pluckhahn et al. 2009). The Crystal River area is relatively flat; ranging from elevations at sea level to around 30 meters above sea level (Cooke 1945).The site has upland, estuarine, and wetland environments but is dominantly upland with many live oak, cabbage palm, and red cedar covering the site. These environments lead to an interesting mix of fauna including deer, raccoon, numerous bird and fish species, turtles, manatees, and crab (Pluckhahn et al. 2009).

The Crystal River archaeological site is a state park and became a National Historical Landmark in 1990 (National Park Service 2011). An archaeological museum, built in 1965, is located in the northwestern corner of the site (Weisman 1995). The site includes numerous architectural features of earth and shell (Figure 2-1). The Main Burial Complex is comprised of a main burial mound (F) which sits atop a platform (E). Surrounding E and F is a flat area (D) and the Circular Embankment (C). Another burial mound, Mound G, is located northwest of the Main Burial Complex. The site also has platform mounds (A and H) located at the southwestern and northeastern ends of the site. A large, artifact-sterile plaza area lies south of Mound H and connects the ramped mound with Mound G. Mound K, another platform mound, and Mound J are located on the eastern end of the site. The comma-shaped Midden B lies east of Mound K and runs north of Mound A, terminating at the southeastern park boundary. The last features of the site are the three limestone stelae located on either side of the Main Burial Complex and south of the Crystal River Archaeological Museum (Bullen 1951a, 1953, 1966; Moore 1903, 1907, 1918; Weisman 1995).

Archaeological and Historical Background of the Crystal River Site

The history of archaeological investigation at Crystal River began with Clarence B. Moore (1900, 1903, 1907, 1918) who conducted excavations between 1903 and 1917. Moore mapped the site, excluding Mounds J and K and the stelae, and excavated the main burial complex. He was responsible for the lettering system assigned to the Main Burial Complex. The same system was later used to letter the other features and is still in use today. His report on these investigations provided detailed drawings and photographs of some of the rare and exotic artifacts excavated from burials (Moore 1903, 1907; Weisman 1995). However, he had little concern for reporting more mundane finds or for placing the site in a cultural historical context (Weisman 1995).

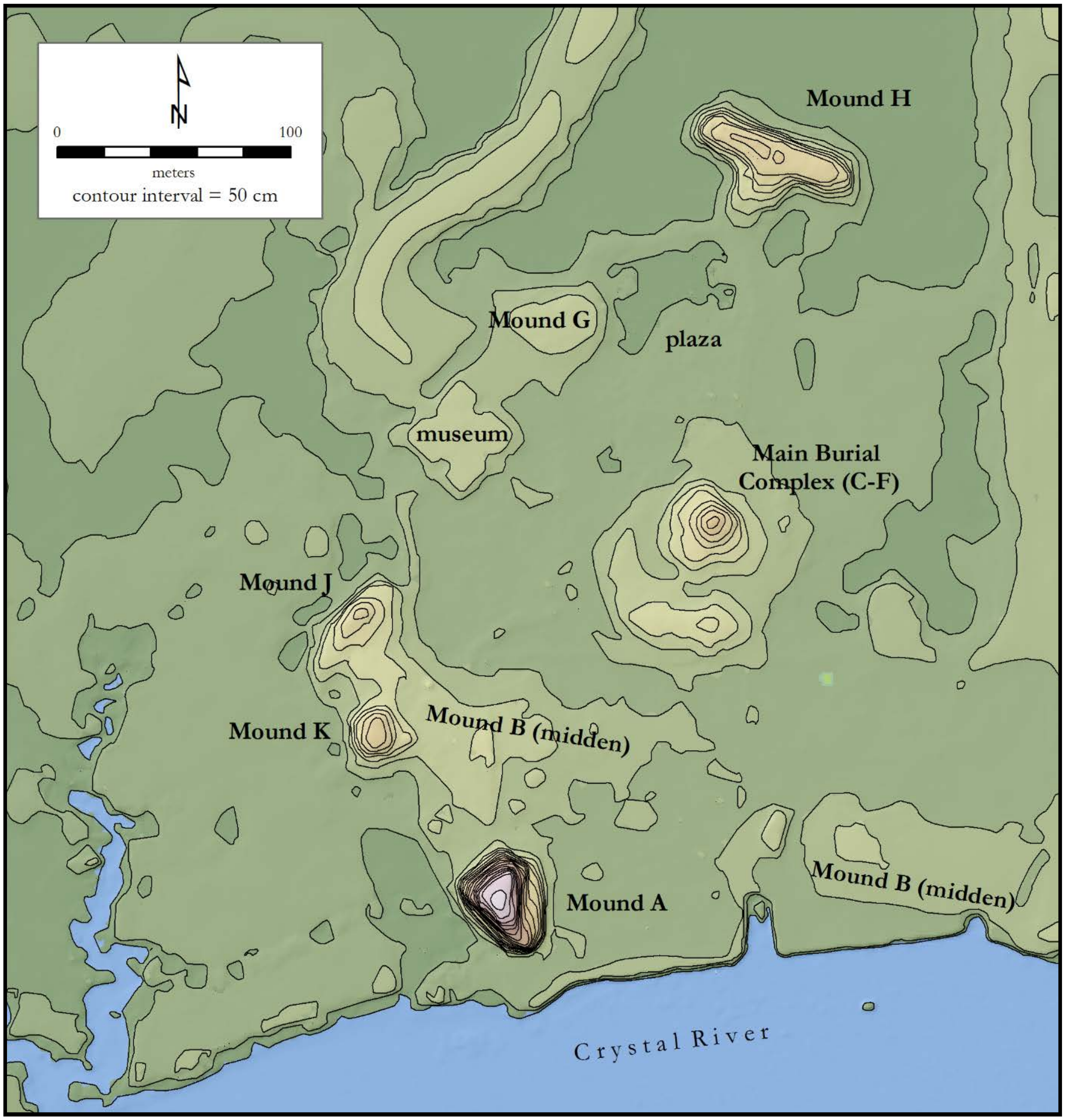

Figure 2-1. Crystal River architectural features.

More than 30 years passed from the time Moore left before any additional archaeological excavations were conducted at the site. During that time, many people studied the site and speculated on its chronological placement and material culture and Hopewellian influence (Pluckhahn et al. 2009; Weisman 1995). These researchers included Greenman (1938) who looked at Hopewell correlations in pottery from the site and Willey (1948, 1949; Willey and Phillips 1944) who discerned that the pottery at Crystal River belonged principally to the Santa-Rosa Swift Creek, and Weeden Island complexes. Willey, Antonio Waring, Jr., and Rufus Nightingale completed a one-day surface survey of the Circular Embankment and Mound F in 1949 (Weisman 1995; Willey 1949). Smith (1951) refined Willey's proposed chronology with conclusions made from a 2 x 2 foot (0.6 x 0.6 meters) excavation unit he opened in Midden B, another in Mound H, a surface survey of Mound A, and tests into Mound C and Platform E.

Smith's conjecture on the chronology of the site was important to the ongoing debate about its placement. The Hopewellian style artifacts suggested a Middle Woodland occupation while the negative-painted pottery and flat-topped mounds were, at the time, thought to be evidence of a Mississippian occupation. Many researchers investigated the "enigmatic" (to borrow from Bullen [1951a]), quality of the site through numerous excavations. Although Bullen (1953) was convinced that at least some of the mounds at Crystal River dated to the Mississippian period, Weisman (1995) noted that in retrospect the excavations reaffirmed the occupation of cultural complexes proposed by earlier researchers at the site---specifically that the bulk of the occupation dated to the Woodland period. This debate lessened as the existence of flat-topped mounds prior to the Mississippian period became more widely accepted (Jefferies 1994; Pluckhahn et al. 2009).

In the summer of 1951, Ripley Bullen began his first field season at Crystal River. It was not until his work that extensive excavations were conducted using more modern methods (Bullen 1951a, 1953, 1966). Bullen excavated two stratigraphic test units in Midden B in 1951, followed by excavations of Mounds K, H, and G, the Main Burial Complex, and surface survey of Mound A in 1960. In the same year, Bullen first recorded Mounds J and K and made topographic maps of the site. During Bullen's final field seasons, the site was in the transition to a state park. The state officially received the deed to the land, approximately 18 acres of the much larger park that presently exists, in 1962 (Weisman 1995). Prior to that, numerous people owned the land. One owner did not deed his land, just east of Mound A, to the state and created a trailer park instead. This area was leveled with fill taken from the eastern side of Mound A and a sea wall was built.

In the mid-1960s, Bullen and the Florida State Museum began preparing the land for public visitors and creating the on-site museum. This included the restoration of previously excavated areas and the creation of an *in situ* burial exhibit in the Circular Embankment. In 1964, Bullen dug two more stratigraphic units in Midden B and excavated around the two stelae near the Main Burial Complex which were discovered when the site was being cleared for creation of the state park (Bullen 1951a, 1953, 1966; Weisman 1995). Hardman (1971), who believed that the layout of the earthworks at Crystal River had astronomical connections, recorded the discovery of the third stele just south of the museum, uncovered during construction. The Crystal River Museum opened to the public in 1965 and has had little update since that time (Weisman 1995).

Excavations at Crystal River since Bullen have been limited. Brent Weisman and Jeffrey Mitchem conducted limited excavations in the 1980s including core samples and two 2-x-2-m units (Weisman 1987, 1995). The *in situ* burial exhibit was also removed around this time. The trailer park located near Mound A remained until 1993. The homes were removed and the land became part of the state park in 1995 (Bullen 1966; Weisman 1995). In the last few decades, excavations at the site have been limited to mitigating the effect of natural disasters and planned developments (Ellis 1999, 2004; Ellis et al. 2003; Weisman et al. 2007).

More recently, Thomas Pluckhahn, Victor Thompson, and Brent Weisman began archaeological investigations as part of an NSF-funded project entitled the Crystal River Early Village Archaeological Project (CREVAP) (Pluckhahn et al. 2010a). The goal of the CREVAP project is to gain insight into the cooperation and competition of past peoples in the Crystal River area through the use of modern technology (Pluckhahn et al. 2010a). This project consists of archaeological fieldwork at both the Crystal River site and other sites in area, especially the nearby Roberts Island Shell Mound Complex located 500 meters west of Crystal River. These investigations include geophysical survey, minimally invasive sampling (core sampling and shovel testing), and limited test excavations (Blankenship 2013; Blankenship et al. 2011; Norman 2014; Pluckhahn et al. 2009; Pluckhahn and Thompson 2009; Pluckhahn et al. 2010b; Thompson and Pluckhahn 2010).

History of Ceramic Research at Crystal River

The ceramic assemblage at Crystal River was a point of interest in even the earliest excavations at the site. In his 1903 publication, Moore noted the existence of 26 vessels recovered from Mound F, most of which are types rarely found at the site including Crystal River Incised and the negative painted style most notably discussed in Willey and Phillips' 1944 publication. He also recovered some possible Hopewellian pots. Moore also provided illustrations of these vessels. His 1906 excavations yielded ten more ceramic vessels from the platform (Mound E); from his illustrations one might deduce that these included vessels that could be classified as Woodland-period types such as Deptford Simple Stamped, Swift Creek Complicated Stamped, Crystal River Incised, Weeden Island Plain, and Basin Bayou Incised. Moore also noted the presence of ceramic drinking cups in burials discovered in the Circular Embankment (Moore 1918).

Subsequent to Moore's work, the first discussion of Crystal River ceramics came from Greenman (1938) who used the ceramics and other artifacts recovered by Moore to argue that Crystal River had connections to the Hopewell Interaction Sphere. Other researchers had previously alluded to the Hopewell connection at Crystal River based on certain artifact traits but disagreed with its addition to the Hopewell Sphere because of the lack of these traits in the ceramic assemblage (Greenman 1938; Shetrone 1930). Greenman created a list of Hopewellian traits and compared these with artifacts recovered from Crystal River and discovered that Crystal River had the most traits in common with Hopewell material out of all 17 Florida mound sites considered. He noted that the Weeden Island flattened globular bowls seen at Crystal River were similar to those in the Hopewell tradition.

Willey and Phillips (1944) also attempted to connect Crystal River ceramics to the Hopewell Interaction Sphere, this time focusing on the negative painted pottery Moore recovered in 1903. They used these similarities to suggest that Mound F dated to the Mississippian period. Willey later reconsidered (Willey 1948) and with the comparison of the Crystal River sherds to those at other mounds, he concluded that the negative painted style ceramics date to the Santa Rosa-Swift Creek period. Willey's 1949 publication outlined all of the ceramics recovered by Moore and placed Crystal River in a cultural historical context. Willey noted that these ceramics belonged to three ceramic complexes: Deptford, Santa Rosa-Swift Creek, and Weeden Island (Willey 1949).

In 1951, both Bullen and Smith worked at Crystal River with the purpose of understanding the sequence of mound construction through the examination of ceramics and their cultural historical association (Bullen 1951a, Smith 1951). Smith's tests in the midden yielded mostly Pasco Plain pottery and also two St. Johns Check Stamped sherds in the Circular Embankment. Smith viewed the check stamped sherds as a possible indication of late Weeden Island period construction for the Circular Embankment, since Goggin had previously noted that the check stamped type appears late in the St Johns sequence. The purpose of Bullen's midden tests, excavated in 1951, were to add support to his hypothesis that the Main Burial Complex could be separated into three ceramic complexes based on the presence of certain ceramic types: Santa Rosa-Swift Creek, Weeden Island, and Safety Harbor (Bullen 1951a, 1953), the latter dating to the Mississippian period. Subsequent work, as described below, has failed to locate a significant Mississippian component at Crystal River.

Though Bullen's excavations at the site have been the most extensive, his work was never published in great detail. Other than Willey's 1949 book, Bullen's 1953 publication contains the most detailed information on Crystal River's ceramic assemblage. Bullen provides sherd tabulations by type and provenience of the two midden units excavated in 1951. Bullen (1953) made many inferences about the midden collection including the abundance of limestone tempered pottery and the lack of decorated types. He also observed two periods with respect to red filmed pottery, one in the later occupation where red filmed types are present and an earlier period where such types are absent.

The purpose of Weisman (1985) and Mitchem's midden excavations was to locate Safety Harbor period ceramics. The recovered material was never properly analyzed or reported. Weisman's 1995 publication, a Crystal River encyclopedia of sorts, provides a detailed outline of the available information from the Bullen excavations including a table listing the ceramics found in Midden B and the Circular Embankment. Weisman (1995) speculated that sourcing studies are important to understanding the ceramic assemblage. He stated that limestone tempered ceramics are usually seen as locally made while the St. Johns series suggest possible regional manufacturing or interaction. The large number of decorated types also points to regional and pan-regional interaction (Weisman 1995).

The crucial point that should be taken from this review is that, although there are a number of publications referencing the Crystal River ceramic assemblage, very little analysis has actually been completed. For a ceramics collection of over 16,000 sherds, few substantial observations have been made from Bullen's excavations. The purpose of this thesis is to make these much needed observations and finally begin to understand the Crystal River site through its available ceramic assemblage.

CHAPTER 3:

THEORETICAL FRAMEWORK

Pottery is an important resource for archaeological research not only for its sturdy composition and subsequent preservation but also for its functionality. As scientists, we often only need a piece of a pot to tell us about its composition, form, function, decoration, and manufacturing technique (Braun 1983; Shepard 1961). These factors can then get us to the information we are really interested in, where the pots were made, how people made them, and why they went through the trouble to do so. A pot, or a pot sherd, is not just evidence of cooking or storing food but is also a record of the materials available, the tools and techniques used for manufacture, the reason for creating the pot, the intellect and skill of the potter, the culture of his or her people, and the social and economic networks those people were involved in (Braun 1983; Hodder 1978, 1979; Plog 1980; Rice 1984, 1987; Shepard 1961; van der Leeuw 1984). All of these factors working together can easily create variability in pot-making that can be measured and used to discuss topics such as social change and the exchange of goods and ideas. Obviously not all of the variability from these factors results from social or cultural change, but it is widely accepted that pottery is strongly influenced by social dynamics (Braun 1983; Clark 1968; Plog 1980; Rice 1984, 1987; Shepard 1961; van der Leeuw 1984).

Shepard (1961:349) refers to pottery as a “cultural barometer” able to reflect social and cultural change. Because of this, archaeologists have developed many research techniques to “read” these barometric changes in pottery variability. Some are basic, such as looking at form to get to function, or at decoration and style to create a culture history seriation. But others are more complicated, such as looking at the compositional makeup of a sherd to discover where the materials within came from (Braun 1983; Shepard 1961). These diverse research techniques show that ceramic analysis is no longer limited to simple dating of a site but can be used to discuss the context of social interaction. Variability amongst prehistoric pottery types can be explained by more than basic spatial and temporal difference. Variation in temper and decoration can speak not only to broad cultural connections but also to smaller scale interactions as with exogamous marriage practices and other local collaborations (Hegmon 1992). This approach is based in practice theory, in which structure and agency play a part in everyday activities such as pottery making and can be used to comment on social constancy or change (Bourdieu 1977; Giddens 1984; Pauketat 2000). Some studies even provide information uncharacteristic of the norm such as Sassaman’s (2006; see also Sassaman and Rudolphi 2001; Sassaman et al. 2006) work on Stallings pottery. His research suggests that differences in the way the punctations on the pottery are oriented can give insight into the handedness of the potters who made them. Practice theory and approaches used by archaeologists will aid in the analysis of Crystal River pottery.

The goal of this thesis is to examine the scale of social interaction at Crystal River using its large ceramic assemblage. Did Crystal River serve as a ceremonial center for a local population or did it instead draw people from more distant areas? Preliminary data from Crystal River suggests that the ceramic assemblage exhibits considerable diversity in temper and decoration (Moore 1900, 1903, 1907, 1918; Greenman 1938; Weisman 1995; Willey 1948, 1949; Willey and Phillips 1944). This would contend that the site was attracting people from distant areas or of different pottery-making traditions, as seen at other large ceremonial sites such as Poverty Point, Moundville, and Cahokia (Pauketat 1997; Sassaman 2005; Sassaman and Rudolphi 2001; Sassaman et al. 2006; Wilson 2010). However, the data currently available are coarse and it is unclear how the role of the site may have changed through time. In this chapter, I develop these issues and review literature related to this research study.

Communities of Practice

Based on the diversity in the ceramic assemblage previously observed (Moore 1900, 1903, 1907, 1918; Greenman 1938; Weisman 1995; Willey 1948, 1949; Willey and Phillips 1944) Crystal River is most likely not a homogeneous community. Depending on the type and scale, the diversity could be explained in a number of ways. The first possibility is that the diversity in ceramics is associated mainly with the initial founding of the site, as people from different areas and pottery traditions came together to form a new community at Crystal River. If variability in ceramics decreases through time, especially in the village area, this would be evidence of the group becoming more homogenous in terms of the practices of pottery production, and by extension community identity more generally. A second possibility is that throughout its history Crystal River functioned mainly as a ceremonial center for disparate groups. This proposition would be supported if ceramic diversity was maintained throughout the occupation sequence at Crystal River. The third possibility, representing something of a middle ground between these two alternatives, is that Crystal River was home to a relatively homogenous group, but attracted people from other areas and other pottery-making traditions for ceremonies. This might be supported by homogeneity in midden ceramics but greater diversity in assemblages associated with mounds or other ceremonial features. These three possibilities correspond with Carr's (2006b) three types of Hopewell communities (residential, sustainable, and symbolic) which are discussed in greater detail later in this chapter.

Underlying these propositions are several key assumptions regarding how and why ceramics changes occur. Many researchers today associate ceramic change with transfer of knowledge. As a person becomes integrated into a new group, the way in which he or she makes pots will change, most likely to fit the style or process of that group (Wendrich 2012a). A person from one community is learning and adapting to the ways of another. The idea that communities are interacting with each other and transferring knowledge, as opposed to focusing solely on the individual is referred to as communities of practice, a term coined by Lave and Wenger (1991) and elaborated on by many current researchers (Pauketat 2002; Pauketat and Alt 2005; Pauketat and Emerson 1991; Sassaman 2005; Sassaman and Rudolphi 2001; Wendrich 2012a; Wenger 1998; Wilson 2010).

As defined by Lave and Wenger (1991:98) a "community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice". Communities of practice theory focuses on how an individual is integrated into a group by "peripheral learning," through imitation, observation, and graduated participation (Lave and Wenger 1991:29; Wenger 1998). Learning within a social context requires a change in a person, to be able to do new things and serve new functions within the new community of practice, "it implies becoming a full participant, a member, a kind of person" (Lave and Wenger 1991:53). Originally developed under the disciplines of education and psychology, "situated learning" theory and "legitimate peripheral learning" were ways to understand this knowledge transference (Lave and Wenger 1991:29-31). Lave and Wenger (1991) were trying to understand learning in the framework of apprenticeship and situated, or hands-on, learning, especially through craft apprenticeship. Their study of crafting in West Africa led them to the conclusion that situated learning is not simply hands-on learning and an important concept for use in education today but that it is a vital part of social practice and continuity in general (Lave and Wenger 1991:30-31). The authors refer to learning as a characteristic of social practice as opposed to practice as a characteristic of learning (Lave and Wenger 1991:34). Learning the ways of the community is part of becoming a member of that community and its social circle. In the sense of communities of practice, "learning is not merely a condition for membership, but is itself an evolving form of membership" (Lave and Wenger 1991:53).

Situated learning and communities of practice provides a useful framework for understanding ceramic variability and, by extension, the scales of social interaction at Crystal River. Pottery attributes that are easily affected by cognitive choice are a good measure of the number and types of communities interacting (Minar and Crown 2001:375). All stages of the pottery chaîne opératoires can reflect community membership or influence. Factors such as decoration, however, can be attributed not only to community membership but also to personal choice and functionality. Of course, as Gosselain (2000:190) states, the transmission of ideas within a process is not the same for all the stages of pottery production. Some stages are easily affected by subtle changes, such as the mimicking of decoration or clay selection, while other production stages such as paste creation and vessel forming require a much more substantial influence to alter the techniques (Lyons and Clark 2012:24-25; Gosselain 2000:191-192). Dyer (2012:147), for example, discusses the Native American resistance to Spanish influence on pottery traditions in New Mexico and shows that other than a few small technological changes, the introduction of Spanish ideas only altered vessel forms. Temper type variation can be accredited to availability in raw materials but paste variability is not so easily explained (van der Leeuw 1984; 1993). The process of creating paste is most likely a learned skill that is resistant to change (Minar 2001 as discussed below) and can be evidence of a potter's community of practice. By this same line of logic, forming certain vessels necessitates a certain level of skill and learned knowledge that are not easily altered. Surface treatment is easily visible on the outside of a pot and could result from imitation and is not necessarily the result of strong interaction (Gosselain 2000). However, the mere fact that a vessel comes in contact with a person who would need to copy the design (instead of learning it from their community) suggests some form of interaction amongst different communities of practice.

Variability at any stage could be evidence of graduated stages of learning, where an individual potter has not yet integrated into the group and completely adopted the new communities' techniques. The reasons behind a person's integration into a community of practice can vary, though for the case of Native American groups intermarrying is a likely candidate (Sassaman and Rudolphi 2001). Wendrich (2012a) claims that the reason communities of practice theory is perfect for looking at knowledge transfer is because it does not require you to know the exact relationship of the transfer. It allows you to deduce, based upon the data, what communities of practice the knowledge may have been transferred in. The learning environment was most likely analogous with the living environment and so a person could potentially be involved in a number of different communities of practice based on where they live and the type of society they live in (Wendrich 2012b). The types of communities of practice an individual is a part of depends on how old they are, the type of community they live in (whether they are exogamous or endogamous), and their position in that community (Minar and Crown 2001). A person at Crystal River would be part of their parents' community of practice, their spouse's community of practice if it differs, and the communities of practice of any other groups they interact with socially or economically. Wallaert's (2012:25) study of the Dowayo people from Camaroon in Africa shows their potters, along with blacksmiths, live in distinct, divided areas from the rest of their people. In this case, the potters themselves are a separate community of practice from that of the rest of the population. Within this community of potters, a girl learns potting from her mother through a long term apprenticeship. Once she is married, she goes through another apprenticeship with her mother in law, learning the techniques of her new community of practice. The variability that this situation would create should be visible in archaeological assemblages (Wallaert 2012:30-31).

A number of researchers have tested the visibility of communities of practice in artifact assemblages. Some focus on decorative elements while others look at more technological aspects of pottery production (Curewitz and Goff 2012; Eckert 2012; Gilpin and Hays-Gilpin 2012; Lyons and Clark 2012; Minar 2001; Sassaman and Rudolphi 2001). Lyons and Clark (2012:27) argue that dispersed populations of Kayenta immigrants moved into the Phoenix Basin and overtook the local pottery making tradition. The introduction of Roosevelt Red Ware from these migrant populations brought a new forming technique, vessel shape, paint, and firing technique to local potters and yet this new red ware type remained uniform. If locals began to adopt these new techniques and create their own copies, Roosevelt Red Ware would have a great amount of diversity visible (Lyons and Clark 2012:30-31). The lack of this variability leads the authors to believe that immigrants continued to keep Roosevelt Red Ware production to themselves, even when inter-marrying with local populations. The "competent execution" of the type in areas that did not even have potters goes against the idea that immigrants were teaching locals how to create this red ware (Lyons and Clark 2012:31). The authors hypothesize that Kayenta immigrants maintained their community of practice even in close contact with local communities because of a closed-ability learning system (one in which learning is limited to imitation and observation) which is not conducive to transferring knowledge outside of the system (Crown 1994:90; Lyons and Clark 2012:32; Wallaert-Pêtre 2001:482). Lyons and Clarke postulate that immigrants and their offspring kept close ties with other immigrant groups and their homeland to maintain the community of practice associated with Roosevelt Red Ware production (Lyons and Clark 2012:32).

If the ceramics in the Crystal River assemblage never reached a significant degree of homogeneity, one could argue that the site was always comprised of communities of practice that maintained distinct traditions of pottery production. Gilpin and Hays-Gilpin's (2012) study of polychrome pottery on the Hopi Mesas in northeastern Arizona supports the opposite result. They discuss a number of Hopi communities of practice, each with their own distinct pottery traditions, which shared techniques and practices and yet were able to sustain their separate community identities through pottery. As populations grew and blended on the mesas however, more and more diversity can be seen in pottery assemblages. This blending culminated in the creation of a new style of pottery, as one would expect if the communities were living close to each other and adopting and implementing techniques of other communities (Gilpin and Hays-Gilpin 2012:54).

Eckert (2012) sees homogeneity in the ceramics of two communities of practice in the Zuni region and yet considers them separate based on seemingly minor stylistic differences. Though the pottery is homogenous in all technological aspects, Eckert argues that the distinct interior slip color represents membership in different communities that are connected under a larger community of identity. She differentiates communities of identity as those in which people choose to identify with a certain group, versus a community of practice in which membership is based more on “unconscious decisions” (Eckert 2012:55). In this instance, variation in one major attribute led the author to believe that two communities of practice were interacting and creating similar yet different pottery (though this could be explained by a number of other factors). No patterns such as this have emerged within the Crystal River assemblage.

Schleher et al. (2012) also focuses on a specific attribute of pottery in their study concerning glaze ware from San Marcos Pueblo. They find that there is little to no variation in the glaze paint recipe at San Marcos throughout its occupation. Other sites in the region were using a comparable recipe, just with different sources of lead. The authors use this evidence to conclude that the single community of practice visible at San Marcos Pueblo may have been much larger and contained sites all along the central and northern Rio Grande Valley (Schleher et al. 2012:106). It is interesting to note that many of these examples show how a number of communities of practice are intermingling at one site or a cluster of close sites and yet some show that one site or region could belong to one single community of practice.

Minar’s (2001) study of cord marked pottery from Woodland period sites in the Alachua area of north-central Florida, and sites thought to be related to Alachua, makes the case that cordage twist direction reflects communities of practice. Since apprentices learn by imitation, they make cordage with the same twist direction as that of their teacher. Once the student becomes adept at making the cord, the process becomes “automatic.” The author argues that once the process is automatic, changing the twist direction requires a conscious alteration which can result in slowly made and potentially sloppy cordage. The automatic process leads to a conservation of twist direction and thus the conservation of the community of practice (Minar 2001:394-395). Groups with shared backgrounds are therefore more likely to have similar ways of making cordage. Out of all the sites considered, Minar concludes that two different communities of practice are at work, those that make Z twists (those related to Alachua peoples) and those that make S twists (those most likely not related to Alachua peoples). Some sites almost exclusively used one or the other of these styles but some were half Z and half S. The author refutes that this variation is based on fiber types and handedness of spinners, though others have used handedness as an indicator of communities of practice (Minar 2001:388; 397-398; Sassaman and Rudolphi 2001).

Sassaman and Rudolphi (2001) hypothesize that communities of practice were acting within pottery traditions in the Southeast, focusing on the Late Archaic Stallings Island culture in Georgia and South Carolina. They discuss how variation in pottery decoration and function fluctuate based on the different communities of practice among potters. The authors focus on the influence that post-marital residence can have on a tradition such as pottery making. They argue that if a community is unilocal, "communities of practice will involve residential continuity among members of one gender and discontinuity among members of the opposite gender" (Sassaman and Rudolphi 2001:416). Though we cannot necessarily relate one specific aspect of variability to a particular community of practice, we can detect the diversity and infer the cause(s). Sassaman and Rudolphi (2001:408) hypothesize that Stallings Island communities had a unilocal residence pattern, based on data concerning handedness of potters. They suppose that if the potters were mostly women, they were involved with two main communities of practice, that of their birth and that of their new spouse's family. The authors claim that pottery making techniques are passed down from the parents while cooking and decorating techniques can cut across different communities of practice based on marriage. This case study can be used as an example of the types of communities of practice that could be engaged at Crystal River. Though we do not have specific information on the configuration of their marriage practices, we can still say something about the communities of practice acting at Crystal River and the interplay of that with marital ties. After communities of practice and resultant variability are established in the collection, the question becomes where did these different communities of practice come from? In the next section, I will discuss the different possible scales of interaction at Crystal River, both local and distant.

The Hopewell Interaction Sphere

Many different frameworks have been created to describe interaction in the Hopewell sphere. Some researchers postulate that these exotic goods could have been exchanged under what is referred to as the prestige goods model. This model states that large interregional exchange structures are based on the exchange of prestige goods, valuable because of specialization or rarity, through elite control. Elites gain power and control through access to these goods (Baugh and Ericson 1993; Goad 1978; Helms 1993). It has also been suggested that the burial mounds and large earthworks characteristic of Hopewell sites were used to mark the power and territory of a certain society, lineage, or individual (Pacheco and Dancey 2006; Seeman and Branch 2006; see Trigger 1990). However, it is important to remember that large earthworks do not equal power and control; they simply represent a claim to that power (Morrison and Lycett 1994).

Shetrone (1930) reasons that the Hopewell Interaction Sphere was made up of one single integrated society and ignores the possibility of local and regional diversification of cultures within the system. Braun (1979, 1986) suggested that Hopewell was made up of peer polities that were connected through a complex network of exchange. Other scholars propose that the cultures are differentiated by their seasonal mobility and semi-sedentary movements and that exchange was dependent on these movements (Cowan 2006; Yerkes 2006). Struever and Houart (1972) consider the sphere to be based mostly on economic necessities while Caldwell (1964) emphasizes that Hopewell was based on common mortuary rituals and religious principles.

Even with all of these frameworks emphasizing different features of the Hopewell sphere, it is generally acknowledged that the interaction crosses many regions and consists of an extensive network connecting local communities (Bolnick and Smith 2007: 628). Caldwell (1964) imagined that the sphere was made up of a network of regionally interacting groups that also interacted on a larger scale. Finished products and raw materials were moved along this network and were deposited as grave goods (Braun 1986; Fie 2006; Seeman 1979; Struever and Houart 1972). It is also accepted that people from sites within this sphere may have gathered certain times during the year at different centralized sites, with mutual burial sites and large earthworks, in order to practice ritual behavior. The people that built and gathered at these places may have been connected by kin groups, made up of several kin groups, been non-descent based sodalities, or belonged to completely separate communities (Byers 2004, 2006; Charles 1995; Charles and Buikstra 2002; Martin 2005; Pacheco and Dancey 2006; Seeman and Branch 2006). This aspect has also been attributed to Crystal River (Goad 1978; Milanich 1994). Milanich (1994) maintains that Crystal River was connected by trade routes to the Midwestern United States and was also significant in trading relationships with other Gulf area sites. This suggests pan-regional and regional interaction. Sears (1962) believed that Crystal River was part of what he defined as the Yent complex, an adapted Florida version of Hopewell with similar artifact types. The people at the site were influenced by the Hopewell Interaction Sphere but did not necessarily contribute to its religious or ceremonial agendas (Sears 1962; Weisman 1995:30).

Sites belonging to the Hopewell Interaction Sphere also had common religious or ideological beliefs which can be seen in their artifact styles, forms and general cultural traditions (Byers 2004; Carr 2006a; see also Carr and Case 2006). Bolstering these social ties with artifacts would have been important not only for group cohesion, but also for political and economic stability during a time when local resource availability was unstable (Braun 1986; Charles 1992; Charles and Buikstra 2002). The Hopewell sphere may have provided much needed resources to areas that were suffering from these resource shortages (Braun 1986). Propagating these beliefs and artifact styles was important for maintaining group identity:

> Trade in exotic terms . . . would have served as a medium for mediating within-group status relationships based on control of access to the foreign materials and finished goods. The between-group trade partnerships would have helped to establish and maintain intercommunity relations through the mutual recognition of the legitimacy of the communities represented by the traders . . . Participation in the community's mortuary ritual would have been one means of mediating social relations within the group. Mutually intelligible mortuary ritual would have served to legitimate community membership and territorial claims within the region . . . Within the community, manipulation of both of these media by the local leadership would have solidified its authority and increased group cohesion [Charles 1992: 190-191].

Burial and mortuary practices can not only give insight into individual status, but can also help to distinguish between non-utilitarian and utilitarian ceramics. Ceramics used as grave goods are usually considered to be non-utilitarian and specialized. Though the pottery at Crystal River does not fit into the common Hopewell pottery style, other artifacts at the site do and this idea can be used when conducting ceramic form and function analyses.

Carr (2006b) outlines three types of Hopewell centers based on their organization and the flow of goods and people. The first type are *residential communities* which are "sets of households and people who live in close proximity and interact regularly on a face-to-face basis, whether they be clustered or dispersed over the landscape" (Carr 2006b:75). These types of communities probably have a common sense of identity including certain ways of life, kinship, and dialect. I suggest that a residential community would contain a single community of practice. As new people were introduced into the community, as in marriage practices, they would adopt the traditions of the community. In the instance of pottery, the person would need to adopt the practices of their new community. In terms of variability, we would expect to see rapid assimilation. Variability would exist as the new potter gets used to the new practices, but would eventually decline as the potter became acclimated. At a larger scale, the same process could be assumed for the initial founding of the site, if people from different communities of practice came together at a new place to form a more homogenous community. Applying this perspective to Crystal River, if variability in ceramics decreases through time, especially in the village area, this would be evidence of the group becoming more homogenous.

Previous research points to the possibility that Crystal River served as a residential community. Estabrook's (2012) recent research on lithic sourcing at Crystal River indicates that the flaked stone assemblage is comprised almost entirely of local raw materials. This suggests that Crystal River was a center for ceremonial activities on a local scale (Estabrook 2012). However, the limited size and lack of temporal control of the lithic assemblage do not permit a great deal of confidence in this inference. The results of this study can be applied to those of Estabrook (2012) to more thoroughly evaluate the existence of a residential community at Crystal River.

The second type of Hopewell center identified by Carr are *sustainable communities*, which he defines as more regionally based social networks in which material resources and crafts, spouses, and food are exchanged often, based upon each smaller communities' demographics and foodstuffs (Carr 2006b: 75; Mahoney 2001). These communities interact but do not necessarily have a shared identity or tradition. Sustainable communities within the Hopewell Sphere are usually large ceremonial centers where people assembled from other potentially far away sites (Carr 2006b:76). I suggest that pottery traditions from a sustainable community most likely maintained individuality with little conveyance of knowledge amongst or between each smaller community. Archaeologically, this would likely produce a great deal of variation in the ceramic assemblage. If ceramic diversity was maintained throughout the occupation sequence at Crystal River, it would be reasonable to infer that the site operated mostly as a ceremonial center for a number of different communities of practice.

Goad's (1978) model for interaction at Crystal River fits well with this possibility. Goad (1978) considers Crystal River a regional center that was central to getting exotic materials to the Gulf coast by providing local raw materials to those nonlocal peoples who wanted them. This incorporated Crystal River into the Hopewellian complex regardless of its distance from other complex sites and may have permitted it to be in charge of inter-regional exchange between the site and other local sites and also between Florida and other areas of the southeastern United States (Goad 1978:178 and 187). Goad postulates that Middle Woodland exchange centers, including Crystal River, traded with the Midwestern sites, bringing in exotic materials, and then traded these goods with other local sites instead of each site having its own separate trade relationship with the nonlocal sites (Goad 1978:201). According to Goad, this could explain why Crystal River has such an abundance of exotic materials compared to other sites in the area. The reasons for gathering these exotic materials are numerous, but Goad proposes that status is the driving factor:

> The nature and movement of inter-regional exchange during the Middle Woodland period may be depicted as one of increasing status hierarchies, coupled with the inclusion of new complexes and raw material sources, and the need for increasing quantities of status identifying goods produced the elaborate networks of the Middle Woodland Period. (Goad 1978: 203)

The size of sites surrounding Crystal River and the distribution of exotic materials at those sites would determine the hierarchies they fit into and would give a baseline for considering the regional trade networks in the area (Goad 1978:204). This model combined with the description of Carr's (2006b) sustainable community could help to explain the existence of exotic goods along with local artifact assemblages.

Carr defines his third and final type of Hopewell center as the *symbolic community*. A symbolic community is "a set of residential communities, or segments of them, that have joined together to form a larger, self-identifying social unit through the active construction and negotiation of affiliation to that unit and the creation of a sense of common purpose" (Carr 2006b:76). This type of community is united by religious, economic, or political purposes and, unlike sustainable communities, can be unified under a common goal or goals. In terms of pottery, a community such as this would perhaps have more variability in the assemblage than a residential community but not as much as a sustainable community. Since a symbolic community can be tied by religious affiliations, pottery traditions and symbology may be shared amongst its members. Therefore some aspects of manufacture may be shared while others are not, resulting in both variability and homogeneity in the assemblage. Symbolic communities are a good medium between residential and sustainable communities. The dual existence of homogeneity and variability could be explained based on the location of ceramics at Crystal River. If there is homogeneity in midden ceramics but greater diversity in assemblages associated with mounds or other ceremonial features, Crystal River could have been home to one fairly homogenous community of practice, but attracted people from other areas and other communities of practice for ceremonies. However, Carr (2006b:76) also suggests that the shared identity of symbolic communities may be the way in which sustained communities endure. If a community can have traits of both a sustainable and symbolic community, the difference between these two may be difficult to see archaeologically.

Carr's model forms a potentially useful way of thinking about the scale of interaction and will thus be the model I will test for Crystal River. Differences between these three possibilities may not be clear cut, especially if scale of interaction changed through time. It is also possible that Carr's model is not transferable to Hopewellian communities in the Southeast, where there appear to have been more permanent villages (Pluckhahn 2010). However this model still serves as an effective way to evaluate the results of this research project.

Hypotheses for Interaction at Crystal River

The forms of interaction presented here are numerous and varied. However, when applying these models to real data, it is important that agency is not left out of these hypotheses. It is easy to leave people out when discussing interaction in the archaeological record when the whole point of these studies should be to understand the actions of people in the past (Fry 1979: Gosden 2005; Stein 2002; Thomas 1991; Wallis 2011).

For Crystal River, the three alternatives of community provide a framework for understanding variability in the ceramic assemblage at Crystal River, and in comparison with other similar Hopewell sites. In the case of a residential community, the Crystal River ceramic assemblage would be expected to reach a level of homogeneity over time, enough to say that the ceramics were made by the same community of practice. The variability that is already established in the collection might be expected near the beginning of the occupation sequence, in association with the formation of a new community, or perhaps during a period of expanded settlement, perhaps indicating an influx of new residents.

If Crystal River functioned more along the lines of a sustainable community, we would expect the ceramic assemblage to exhibit sizeable variability, representing a number of comingling communities of practice. These communities would interact and yet sustain their individual community traditions and practices throughout the occupation sequence of Crystal River. Since these communities would maintain separation from each other, the ceramic collection should not ever coalesce and become uniform.

The evidence might be more mixed if Crystal River served as a symbolic community as defined by Carr. If the site was home to a homogenous residential community that interacted with communities of practice from other areas, we might expect variability in the ceramic assemblages to depend on context. In the midden area, little to no variation would be expected. On the other hand, the ceramics associated with ceremonial features such as mounds would be expected to exhibit much greater diversity. The following chapters will outline the analyses conducted to test these hypotheses.

CHAPTER 4:

TYPE/ATTRIBUTE ANALYSIS

Prior to more detailed analyses, the Crystal River ceramics collection was first classified by type and attribute. As noted in Chapter 1, Bullen (1951, 1953) and Willey (1949) made efforts to count and record the collection, but sherd counts were restricted and also based on the coarse typologies of the mid-twentieth century. None of the counts based on type have been published for Bullen's later work; these are limited to the catalog cards accompanying the collection which are frequently inaccurate. Weisman (1995:69) provided sherd types by percentage for only the Circular Embankment and Midden B, but this information appears to have been drawn from the catalog cards as well.

Due to the limited scope of previous analyses, only a few inferences can be drawn from these previous tabulations. Bullen (1953) noted the dominance of plain wares and limestone-tempered sherds in Midden B and also observed that red filmed pottery appeared to be limited to the later occupation at the site. Weisman (1995:68) noted an overall diversity in the temper, and to some extent surface treatment, of the sherds identified at Crystal River. These observations are based on preliminary data, however, and require further analysis. An extensive and updated tabulation can test Weisman's speculation and can also provide the collection's spatial and temporal distribution as has not been previously available.

Methods

This research was conducted through the study of a previously recovered ceramics collection. The collection, consisting mainly of artifacts from Bullen's excavations in the 1950s and 1960s, is housed at the Florida Museum of Natural History [FLMNH] (Bullen 1951a, 1953, 1966). I re-catalogued the Crystal River ceramics collection held at the FLMNH by type/attribute. Pottery types were identified based on attributes of paste and surface treatment according to Willey (1939, 1949), Goggin (1940, 1948, 1953), and others (Caldwell and Waring 1939; Jennings and Fairbanks 1939; Kelly 1938). Ann Cordell and the FLMNH comparative collection aided in ceramic identification. In some cases, Ann Cordell made fresh breaks on sherds in order to properly identify paste and also used a one percent hydrochloric acid solution to help differentiate between temper types. This technique was especially important with the occurrence of a substance similar in appearance to limestone in some sherds. This substance, possibly the clay-like Fuller's Earth, does not react to hydrochloric acid in the same manner as limestone and other calcareous particles.

It was not always possible to classify sherds by known type categories. In these cases, I created new categories based on temper and surface treatment. For temper, new categories included sand-tempered plain with inclusions (inclusions referring primarily to limestone), Pasco with sand (limestone and sand-tempered), and non-limestone Pasco, which refers to sherds containing possible Fuller's Earth. Sherds that were predominantly mica tempered were placed in a micaceous plain category. Sherds that had identifiable surface treatments but did not fit into established type categories were placed in unidentified categories based on surface treatment such as unidentified incised and unidentified punctated. These and other unidentified and unique types were described and grouped into an other/unidentified (UID) category for the purposes of this analysis.

The pottery collection is stored in boxes that roughly correspond with catalog sheets that include Bullen's classification. In some cases there are numerous boxes assigned to the same catalog number. To address this, I recorded quantity and weight to the nearest tenth of a gram for each pottery type encountered according to the catalog number and box number designated by the FLMNH. Each catalog number and box number had a separate data form (Figure 4-1). The forms also noted other observed information about the recorded sherds including the presence of rims, sooting, and mend holes. All artifact information recorded on the forms was entered into a Microsoft Access database.

Results

The entire ceramic collection totals 16,738 sherds. Many ceramic series are represented, including Deptford, Weeden Island, St. Johns, and Safety Harbor, as can be seen in Table 4-1. The majority of the sherds come from the sand-tempered Weeden Island Series (44 percent, see Figure 4-2), followed by the limestone-tempered Pasco Series (25 percent), and the sponge spicule-tempered St. Johns Series (23 percent). Other/Unidentified sherds account for the other four percent of the collection. Mixed temper sherds make up only one percent.

Bullen collected artifacts from all of the major architectural features at the site excluding Mound J, which he identified in 1960 but apparently never excavated (Bullen 1966). Bullen's excavation methods were far from modern; he dug in levels ranging from 4 in to 1 ft (10.2 cm to 30.5 cm) and probably did not screen the recovered material. The pottery he collected is most

CRYSTAL RIVER POTTERY ANALYSIS

Analyst_______________________________________ Date____________________

Catalog No:__________________ Cabinet:________ Tray:____________ Acc#:____________

Description:____

Surface Treatment	Type/Description	N	G	Comments (sooting, rims, tetrapods, etc)
Unidentified/ Other				
Plain	plain sand temp			
	St. Johns-like			
	Pasco			
	Franklin Plain (rim)			
	Weeden Island Plain (rim)			
	Pinellas			
Filmed/Painted	WI Red (not zoned)			
	Weeden Island Zoned Red			
	Pasco Red			
	Dunn's Creek Red			
	CR Negative Painted			
Check	Deptford Check Stamped			
	Deptford Linear Check			
	St. Johns Check			
	Wakulla Check			
Cord Marked	West Florida			
Punctate	Carrabelle Punctate			
	Papys Bayou			
	WI Zoned Punctate			
	Santa Rosa			

Figure 4-1. Type/Attribute Recording Form.

likely biased toward larger and more ornate sherds. Another difficulty with the collection is that most of Bullen's work was never published and he left only marginal notes and maps. We therefore have only general idea where the excavation units were placed (Figure 4-3). Thus, my analysis is limited mainly to general proveniences such as mound or test unit.

The distribution of wares by gross provenience is shown in Table 4-2. Bullen's excavation in the Circular Embankment accounts for the majority (71 percent) of the overall assemblage, followed by Midden B (15 percent) and Mounds E and F (12 percent). The sherds recovered from Mounds G, H, and K, the surface survey of Mound A, and general site together account for only two percent of the collection. It should be noted that this distribution is most likely skewed by Bullen's focus on the burial features at the site. These results do show that there is vastly more variety in types in the mounds than are seen in the midden. The following description of the ceramic assemblage demonstrates this and is organized by feature.

Table 4-1. Crystal River Assemblage by Series

Ceramic Series	N	%	G
Deptford Series	127	.8	2427.9
Crystal River Series	1	-	14
Weeden Island Series	7306	43.6	115249.5
Complicated Stamped Series	168	1	3248.8
Hillsborough Series	188	1.1	3612.6
Papys Bayou Series	34	.2	460.8
Little Manatee Series	2	-	13.9
St. Johns Series	3828	22.9	59401.3
Pasco Series	4237	25.3	65279.2
Safety Harbor Series	13	.1	189.8
Mixed Temper	197	1.2	2454.4
UID/Other	637	3.8	9428.6
Total	16738	100	261780.8

Figure 4-2. Weeden Island Series decorated types from Crystal River. Weeden Island Punctated (*a*), Weeden Island Incised (*b*), Carrabelle Punctated (*c*), Carrabelle Punctated/Keith Incised variant (*d*), Swift Creek Complicated Stamped (*e*), and Weeden Island Red (*f*). Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat Nos. 98917, 98922, and 99960.

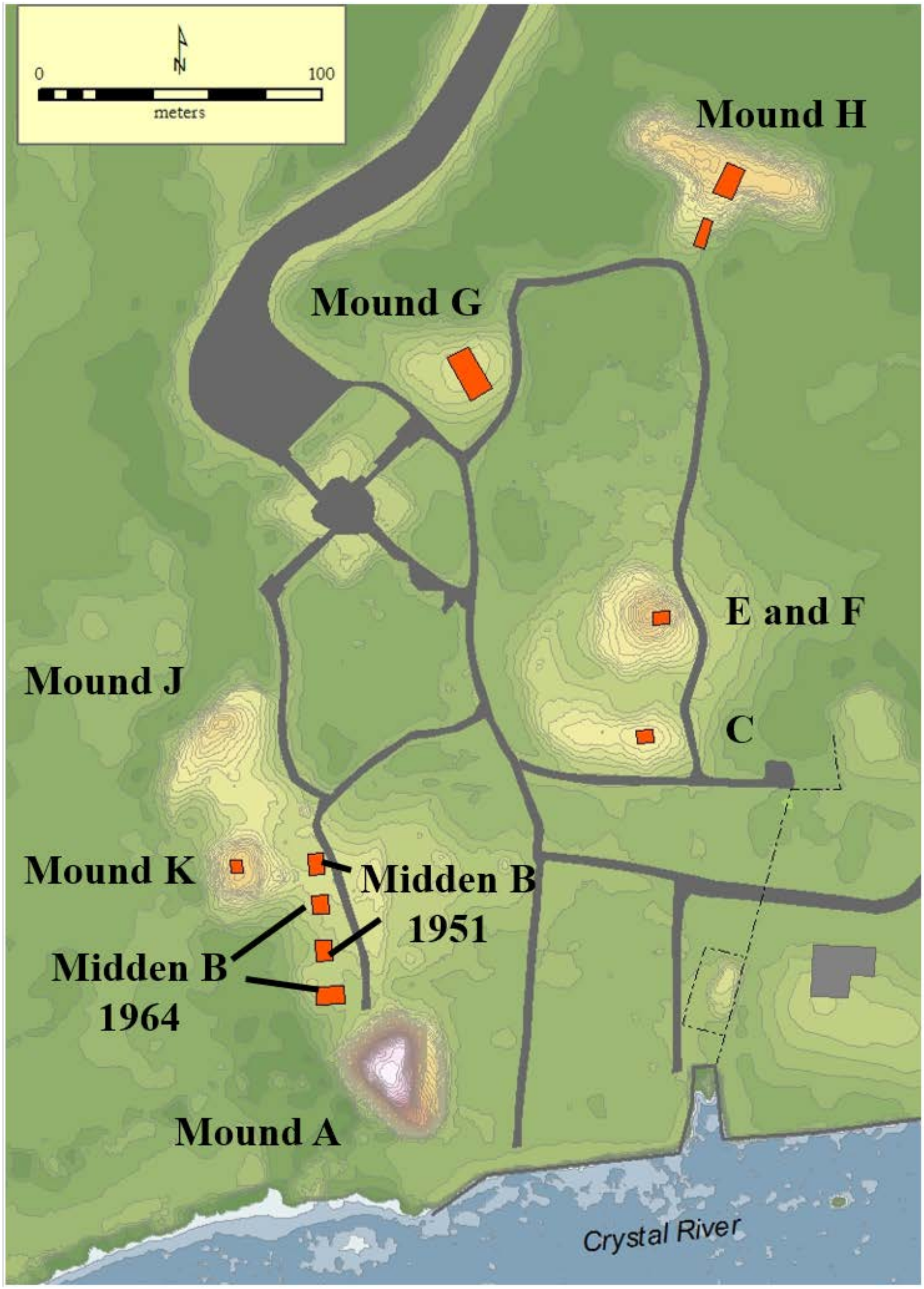

Figure 4-3. Approximate locations of Bullen's excavation units.

Table 4-2. Crystal River Ceramic Assemblage by Provenience

Ceramic Series	Crystal River Site, General		Mound G		Mound E and Platform F		Circular Embankment (C)		Midden B		Mound K		Stelae 1 and 2		Mound H		Mound A		Total by Type	%	G
	N	G	N	G	N	G	N	G	N	G	N	G	N	G	N	G	N	G			
Deptford Series	1	34.5	2	37	18	549.2	96	1726	10	81.2									127	.8	2427.9
Crystal River Series					1	14													1	-	14
Weeden Island Series	10	223.1	25	280.1	693	13338.6	6308	98038.8	255	3153	2	20.3	8	107.7	3	43.5	2	44.4	7306	43.6	115249.5
Complicated Stamped Series			1	16.6	38	930.2	121	2191.9	8	110.1									168	1	3248.8
Hillsborough Series	4	55.9			13	354	171	3202.7											188	1.1	3612.6
Papys Bayou Series					2	15.6	31	437.5	1	7.7									34	.2	460.8
Little Manatee Series							2	13.9											2	-	13.9
St. Johns Series	11	273.3	4	50.8	754	13808.3	2879	42836.1	167	2297.8	3	46.1	4	9.6	2	13.7	4	65.6	3828	22.9	59401.3
Pasco Series	30	535.9	109	1844.7	398	5080.5	1706	24864.4	1897	31325.7	22	205.4	10	51.2	30	738.5	35	632.9	4237	25.3	65279.2
Safety Harbor Series	3	25.8			4	26.6	4	98.5	1	16.8					1	22.1			13	.1	189.8
Mixed Temper					5	94.4	122	1530.8	65	781	5	48.2							197	1.2	2454.4
UID/Other	7	181.4	14	65.1	86	1444.1	491	7079.5	36*	622.1	2	24.8			1	11.6			637	3.8	9428.6
Total	66	1330	155	2294.3	2012	35655.5	11931	182020.1	2440	38395.4	34	344.8	22	168.5	37	829.4	41	742.9	16738	100	261780.8

Note: UID/Other category includes other temper types not represented by series such as micaceous plain

*Includes a Belle Glade Plain and a Perico Incised

Midden B

Of all the tests he excavated at Crystal River, the four midden tests that Bullen dug (two each in 1951 and 1964) have the greatest stratigraphic control and thus provide the best chance of understanding temporal change in ceramics. The 1951 units were done in 4-inch (10.2-cm) levels while the 1964 units were done in 6-inch (15.2–cm) levels. The deepest these units went was 90 inches (2.3 m) below surface. The first unit was generally located 20 meters north of the easternmost point of Mound A. The other three units were lined up to the north of the first, ending in front of Mound K (Bullen 1953; 10; Weisman 1995:49-50) (see Figure 4-3). The collection from these midden tests total over 2,000 sherds (Table 4-3).

The majority of the sherds from the midden are of the Pasco Series (78 percent). Thus the majority of the sherds are limestone-tempered, as has been generally suggested by Bullen (1953) and Weisman (1995). Sand-tempered sherds make up 12 percent of the midden assemblage, while sponge spicule-tempered comprise 7 percent. Mixed temper sherds such as sand-tempered with limestone inclusions are minimal, but Pasco with sand is relatively abundant in the midden area. In terms of surface treatment, the majority of the sherds are plain along with a sparse number of decorated and red filmed wares. Overall there is very little diversity in surface decoration.

Based on their presence in levels from top to bottom, sand-tempered and limestone-tempered plain pottery seem to run the entire occupation sequence. On the other hand, sponge spicule-tempered pottery is mostly seen in the upper, later levels of the sequence. My analysis provides corroboration for Bullen's (1953) observation of two general periods with respect to red filmed pottery, one in the later occupation where red filmed types are present and an earlier period where such types are absent. Dunn's Creek Red and Pasco Red are the two types of red

Table 4-3. Midden B Assemblage by Series

Ceramic Series	N	%	G
Deptford Series	10	.4	81.2
Weeden Island Series	255	10.5	3153
Complicated Stamped Series	8	-	110.1
Papys Bayou Series	1	-	7.7
St. Johns Series	167	6.8	2297.8
Pasco Series	1897	77.7	31325.7
Safety Harbor Series	1	-	16.8
Mixed Temper	65	2.7	781
UID/Other	36	1.5	622.1
Total	2440	100	38395.4

filmed pottery in the upper levels of the midden. Interestingly, only two Weeden Island Red sherds are present.

There are too few of the individual sand-tempered decorated types to make any definitive statements regarding their chronology, but the distribution of West Florida Cord Marked and Swift Creek Complicated Stamped types in Bullen's midden levels suggest that they may have had a long history at the site. Carrabelle Incised and Carrabelle Punctated types mainly occur in the later occupation. Deptford wares are few in number and seen mostly in the early occupation levels.

Finally, there is no Wakulla Check Stamped in the midden; the seven check stamped sherds that were found in the midden appear to belong to the earlier Deptford Series. It can be difficult to distinguish between these two series of check stamped types (Figure 4-4). The Deptford Series check stamped variations, linear check and bold check stamped, differ from Wakulla Check Stamped in these categories. Deptford Check Stamped sherds are mostly compacted (with few large sand granules), smoothed, polished, and are more solid to the touch. Wakulla Check Stamped has much more variation in paste from fine sand to coarse sand and in my experience most tend to crumble to the touch (Willey 1949:355, 438). In terms of decoration, Wakulla Check Stamped pottery usually has fine to medium sized checks, with squares that range from 0.04 to 0.2 in (1 to 5 mm) according to Willey (1949:438). The stamp itself is clear but lightly impressed leaving shallow squares and usually thin lands. In contrast, the Deptford check stamped types usually have much larger checks, with squares that range from 0.12 to 0.28 in (3 to 7 mm) (Willey 1949:357). Deptford Linear Check Stamped is clearly distinguished form the Wakulla type because of its linear nature which has one direction of large, parallel, pronounced lands and another of transverse smaller lands (Willey 1949:355). Other than the occurrence of linear check stamping, the most distinguishing characteristics of the Deptford check stamped types in my opinion are the deep squares and bold, wide lands, both of which are not seen in the Wakulla Check Stamped variation.

The lack of Wakulla pottery is surprising and perhaps significant given that this type is prominent in other areas of the site. It is consistent with recent dating of the midden that suggests domestic occupation at Crystal River was greatly reduced by the Late Woodland period (Pluckhahn et al. 2015).

Tentative Chronology of Ceramic Wares

From these observations of the stratified midden assemblage, I can suggest a tentative internal chronology divided into early, middle, and late occupations. This chronology is obviously tentative, in that it is based on small samples retrieved with relatively crude methods. Still, the patterns are roughly consistent among Bullen's midden excavations, suggesting that the basic outline will hold. My tripartite division also parallels more recent dating of the midden, which points to three main phases of occupation at Crystal River (Pluckhahn et al. 2015).

Although it is difficult to correlate Bullen's stratigraphic levels with those in more recent excavations, the early occupation may coincide with Phase 1 of midden deposition which has a two-sigma modeled start date of cal AD 65 to 224 and end date of cal AD 143 to 265 (Pluckhahn et al. 2015:29). The early occupation is characterized by predominate limestone (80 percent of the assemblage) and sand-tempered wares (12 percent, mostly plain). There are few to no sponge spicule (4 percent) or red filmed wares present. Swift Creek Complicated Stamped and Deptford types are present, but only in small quantities. Mixed temper sherds are rarely seen.

Figure 4-4. Wakulla Check Stamped (*a*) and Deptford Check Stamped (*b*) types. Crystal River assemblage, Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat Nos. 98913 and 98918.

The longest phase, Phase 2, may coincide with the middle occupation and has a modeled start date of cal AD 221 to 321 and a modeled end date of cal AD 435-544 (Pluckhahn et al. 2015:31). In the middle occupation, limestone (77 percent of the middle occupation assemblage) and sand-tempered plain (12 percent) still predominate. At this point, a few sponge spicule types (6 percent) such as St. Johns Plain and Dunn's Creek Red begin to appear. Red filmed sherds are also sporadically seen. Swift Creek Complicated Stamped and Deptford types are observed, but still only in small quantities. Mixed temper types are more common in the middle occupation but are still rare in the assemblage.

Finally, the late occupation outlined here coincides with the last main phase of the midden; Phase 3 has a modeled start date of cal AD 479 to 634 and an end date of cal AD 663 to 809 (Pluckhahn et al. 2015:32). The late occupation is also characterized by predominate limestone (70 percent of the late occupation assemblage) and sand-tempered plain (11 percent) types. Sponge spicule-tempered (19 percent) sherds are now more prominent, and are represented by various types of surface decoration (Figure 4-5). Red filmed sherds are also present in the late occupation. Swift Creek Complicated Stamped is still seen in small quantities but Deptford wares are rare or absent. Lastly, mixed temper sherds are much more common in the late occupation. The ceramics from these better controlled excavations by Pluckhahn and colleagues (2015) are still being analyzed, but will ultimately be used to refine the chronology presented here.

A Similar Chronology in Southwest Florida. This chronology is similar to the pottery assemblage seen at Bayshore Homes, though the Bayshore assemblage runs a little later than that of Crystal River. Recent research combined with a reevaluation of older excavations by Sears (1960), has provided a detailed chronology of ceramic wares at Bayshore Homes in Pinellas

County (Austin and Mitchem 2009, 2014; Austin et al. 2008). At this site Austin and others found that there are two main occupations sequences, one early with a date of cal A.D. 140-565 and one later with a date of cal A.D. 890-1390 (Austin and Mitchem 2014:68). The Bayshore Homes early phase coincides with Phases 1 and 2 at Crystal River. The late occupation at Bayshore overlaps with Crystal River's Phase 4 (start date of cal AD 722–881 and end date of cal AD 890–1068), the last phase at the site which has little activity and which my chronology does not include (Pluckhahn et al. 2015:34).

Looking at the ceramics from the earlier occupation at Bayshore Homes, the types represented are comparable to Crystal River and the chronology is fairly similar. Sand-tempered plain spans the entire sequence as is the case with the Crystal River assemblage. The early Bayshore Homes phase also has little to no Weeden Island series pottery and no check stamped pottery (Austin and Mitchem 2014:81). Though the Crystal River assemblage has numerous Weeden Island types present, few Weeden Island decorated types are seen in Midden B, which was the basis of the chronology. No Wakulla Check Stamped occurs in Midden B, though this type dominates elsewhere in the assemblage, but a few Deptford Check Stamped are seen (Bayshore Homes is a later site based on the ceramics and radiocarbon dates and does not seem to have a Deptford component). Swift Creek Complicated Stamped sherds are seen in only the early phase at Bayshore Homes which coincides with the occurrence of this type in the Crystal River chronology. Overall the early phase has less decorated ceramics as is the case at Crystal River.

Most of the ceramic types listed as being part of the later phase at Bayshore Homes, including a broad range of Weeden Island types, are seen much earlier at Crystal River. This may result from the lull in activity at Bayshore Homes between the two phases (Austin and Mitchem

2014:81). Limestone-tempered pottery is present in mostly the later phase at Bayshore Homes while this type spans the whole chronology at Crystal River (Austin and Mitchem 2014:Table 2). One way the two chronologies line up well is with the sponge spicule wares. St. Johns Plain and Check Stamped seem to increase through time at Bayshore Homes just as they do at Crystal River. Red painted sponge spicule types increase through time at Crystal River also, yet little to no red painted wares of any temper exist in the phases at Bayshore Homes (Austin and Mitchem 2014:Table 2). Generally, the two chronologies coincide with only a few types and time period differences.

The main difference between the Bayshore Homes assemblage and that of Crystal River is the occurrence of Pinellas Plain. This pottery type is characterized by a laminated paste and is difficult to distinguish from sand-tempered plain (Austin et al. 2008:100). Pinellas Plain was originally described by Willey (1949:482) who determined that this type was characteristic of Safety Harbor assemblages; others have noted its occurrence with Weeden Island period vessels (Bullen 1951b:Table 2; Sears 1960:8-9). There are only a handful of recorded Safety Harbor sherds in this assemblage and few of those are Pinellas Plain. There could be two possible explanations for this minimal occurrence. The first is the difficulty of identifying this type; perhaps I and other researchers missed some Pinellas Plain sherds. Another explanation may be that Pinellas Plain either occurs too late for Crystal River occupations or that it is more of a southern Florida phenomenon. Either way, this type does not have a presence at Crystal River and it is the only major difference separating the Crystal River and Bayshore Homes ceramic assemblages.

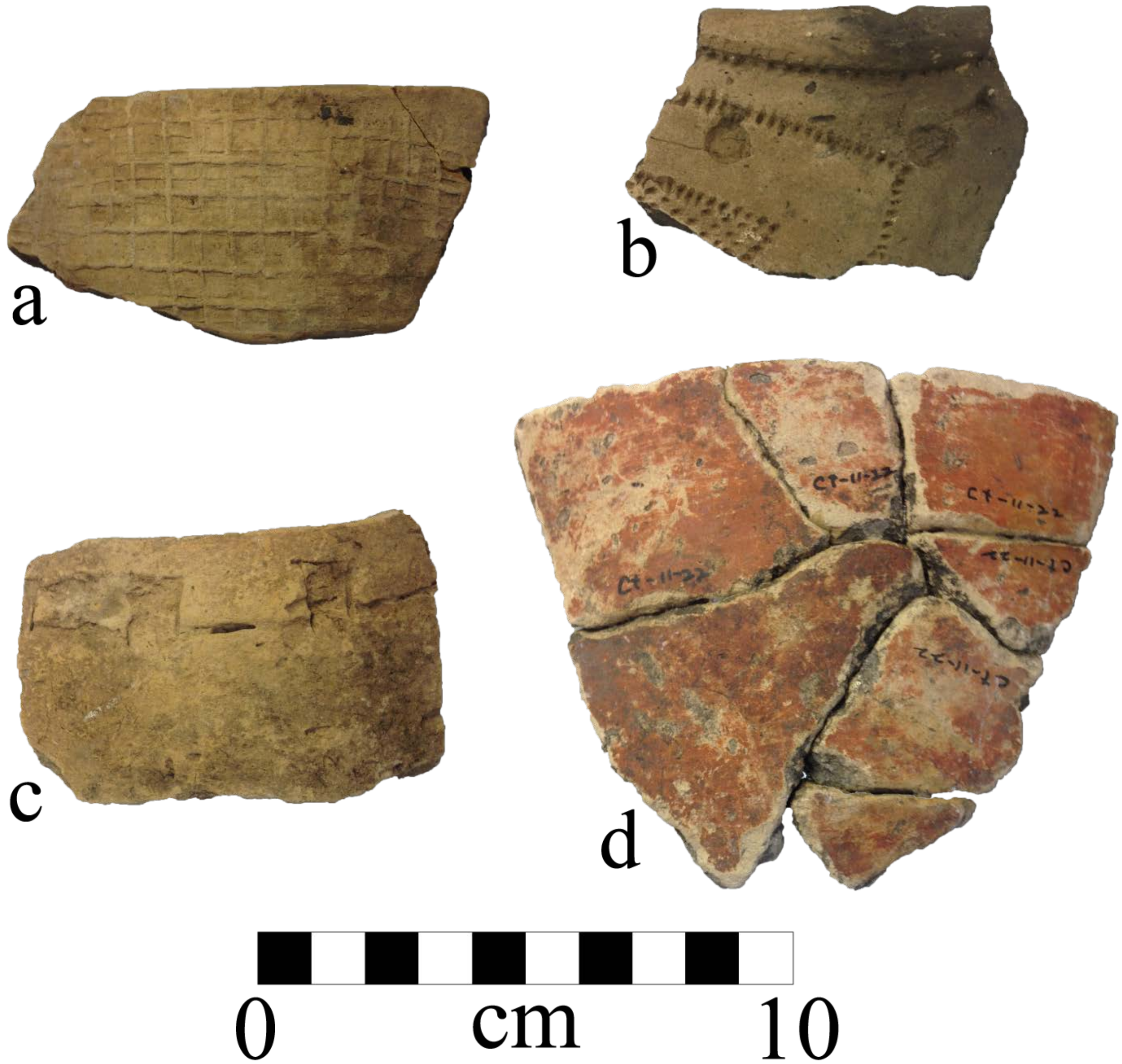

Figure 4-5. Crystal River sponge spicule decorated types. St. Johns Check Stamped (*a*), Papys Bayou Punctated (*b*), Oklawaha Plain (*c*), and Dunn’s Creek Red (*d*). Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat Nos. 98966, 98920, 999252, and 99302.

Ceramic Assemblages from Other Architectural Features

The chronology developed here from Bullen's midden excavations is the best currently available. Thus, I use this chronology as a framework for discussing the ceramic assemblages from the other features at the site.

Mound G. Radiocarbon dating suggests that Mound G may have been one of the earliest architectural features initiated at Crystal River (Katzmarzyk 1998; Milanich 1999:23). Bullen (1966) conducted a few tests in Mound G in 1960; he extended these tests as burials were discovered. He excavated here in 1-foot (30.5-cm) levels to a depth of 5 ft (1.5 m) (Weisman 1995). The sherds from this mound total only 155 (Table 4-4). As with the midden, the majority (70 percent) of the sherds from Mound G are limestone-tempered, with sand-tempered following at 18 percent. Sponge spicule-tempered pottery makes up an extremely minimal 3 percent of the assemblage. There is no occurrence of mixed temper types.

Most of the recovered sherds are plain, with the exception of Deptford Check Stamped, Deptford Simple Stamped, Weeden Island Red, Swift Creek Complicated Stamped, and St Johns

Table 4-4. Mound G Assemblage by Pottery Type

Pottery Type	N	%	G
Deptford Check Stamped	1	.6	23.3
Deptford Simple Stamped	1	.6	13.7
Weeden Island Red (not zoned)	1	.6	2.8
Swift Creek Complicated Stamped	1	.6	16.6
Sand-Tempered Plain	24	15.5	277.3
St. Johns Plain	1	.6	5.6
St Johns Check Stamped	3	1.9	45.2
Pasco Plain	109	70.3	1844.7
UID/Other	14	9	65.1
Total	155	100	2294.3

Check Stamped, each of which are represented by only one sherd. In general, the absence of later decorated types, such as the punctated and incised varieties of the Weeden Island series or Wakulla Check Stamped, suggests the main use of the mound was early. However, the occurrence of a few sherd types such as Weeden Island Red suggests localized use of the mound in later occupations. This is consistent with radiocarbon dating of human bone from the mound, which implies a long span of use, beginning early and continuing relatively late (Katzmarzyk 1998; Milanich 1999:23; Pluckhahn et al. 2010b). Additionally, the redundancy in types and wares suggests that the areas of Mound G where Bullen excavated were not secondary deposits.

Mound H. Bullen (1966) excavated two tests in platform Mound H in 1960 and 1964. The 1960 unit was placed on the top of the mound where it joined with the ramp and was excavated in 1-foot (30.5 cm) levels down to 5 ft (1.5 m). Bullen placed the 1964 unit in the ramp itself though the exact location and depth of this unit is unknown (Weisman 1995). The sample from these two units is small, 37 sherds in all (Table 4-5). The sherds are mostly limestone-tempered (n=30) with sand-tempered (n=5) and sponge spicule-tempered (n=2) making up the rest of the sample. The sample does not contain any of the mixed tempered sherds seen in the other mounds.

The Mound H assemblage consists of plain ware with the exception of one Lochloosa Punctated sherd. This pottery type is part of the Alachua tradition focused in north-central Florida and is considered a Late Woodland type (Goggin 1953; Milanich 1971). Although interpretations must be limited given the small sample size, the scarcity of both early (e.g. Deptford) and later (e.g., Weeden Island) decorated types may be consistent with construction during the later Middle Woodland period. This is consistent with recent dating of the mound

Table 4-5. Mound H Tests 1 and 2 Assemblage by Pottery Type

	Test 1								Test 2 in ramp		Total by Type		
	0-1 ft		1-2 ft		2-3 ft		3-4 ft						
Pottery Type	N	G	N	G	N	G	N	G	N	G	N	%	G
Sand-Tempered Plain	1	7.2	1	24.2			1	12.1			3	8.1	43.5
Lochloosa Punctate	1	22.1									1	2.7	22.1
St. Johns Plain			2	13.7							2	5.4	13.7
Pasco Plain	7	163.4	7	222.4	5	63.5	3	48.7	8	241	30	81.1	738.5
UID/Other			1	11.6							1	2.7	11.6
Total											37	100	829.4

(Norman 2014; Pluckhahn et al. 2015). The occurrence of St Johns ceramics, though few, suggests that Mound H is associated with the middle or later deposition of the midden.

Mound K. Bullen (1966) excavated one unit in Mound K in 1960. The exact location of this unit is unknown, although recent CREVAP excavations intersected one of Bullen's test pits to the east of Mound K. Bullen excavated this unit in 1-foot (30.5 cm) levels down to a depth of 5 ft (1.5 m) (Weisman 1995). The sherds are organized by level distribution in Table 4-6. The sample from this mound is small (n=34) and is made up of mostly limestone-tempered sherds

Table 4-6. Mound K Test A Assemblage by Pottery Type

	0-1 ft		1-2 ft		2-3 ft		4-5 ft		Total by Type		
Pottery Type	N	G	N	G	N	G	N	G	N	%	G
Sand-Tempered Plain	1	5.5			1	14.8			2	5.9	20.3
St. Johns Plain	1	17.1	1	15.4	1	13.6			3	8.8	46.1
Pasco Plain	15	148.8	1	28	3	12.3	3	16.3	22	64.7	205.4
Pasco Plain with Sand					2	27.9			2	5.9	27.9
Sand-Tempered Plain with Inclusions	3	20.3							3	8.8	20.3
UID/Other	2	24.8							2	5.9	24.8
Total									34	100	344.8

(n=22) with only a few sand (n=2) and sponge spicule-tempered (n=3) sherds. Mound K has five mixed temper sherds in its sample, quite a few for such a small sample size.

Interestingly, all of the sherds recovered from this mound are plain except for a UID incised sherd. As noted above for Mound H, and with the same caveat regarding sample size, this may suggest construction during the later Middle Woodland period. This too is consistent with recent dating (Norman 2014).

Platform E and Mound F. The Main Burial Complex platform, E, and Burial Mound F, were excavated by Moore (1903, 1907, 1918) in 1903, 1906, and 1917 and again by Bullen (1966) in 1960. Bullen and Moore sampled most areas of these two features with little or no stratigraphic control. The assemblages are generally identified by general provenience, but this is not the case with Mound F and the surrounding platform E, and I thus consider these together. The total pottery recovered from this area in the collections of the FLMNH is 2,012 sherds (Table 4-7). The distribution of sherds by temper is extremely different in this area of the site compared to those previously described. Sand-tempered (Weeden Island Series) and sponge

Table 4-7. Platform E and Mound F Assemblage by Series

Ceramic Series	N	%	G
Deptford Series	18	.9	549.2
Crystal River Series	1	-	14
Weeden Island Series	693	34.4	13338.6
Complicated Stamped Series	38	1.9	930.2
Hillsborough Series	13	.6	354
Papys Bayou Series	2	.1	15.6
St. Johns Series	754	37.5	13808.3
Pasco Series	398	19.8	5080.5
Safety Harbor Series	4	.2	26.6
Mixed Temper	5	.2	94.4
UID/Other	86	4.3	1444.1
Total	2012	100	35655.5

spicule-tempered (St. Johns Series) ceramics make up 38 and 37 percent of the assemblage, respectively. Limestone-tempered (Pasco Series) sherds make up about 20 percent of the total, and very few mixed tempered sherds are seen.

Surface decorations also exhibit much more diversity here than in the assemblages from the midden and other architectural features. Although the majority of the sherds are still plain, Weeden Island Red makes up 12 percent of the total, and Wakulla Check Stamped contributes another 9 percent. The other 18 percent of the collection is spread between 16 different decorated types.

Greater diversity might be expected in the ceramic assemblages from these burial mounds, which also produced many of the Hopewellian exotics for which Crystal River is famous (Moore 1900, 1903, 1907, 1918). But the high percentage of chalky St. Johns pottery is unexpected, given that this paste is infrequent in earlier midden layers, when these mounds were presumably constructed. The same holds for the relatively high percentages of Weeden Island Red and Wakulla Check Stamped. The ceramic data seem to suggest that at least some parts of these mounds continued to be used after the heyday of Hopewellian trade in the Middle Woodland period. But perhaps the safest observation may be that Mounds E and F were in use for a long time, and continued to be used relatively late in the occupation sequence. Additionally, burials in the mound included a variety of ceramic types that were not commonly utilized for domestic purposes at Crystal River, and may have been imported from other areas.

Circular Embankment. The other major component of the Main Burial Complex, the Circular Embankment (C), was excavated by Moore (1900, 1903, 1907, and 1918) in 1906 and 1917 and Bullen (1966) in 1960 and 1964. Moore placed six 4-foot by 4-foot (1.2 m by 1.2 m) and 4-foot by 5-foot (1.2 m by 1.5 m) test pits in C in 1906 and furthered this excavation in

1917. Bullen excavated a number of tests in various areas of the circular embankment, eight of which have no recorded stratigraphic information. The other tests from 1960 and the four tests excavated in 1964 were excavated in either 6-inch (15.2 cm) or 1-foot (30.5 cm) levels to a depth of 2 ft (60.7) to 3 ft (91.4 cm).Though the exact locations of all of Bullen's test units are not known, his 1960 map shows that he focused excavations in the southern part of C (Weisman 1995).

The assemblage from the Circular Embankment includes 11,931 sherds (Table 4-8). The distribution of sherds by temper is similar to that of E and F, with sand-tempered sherds (mostly Weeden Island Series) making up 56 percent of the sample, sponge spicule-tempered (St. Johns Series) at 25 percent, and limestone-tempered (Pasco Series) at 14 percent. Many more mixed tempered sherds (122 in total) are seen here compared to the rest of the site.

Table 4-8. Circular Embankment Assemblage by Series

Ceramic Series	N	%	G
Deptford Series	96	.8	1726
Weeden Island Series	6308	52.9	98038.8
Complicated Stamped Series	121	1	2191.9
Hillsborough Series	171	1.4	3202.7
Papys Bayou Series	31	.3	437.5
Little Manatee Series	2	-	13.9
St. Johns Series	2879	24.1	42836.1
Pasco Series	1706	14.3	24864.4
Safety Harbor Series	4	-	98.5
Mixed Temper	122	1	1530.8
UID/Other	491	4.1	7079.5
Total	11931	100	182020.1

As with Mounds E and F, there is also much more diversity in surface treatment here than in assemblages from the midden and other architectural features of the site. Again plain pottery predominates, with sand-tempered plain pottery forming 69 percent of the assemblage, but Weeden Island Red and Wakulla Check Stamped are both common at 15 and 6 percent, respectively. The other 10 percent of the collection is spread between 25 different decorated types, including types such as Ruskin Linear Punctated which are rare in the assemblage (Figure 4-6). More than half of these decorated types are represented by more than one sherd. The diversity in ceramics is consistent with a long history of use for the Circular Embankment.

Figure 4-6. Ruskin Linear Punctated rims and body sherds. Crystal River assemblage, Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat Nos. 98917.

Moore (1903, 1907) noted the diversity in the ceramic assemblage in his excavation reports, though he mentions that the ceramics were "inferior" to those found in the main burial mound. This diversity in ceramic type and temper led Moore to suggest extensive use in C. As with Mounds E and F, it seems safe to conclude that the Circular Embankment was used for some time. The presence of sponge spicule and red filmed types indicates that much its use was coeval with the middle and later deposition of the midden. Pluckhahn et al. (2009) recovered a radiocarbon date suggesting early use of this area. The ceramics do not rule out this earlier date, but do suggest that the Circular Embankment was in use until much later.

Stela 1. In 1964, Bullen (1966) dug around Stela 1 in a roughly 6-foot by 6-foot (1.8 m by 1.8 m) unit centered on the Stela. Bullen's unit had two levels, one from 0 to 20.3 cm (0 to 8 in) and one from 20.3 cm to 35.6 cm (8 in to 14 in). Only 20 sherds were recovered. All of the sherds are plain and consist of sand, limestone, and mix tempered sherds (Table 4-9). Little can be said regarding the temporal placement of Stela 1 from this assemblage, given its small size and lack of diagnostics. In general, however, the assemblage seems consistent with Bullen's radiocarbon date. Bullen (1966:865) averaged two radiocarbon dates to get a date around AD 440. Because all of the sherds are plain, not much information can be gleaned from this small assemblage and what its placement next to the stela means.

Mound A. No full scale excavations have occurred in Mound A. However, Bullen (1951) and Smith (1951) surface collected a minimal number of sherds. According to Weisman (1995:46), Smith collected 28 sherds (almost all Pasco Plain) and Bullen collected 53 sherds (also mostly Pasco Plain). Upon my reevaluation of the collection however, I only recorded 41 sherds from Mound A (Table 4-10). Most are limestone-tempered, as suggested by Weisman (1995:46), making up 85 percent of the assemblage. St. Johns Plain and St. Johns Check

Table 4-9. Stela 1 Assemblage by Pottery Type

Pottery Type	N	%	G
Sand-Tempered Plain	4	20	74.1
St. Johns Plain	4	20	9.6
Pasco Plain	6	30	28.5
Non-limestone Pasco	2	10	15.4
Sand-Tempered Plain with Inclusions	3	15	30
UID/other	1	5	3.6
Total	20	100	161

Table 4-10. Mound A Assemblage by Pottery Type

Pottery Type	N	%	G
Sand-Tempered Plain	2	4.9	44.4
Pasco Plain	35	85.4	632.9
St. Johns Plain	3	7.3	61.5
St. Johns Check Stamped	1	2.4	4.1
Total	41	100	742.9

Stamped are also present. Though this is a small collection, it is interesting to note that all of the sherds are common plain (and one decorated) types. The occurrence of a St. Johns Check Stamped sherd is consistent with radiocarbon dates that suggest Mound A was constructed during Phase 3 (Pluckhahn et al. 2015:33).

Conclusions

To briefly summarize, the chronology developed based on the midden sample proved useful in relating it to other features in the site. Mound G was seen to be created early with late occupation use in localized areas. Mound H and Mound K both seem to be from the middle occupation of the site. Mounds E and F, contrary to expectations based on the preponderance of Hopewell goods, exhibit a diversity of ceramics consistent with a long history of use, at least at the level of very general provenience allowed by the collection. Finally, the Circular Embankment sample suggests use of this feature throughout the entire occupation sequence.

Though there are a number of limitations to the collection, I am able to make other observations about the character of the ceramic assemblage. Particularly relevant is the diversity in temper exhibited in the collection. In the earliest occupation levels, pottery types are mostly sand or limestone-tempered, lacking the mixed temper and sponge spicule sherds seen in later levels. The early occupation is also characterized by minimal diversity in surface treatment. These characteristics are evident in the Mound G assemblage associated with the early occupation of the site. These observations may suggest that occupation at Crystal River was primarily a local phenomenon at the time of the earliest occupation.

Moving to the middle occupation levels, the temper begins to diversify with the appearance of more mixed temper sherds and the addition of sponge spicule-tempered pottery which becomes a very large component of the ceramic assemblage after this point. A slight increase in diversity of surface treatment is also evident in the middle occupation.

Unfortunately, a change in temper diversity from the middle to late occupation is not visible in the percentages of limestone and sand-tempered wares. The percentage of sponge spicule wares does increase but the change is not significant enough to say that temper diversity as a whole increased during this phase. However, the latest occupation levels do see the most diversity in surface decoration. This diversity has been suggested by earlier researchers and seems to have a pattern with increasing diversity through time (Weisman 1995). This suggests that Crystal River pottery traditions changed through time possibly with the introduction of different groups of people such as migrants or visitors.

This research project also recorded how much more diversity exists in the mound assemblages compared to that in the midden. The midden assemblage is mostly limestone-tempered (78 percent) and is made up of only 12 decorated types. The mound assemblages are majorly sand-tempered but also have many sponge spicule, limestone, and mixed temper sherds. The mound assemblages also have 42 different decorated types, vastly more than the 12 types present in the midden. This supports the hypothesis that Crystal River had a number of communities interacting at the site, possibly for specialized purposes.

The diversity in the collection is not what one would expect if a single group lived consistently at the site, as in the residential community outlined by Carr (2006b). The change in diversity through time suggests that the site was home to a relatively homogenous group, but through time attracted people from other areas and other pottery-making traditions (as in a symbolic community). The minimal number of mixed temper ceramics in Midden B compared to the large quantity in C and K support this possibility. However, the datasets from Midden B and other mound features are rather small. For Crystal River to be a symbolic community, this divide between homogeneity and variety would need to persist through time, which does not seem to be the case. Evidence of a homogenous group that lived at the site would need to be visible through time in the assemblage. It seems more likely that Crystal River may have started out as a residential community, but that as the site grew and the community attracted more people from other areas, Crystal River began to function more along the lines of Carr's sustainable community.

The type/attribute analysis is one line of evidence for determining communities of practice and interaction at Crystal River. The form and function and chemical analyses will refine this hypothesis and judge if this diversity is present in other aspects of the ceramics assemblage.

CHAPTER 5:

VESSEL FORM AND FUNCTION

Previous focus on ceramics at Crystal River has rested on culture history, assessment of exotic influence, and quantifying sherds by type (Bullen 1951a, 1953; Greenman 1938; Moore 1903, 1907, 1918; Smith 1951; Weisman 1995; Willey 1949; Willey and Phillips 1944). Moore (1903; 1907) and Willey (1949) are the only researchers who devote more than passing mention of vessel forms found at the site. They outline a number of whole vessels from the Main Burial Complex, focusing primarily on describing the types of vessel forms and assessing surface treatment and other characteristics. Inferences based on this previous work are limited as the focus on burial context ceramics is not applicable to the site as a whole.

Moore (1903:383-393; 1907:409-415) notes that many of the vessels from the burial complex are open bowls and collared jars, while others are more specialized forms such as miniature vessels, lobed jars, and effigy style vessels. He also mentions an abundance of podal support vessels. Unfortunately Moore does not make any attempt at discussing use wear or function of the vessels but his observations provide helpful contextual information for this research project. A full assessment of the number and types of vessel forms and their functions can lead to a better understanding of the communities of practice that were interacting at Crystal River and what activities dominated the site.

Methods

The methods used to analyze the ceramics were based on techniques outlined in Prudence Rice's (1987) sourcebook. The form and function analysis consisted of numerous components. First, I conducted a Minimum Number of Vessel (MNV) analysis of rim sherds. The collection at FLMNH used for this research project does not contain any whole vessels; therefore single rim sherds, or partly-mended vessels, were the unit of analysis. Rims were separated from body sherds in the type/attribute analysis previously discussed. Then, these were combined into vessel lots distinguishing each vessel based on sherd articulation, rim and lip form, temper, and surface treatment. Each vessel lot contained only rim sherds unless body sherds were known to articulate to rims or were clearly unique to a certain vessel. Body sherds that were unable to be assigned to specific vessel lots were omitted from this part of the research project.

I recorded each vessel on its own data form (Figure 5-1) which provided information on the vessel's catalog number and provenience information, assigned vessel lot, vessel form, wall thickness, orifice diameter, percent of total vessel, rim type, lip type, and use wear attributes. Profiles for each vessel were also drawn and recorded on the form using a profile gauge. Only rims representing greater than 5 percent of orifice diameter were recorded as vessel lots. Orifice diameter (to the nearest 2 cm) and percent of total vessel were measured using an orifice diameter rim chart. Rim thickness was measured using digital calipers at a point 3 cm below the lip on all vessels, regardless of sherd length. If a sherd was not 3 cm in vertical extent, a measurement was taken at the bottom of the sherd. Use wear characteristics such as sooting, fire clouding, attrition, and mend holes were also noted on the form. In the case of sooting, I also recorded the location and extent. Photographs were also taken of each vessel lot and assigned a number which I recorded on the data form. After all of the data were collected, I entered all of the information into an Access database.

Vessel Forms

Vessel forms were identified with reference to Willey (1949) and Wallis (2011). The forms considered include: open bowls, restricted bowls, open pots, restricted pots, flattened globular bowls, collared jars, small jars, cups, beakers, boat-shaped bowls, and plates. Any vessels that could not be placed in these categories went into an ‘other’ category or into unidentified (UID) unrestricted or unidentified restricted categories. I will briefly describe the distinguishable qualities of each of these forms.

Open bowls have an unrestricted orifice and walls that are more or less straight or outleaning. For the latter, vessels placed in this category had walls with a clearly discernible point of inflection defining a neck from which the rim lean outward at an angle less than 45 degrees. Open bowls are also wider (this form is always widest at the rim) than they are tall, although this is difficult to determine at the level of smaller sherds or vessel fragments. This form is fairly easily identified because it does not require large sherds in order to see the outward wall slope (Wallis 2011:145,151).

Open pots are similar to open bowls in that the vessel walls have a visible point of inflection defining a neck from which they lean outward at an angle of less than 45 degrees. However, these vessels are taller than they are wide. Again, this requires larger pieces of the vessel in order to differentiate this form from open bowls (Wallis 2011:154). Vessels placed in this category had enough of the vessel to estimate the vessel height so that it could be compared with the rim diameter.

CRYSTAL RIVER MNV ANALYSIS

Analyst____________________ Date________________

Catalog No:__________ Cabinet:_______ Tray:_______ Acc#:__________

Description:____________________________________

VESSEL NUMBER:__________ TYPE/DESCRIPTION:____________________

PHOTO #:__________ SECTION PHOTO #:____________________

VESSEL FORM:

open bowl	open pot	UID unrestricted
restricted bowl	restricted pot	UID restricted
flattened globular bowl	collared jar	cup
plate/dish	small jar	boat-shaped bowl
beaker	double bowl	double lobed jar
multi-compartment tray	other (describe below)	

vessel wall thickness (measure 3 cm below lip):__________ draw profile on reverse with exterior to left

form comments:____________________________________

ORIFICE:

Diameter:__________ Percent of Total:____________________

RIM:

direct	folded	scalloped
folded/pinched	other (describe below)	

rim comments:____________________________________

Fold width: __________

LIP:

flat	rounded	notched
pointed/tapered	other (describe below)	

lip comments:____________________________________

Use-wear/Alteration:

mend hole fire-clouding sooting (describe extent/location below) attrition

use wear comments:____________________________________

Figure 5-1. Rim Analysis Recording Form.

Unidentified unrestricted are those that were not identifiable as either open pots or open bowls. These vessels had walls that were either straight or outleaning but the vessel fragment was of insufficient size to discriminate pots from bowls.

Restricted bowls are similar to open bowls in that they are wider than they are tall but have a restricted orifice, meaning the maximum width of the vessel is below the orifice. To be placed in this category, sherds had to exhibit a point of inflection on the vessel wall defining a shoulder from which the rim leaned inward at an angle less than 45 degrees. Restricted bowls can be difficult to identify because proper identification requires a large sherd or mending sherds that together form a large fragment of the vessel diameter (Wallis 2011:151).

Restricted pots are similar to restricted bowls in that they have a visible point of inflection defining a shoulder from which the wall leans inward at an angle less than 45 degrees. However, these vessels are taller than they wide (Wallis 2011:152). As with restricted bowls, rims have to be large enough to estimate width and height in order to determine if a vessel is a restricted pot versus a restricted bowl.

Unidentified restricted are those that were not identifiable as either restricted pots or restricted bowls. These vessels had a restricted orifice but did not have enough of the sherd to determine if the vessels were pots or bowls.

The flattened-globular bowl form is defined by Willey as a “medium-deep to deep bowl with a maximum diameter at about midpoint of vessel and with inturned sides and constricted orifice” (1949:496,498). These bowls vary in height but are usually squat in appearance, only as tall as they are wide to half as tall as they are wide (Willey 1949:498). Flattened-globular bowls are distinguished from restricted bowls by their “sharply incurvate vessel wall near the rim”

(Wallis 2011:155-156). For the purpose of this study, a rim that leaned inward from a shoulder at angle greater than 45 degrees was placed in this category.

Willey (1949:498,500) defined two different types of collared jars, but this study follows Wallis in employing a single category which includes any vessel with a collar (2011:158). These vessels exhibit vessel walls that are generally straight or slightly outleaning above a neck (Willey 1949:498,500). The neck is commonly the narrowest point of the vessel. These can be difficult to distinguish from other unrestricted vessels if the rim sherd is not large enough to show the neck progression.

Small cups or bowls as a vessel type are defined by Wallis (2011:158) but referred to by Willey (1949:506) as "miniature vessels". These small vessels are simply smaller versions of open bowls with the same morphological characteristics (Wallis 2011:158,160; Willey 1949:506). For this study any unrestricted vessel with an orifice diameter less than 13 cm was placed in this category.

Small jars are also lumped by Willey (1949:506) as "miniature vessels." However, I follow Wallis (2011:161) in differentiating these from cups and small bowls, in that these exhibit restricted orifices and are taller than they are wide. They are a smaller form of collared jars and other jar forms (Wallis 2011:161). As with cups, the orifice diameter of a vessel had to be less than 13 cm to be considered a small jar.

A boat-shaped bowl is a "medium-deep or shallow bowl which is oval or ovate-rectangular in form" with "outslanted or straight" walls (Willey 1949:498). These vessels are usually much shorter than they are wide (Willey 1949:498). Boat-shaped bowls can be identified by their strangely shaped rims.

Multi-compartment trays are defined by Willey (1949:502) as low or flat trays that have three or more bowls attached to the same vessel. Willey describes a number of size and shape variations but the number of compartments make this vessel type easy to identify when certain parts of the vessel are present.

Willey (1949:500) describes beakers as being taller than they are wide with straight walls and a flat base. Vessels in this category require a large amount of the vessel to be identified and have an orifice diameter of less than 13 cm.

Plates and shallow bowls have very steeply excurvate walls. These forms are shallow, commonly a quarter of their height in diameter (Willey 1949:496). For the purposes of this study, rim sherds had to angle outward more than 45 degrees.

Use Wear

Evidence of the use of a vessel comes from its alteration (Hally 1983, 1986). According to Rice (1987:235), "the presence and location of soot deposits and fireclouds on the exterior sides and base of a vessel are clear indications of use in cooking or other activities involving fire". As stated above, I recorded the presence of any soot deposits and fire clouding on the vessels. With soot, I also noted the location of the soot. Mend holes also provide evidence of use. They provide information on the lasting quality of the pots' construction and the choice by a person to fix and reuse a damaged pot (Wallis 2011:180).

Vessel Function

Once vessel type was determined, I considered the primary function each vessel would have served based on previous research from the Southeast (Hally 1983, 1986; Wallis 2011).

Each vessel was assigned to one of three functional categories: cooking, serving, and storage. This allowed me to make inferences based on activities.

Open pots are seen as evidence of cooking, usually with fire clouding or sooting on the vessel. Wallis (2011:154) states that these pots were utilitarian in function and were not commonly repaired (based on the lack of mend holes). This evidence, along with the soot found on vessels, suggests open pots were used in cooking activities.

Restricted pots have also commonly been attributed as cooking vessels in the Woodland period (Wallis 2011:154). Wallis (2011:153-154) found evidence of soot on restricted pots from his Swift Creek pottery study and proposes cooking as the main reason for this. He states that the restricted orifice would have contained spillage and conserved heat while cooking.

The second functional category is serving. Some researchers believe open bowls served as cooking vessels (see Wallis 2011:151) but these are generally accepted to be serving vessels. Hally (1986:289) hypothesizes that the open nature of the bowls would allow for easy access to contents with a utensil or hand and that this form is usually small enough to be easily moved around when serving.

Much like the open bowl, the restricted bowl has been seen as a cooking and serving vessel. Wallis found that some larger restricted bowls from the Lower St. Johns River were sooted and possibly used for cooking while smaller bowls served another function (2011:152). Hally also proposes that restricted bowls were cooking vessels but also suggests that the majority of them were probably used for mixing and serving food, especially because the shape minimized content spillage (1986:288-289). Therefore restricted bowls were placed in the serving category.

Cups and plates would also have been serving vessels. Cups most likely held drinks and small food portions while plates would have been reserved to solid food (Wallis 2011:160,169). Both of these vessels are also associated with ceremonial offerings and can be found in burial contexts.

Beakers were most likely only suitable for liquid and were utilized as serving cups. Boat-shaped bowls and multi-compartment bowls are both associated with ceremonial contents and burial contexts. Wallis suggests that both were used to hold and serve items while boat-shaped bowls functioned similarly to cups and other small bowls (Wallis 2011:165,168).

The last category is vessels used for storage purposes. These vessels generally have restricted orifices which better suit containment, enclosure, and storage. Flattened-globular bowls have characteristics that were amenable to use as storage vessels. However, these bowls are also commonly associated with burial contexts, especially during the Woodland Period. Wallis (2011:156) concludes that this type of vessel was ceremonial and deposited with the dead. The restricted nature of collared jars most likely served as a storage function. Hally (1986:285) believes that it would be difficult to get to substances within these jars for the purposes of cooking and serving. He states that the shape would reduce content spillage and allow for a type of lid to be tied or placed on top. According to Wallis (2011:158), collared jars could have also been used as cooking or serving vessels because of the presence of soot and their location in burial contexts of vessels from the Swift Creek ceremonial complex. This is based on a small sample size and therefore collared jars are seen to function as storage vessels. Small jars are similarly seen to be storage vessels. Wallis (2011:163) thinks that the small jars from his study from the Lower St Johns River were used to hold ceremonial materials, possibly for offerings.

All 12 of the main vessels form types were separated into these three functional categories discussed above. The placement of vessel form types into these categories is for ease of analysis but it is important to note that some vessels may have been used for purposes other than what was originally intended, for purposes that may seem contradictory to the purely functional aspects of vessel form, and for more than one purpose. Cooking vessels include open and restricted pots; serving vessels include open and restricted bowls, cups, plates, beakers, boat-shaped bowls, and multi-compartment trays; and storage vessels include flattened-globular bowls, collared jars, and small jars. Unidentified restricted and unidentified unrestricted vessels were not included in this part of the analysis because they could not be properly determined as a specific vessel form or placed in a category for analysis.

It should be noted here that most vessels from Florida, especially Weeden Island types, are open bowls or restricted forms, representing serving and storage vessels (Willey 1949:406). There is not extensive evidence of cooking vessels in this region and therefore these categories may be skewed. In terms of use wear, exterior soot is more prominent on vessels used for open fire cooking (Hally 1986:275). This would suggest that cooking vessels would have more soot than those vessels only occasionally used for cooking, or at least, that more "cooking" vessels would have soot than those not considered cooking vessels. Hally (1986:281) uses the percentage of sooted vessels within each form category (represented by at least four vessels) to determine whether they were used exclusively, frequently, or infrequently over fire. Therefore, if only one percent of collared jars have soot it would stand to reason that they are rarely used for cooking purposes. Exclusively serving or storage vessels would then have no soot present.

Results

Overall Collection

Out of the entire ceramic collection of 16,738 sherds, 859 vessels were recorded. This MNV shows that the majority of the collection is made up of body sherds which are not useful in the form analysis. Table 5-1 organizes the vessels by vessel form. The majority of the vessels are Unidentified, either restricted (36 percent) or unrestricted (9 percent). Since these cannot be placed into formal vessel form categories, the unidentified vessels were omitted from the analysis (omitting many potential cooking vessels). The analyses were then conducted using the 478 identifiable vessel forms (Table 5-2).

Of these 478 identifiable vessels, open bowls (66 percent) are by far the most abundant. Restricted bowls (12 percent), flattened globular bowls (12 percent), cups (4 percent), collared

Table 5-1. Vessels by Vessel Form

Form	Total	%
Open bowl	317	36.9
UID restricted	306	35.6
UID unrestricted	75	8.7
Restricted bowl	57	6.6
Flattened globular bowl	55	6.4
Cup	20	2.3
Collared jar	7	.8
Small jar	7	.8
Open pot	6	.7
Restricted pot	2	.2
Boat-shaped bowl	2	.2
Other	2	.2
Multi-compartment tray	1	.1
Beaker	1	.1
Plate/dish	1	.1
Total Vessels	859	100

Table 5-2. Identifiable Vessels by Vessel Form

Form	Total	%
Open bowl	317	66.3
Restricted bowl	57	11.9
Flattened-globular bowl	55	11.5
Cup	20	4.2
Collared jar	7	1.5
Small jar	7	1.5
Open pot	6	1.3
Restricted pot	2	.4
Boat-shaped bowl	2	.4
Other	2	.4
Multi-compartment tray	1	.2
Beaker	1	.2
Plate/dish	1	.2
Total Vessels	478	100

jars (2 percent), small jars (2 percent), and open pots (1 percent) make up the rest of the collection. Restricted pots, boat-shaped bowls, multi-compartment trays, beakers, plates, and other forms all together account for around one percent of the collection (9 vessels).

Evidence of fire clouding is present on 50 percent (239 vessels) of the identifiable vessels (Figure 5-2). This pattern is repeated when looking at the number of fire clouded vessels within each vessel form (Table 5-3). Fire clouding is present on at least 40 percent of the total for all vessel types.

Only eight percent of the 478 total vessels have soot present (see Table 5-3 and Figure 5-2). The majority of these are open bowls, but soot is present on only ten percent (33 vessels) of this vessel type. Restricted bowls (five percent), cups (10 percent), and one collared jar (14 percent) also had evidence of soot. Based on soot, this does not support the idea that open and restricted pots are cooking vessels. However, the very small sample of these vessel types is problematic in making any such conclusion. These results do suggest that open bowls were not

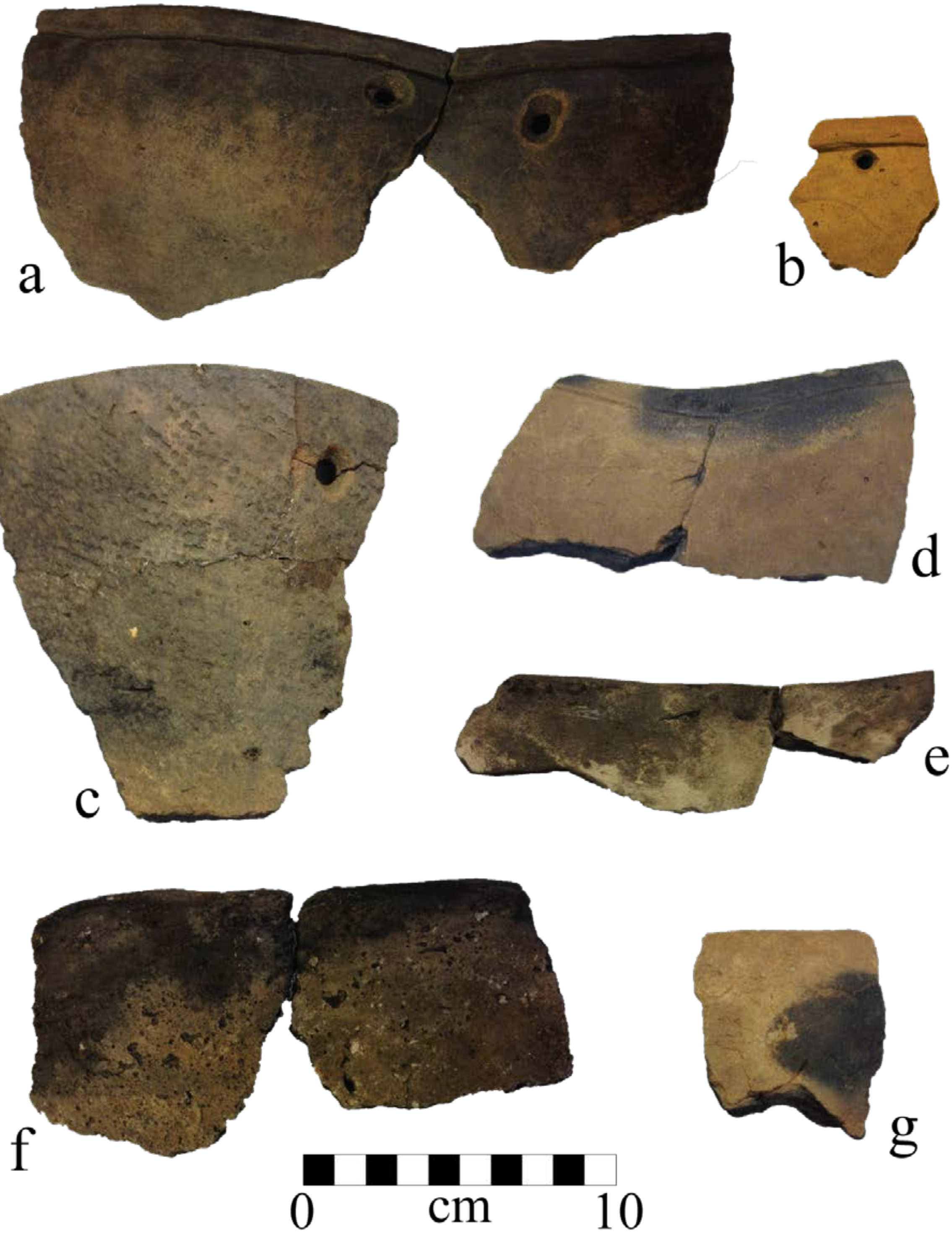

Figure 5-2. Use wear examples. Mend holes on Weeden Island Plain (*a*), Weeden Island Red (*b*), and Wakulla Check Stamped (*c*); Fire clouding on Weeden Island Plain (*d*), St. Johns Plain (*e*, also with soot near rim), Pasco Plain (*f*), and sand-tempered plain (*g*). Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat Nos. 98913, 98917, 98923, 98932, and 99960.

Table 5-3. Evidence of Use Wear by Vessel Form

Vessel Form	Total	Fire Clouding		Sooting		Mend Hole	
		N	%	N	%	N	%
Open bowl	317	153	48.3	33	10.4	5	1.6
Restricted bowl	57	36	63.2	3	5.3		
Flattened-globular bowl	55	26	47.3			1	1.8
Cup	20	8	40	2	10	1	5
Small jar	7	3	42.9				
Collared jar	7	3	42.9	1	14.3		
Open pot	6	5	83.3			1	16.7
Restricted pot	2	1	50				
Other	2	1	50				
Boat-shaped bowl	2	1	50				
Plate/dish	1	1	100				
Multi-compartment tray	1	1	100				
Beaker	1						
Total	478	239	50	39	8.2	8	1.7

used exclusively for serving and may have been utilized as cooking vessels as well. A total of 13 sooted vessels (33 percent, all either open or restricted bowls and one collared jar) are sooted on the exterior of the vessels while 54 percent (all open bowls and one cup) are sooted on vessel interiors. A few vessels (13 percent) have both interior and exterior sooting. Exterior sooting is seen as a result of cooking (Rice 1987:235) but interior soot could result from a number of possibilities including from food remains, use of broken sherds for other purposes, or the soot could have occurred after deposition.

Mend holes are by far the least frequent form of use wear in this collection (see Figure 5-2 for examples). Only eight vessels have them, five of which are open bowls. The other three are present on a flattened-globular bowl, cup, and an open pot.

Of the open bowls that have use wear, 21 vessels have both fire clouding and sooting, while only one vessel has fire clouding, sooting, and a mend hole. Restricted bowls have three vessels with both sooting and fire clouding as well.

If the vessels types are separated into the three categories based on function discussed above (Table 5-4), 84 percent of the vessels are serving vessels, 14 percent are associated with cooking, and 2 percent are considered storage vessels. The serving category had the largest number of forms associated with it and also the highest frequency vessel form (open bowls).

The pottery types represented are numerous (Table 5-5) as are the ceramic series within the different vessel form types (Table 5-6).The majority of open bowls are Pasco Plain (41 percent), Dunn's Creek Red (22 percent), and St. Johns Plain (19 percent). Restricted bowls are more evenly split. Weeden Island Plain/sand-tempered plain account for 35 percent of the restricted bowls, while Dunn's Creek Red (18 percent), Pasco Plain (18 percent), and St. Johns Plain (11 percent) make up the greater part of the rest of these vessels. Flattened-globular bowls are dominated by the Weeden Island Plain/sand-tempered plain type (47 percent) followed by St. Johns Plain (16 percent), Weeden Island Zoned Punctated (9 percent), and Weeden Island Red (7 percent). It is interesting to note the lack of flattened-globular bowls among the Pasco series types. Cups are the only other vessels that have dominate pottery types with most of these being either Pasco Plain (35 percent) or sand-tempered plain (30 percent).

Table 5-4. Vessels by Functional Category

Vessel Function	N	%
Serving	399	83.5
Cooking	69	14.4
Storage	10	2.1
Total	478	100

Few vessels come from the Deptford, Complicated Stamped, Hillsborough, and Papys Bayou Series (3 percent, combined). These vessels were mostly open bowls, with a few restricted bowls, a flattened globular bowl, and an open pot. None of the Deptford vessels had podal supports. The Weeden Island, St. Johns, and Pasco Series make up the majority of the collection. The vessels are fairly evenly spread between these three series with the Weeden Island Series at 27 percent of all identifiable vessels, the St Johns Series at 35 percent, and the Pasco Series at 34 percent. The majority of the St. Johns and Pasco Series vessels are open bowls (79 percent of St. Johns Series vessels and 82 percent of Pasco Series vessels), followed by restricted bowls for both series, flattened-globular bowls for the St. Johns Series, and cups for the Pasco Series. The Weeden Island Series vessels (130 in total) are spread more evenly amongst open bowls (33 percent), flattened-globular bowls (29 percent), and restricted bowls (19 percent). Cups (7 percent), small jars (5 percent), collared jars (3 percent), open pots (2 percent), and boat-shaped bowls (2 percent) make up the rest of the vessels from the Weeden Island Series.

The distribution of vessels by temper, similar to that of series, is summarized in Table 5-7. Generally, sand-tempered vessels have a lot of variation in vessel form while sponge and limestone have less. Of the 317 total open bowls (66 percent of the collection), most are sponge spicule (42 percent) or limestone (41 percent) tempered. Only 16 percent of the open bowls are sand-tempered. Restricted bowls are more evenly distributed amongst the major series/temper categories. They are mostly sand-tempered (47 percent) followed by sponge spicule (30 percent) and limestone (21 percent). The majority of the flattened-globular bowl vessels are also sand (67 percent) and sponge spicule (26 percent) tempered. Cups are mostly sand (45 percent) or limestone (40 percent) tempered. At least 50 percent of all collared jars, small jars, and open pots

Table 5-5. Vessels by Pottery Type

Type	Open bowl	Restricted bowl	Flattened globular bowl	Cup	Collared jar	Small jar	Open pot	Restricted pot	Boat-shaped bowl	Other	Multi-compartment tray	Beaker	Plate/dish	Total	%
Deptford Check Stamped	1													1	.2
WI Zoned Incised			1											1	.2
WI Zoned Punctated		1	5	1										7	1.5
WI Zoned Incised/Punctated			1											1	.2
WI Red (not zoned)	2	2	4	1		2								11	2.3
Keith Incised					1									1	.2
Swift Creek Complicated Stamped							1							1	.2
St Andrews Complicated Stamped		1												1	.2
Tampa Complicated Stamped		1												1	.2
Wakulla Check Stamped	7	1		1			1							10	2.1
West Florida Cord Marked					1									1	.2
Hillsborough Shell Stamped	1													1	.2
Ruskin Dentate Stamped	4	1												5	1.0
Ruskin Linear Punctated	1													1	.2
Papys Bayou Plain	1													1	.2
Papys Bayou Punctated	1	1	1											3	.6

Table 5-5 (continued)

Type	Open bowl	Restricted bowl	Flattened globular bowl	Cup	Collared jar	Small jar	Open pot	Restricted pot	Boat-shaped bowl	Other	Multi-compartment tray	Beaker	Plate/dish	Total	%
St. Johns Plain	60	6	9	2	1	1		1			1			81	16.9
Dunn's Creek Red	70	10	4											84	17.6
Pasco Plain	130	10		7	1			1		1			1	151	31.6
Pasco with Sand	1			1			1							3	.6
Pasco Red	1	2	3	1										7	1.5
Non-limestone Pasco	1													1	.2
Sand-Tempered Plain	33	20	26	6	2	4	2		2					95	19.9
Sand-Tempered Plain with Inclusions	1		1											2	.4
Micaceous Plain		1												1	.2
UID/ Other	2				1		1			1		1		6	1.3
Total	317	57	55	20	7	7	6	2	2	2	1	1	1	478	100

Table 5-6. Vessels by Ceramic Series

Ceramic Series	Open bowl	Restricted bowl	Flattened globular bowl	Cup	Collared jar	Small jar	Open pot	Restricted pot	Boat-shaped bowl	Other	Multi-compartment tray	Beaker	Plate/dish	Total	%
Deptford Series	1													1	.2
Weeden Island Series	43	25	38	9	4	6	3		2					130	27.2
Complicated Stamped Series		2					1							3	.6
Hillsborough Series	6	1												7	1.5
Papys Bayou Series	2	1	1											4	.8
St. Johns Series	130	16	13	2	1	1		1			1			165	34.5
Pasco Series	133	12	3	9	1		1	1		1			1	162	33.9
UID/Other	2				1		1			1		1		6	1.3
Total	317	57	55	20	7	7	6	2	2	2	1	1	1	478	100
%	66.3	11.9	11.5	4.2	1.5	1.5	1.3	0.4	0.4	0.4	0.2	0.2	0.2	100	

Table 5-7. Vessels by Temper Type

Temper	Open bowl	Restricted bowl	Flattened globular bowl	Cup	Collared jar	Small jar	Open pot	Restricted pot	Boat-shaped bowl	Other	Multi-compartment tray	Beaker	Plate/dish	Total	%
Sand	49	27	37	9	4	6	4		2					138	28.9
Limestone	131	12	3	8	1			1		1			1	158	33.1
Sponge Spicule	132	17	14	2	1	1		1			1			169	35.4
Other	5	1	1	1	1		2			1		1		13	2.7
Total	317	57	55	20	7	7	6	2	2	2	1	1	1	478	100
%	66.3	11.9	11.5	4.2	1.5	1.5	1.3	0.4	0.4	0.4	0.2	0.2	0.2	100	

are sand-tempered. All of the vessels except the small jars, restricted pots, and boat-shaped bowls have at least one vessel that is either mixed temper or micaceous. There are only 13 vessels that are considered to have an "other" temper. These include non-limestone Pasco, Pasco with sand, and sand-tempered plain with inclusions.

The sizes of vessels in this collection range widely, with orifice diameters ranging from 3 to 52 cm. The majority are between six and 40 cm. The distribution of these by temper is shown in Table 5-8. The smaller vessels (up to 15 cm in diameter) are predominantly sand-tempered while the mid-size vessels are mostly limestone-tempered (16 to 25 cm). Larger vessels (26 to 52 cm) are predominately sponge spicule-tempered, followed by limestone. A pattern emerges here with sand temper dominating the smaller vessels but essentially disappearing as the orifice diameter increases. Limestone and sponge spicule-tempered vessels are more normally distributed across the vessel size spectrum represented.

Though patterns are visible in the distribution of vessel size by temper, the more relevant information is held in looking at each individual vessel form (Table 5-9). Open bowls (Figure 5-3) range from 12 cm to 52 cm, the largest range of all recorded vessel forms, and have a mean of 27.5 cm. The histogram (Figure 5-4) shows a bimodal distribution with vessels fitting into two

Table 5-8. Temper Distribution by Orifice Diameter

Orifice Diameter	Sand Tempered	Limestone Tempered	Sponge Spicule Tempered	Other	Total	%
0-15	69	27	13	4	113	23.6
16-25	47	71	46	3	167	34.9
26-52	25	61	110	1	197	41.2
Unidentifiable	1				1	.2
Total	142	159	169	8	478	100
%	29.7	33.3	35.4	1.7	100	

general categories, one of small and mid-size vessels (10 to 40 cm in diameter) and another of larger vessels (around 50 cm in diameter). Restricted bowls (Figure 5-5) have a mean of 19.8 cm and range from 5 to 36 cm. The histogram (Figure 5-6) for restricted bowls illustrates two main modes, smaller vessels between 10 and 20 cm in diameter and mid-size vessels between 22 and 30 cm in diameter. A third mode of larger vessels from 34 to 38 cm in diameter can also be interpreted from the diagram. Flattened-globular bowls profiles are shown in Figure 5-7. They have a range similar to that of restricted bowls, from 3 to 36 cm, but a smaller mean at 14.4 cm (Figure 5-8). Their distribution is also bimodal with a grouping of smaller vessels between 5 and 14 cm in diameter and another of larger vessels between 16 and 26 cm in diameter. Cups (Figure 5-9) have a much smaller range in size, only 8 to 12 cm, and average on the smaller side at 9.6 cm. Rim profiles for jars, pots, and plates are shown in Figure 5-10. Similar to cups, small jars

Table 5-9. Orifice Diameter Summary Statistics by Vessel Form

Vessel Form	N	Range	Mean	Standard Deviation	Median	Mode	Minimum	Maximum
Open bowl	317	40	27.5	9.3	26	24	12	52
Restricted bowl	57	31	19.8	7	18	18	5	36
Flattened globular bowl	55	33	14.4	7.3	12	10	3	36
Cup	20	4	9.6	1.4	10	10	8	12
Small jar	7	6	8.3	2.7	8	6	6	12
Collared jar	7	16	14.9	5.5	14	12	6	22
Open pot	6	10	14.5	4.5	13	20	10	20
Restricted pot	2	12	10	8.5	10	4	4	16
Other	2	4	14	2.8	14	12	12	16
Boat-shaped bowl	2		4		4	4	4	4
Plate/dish	1		24					
Multi-compartment tray	1		7					
Beaker	1		8					
Total	478							

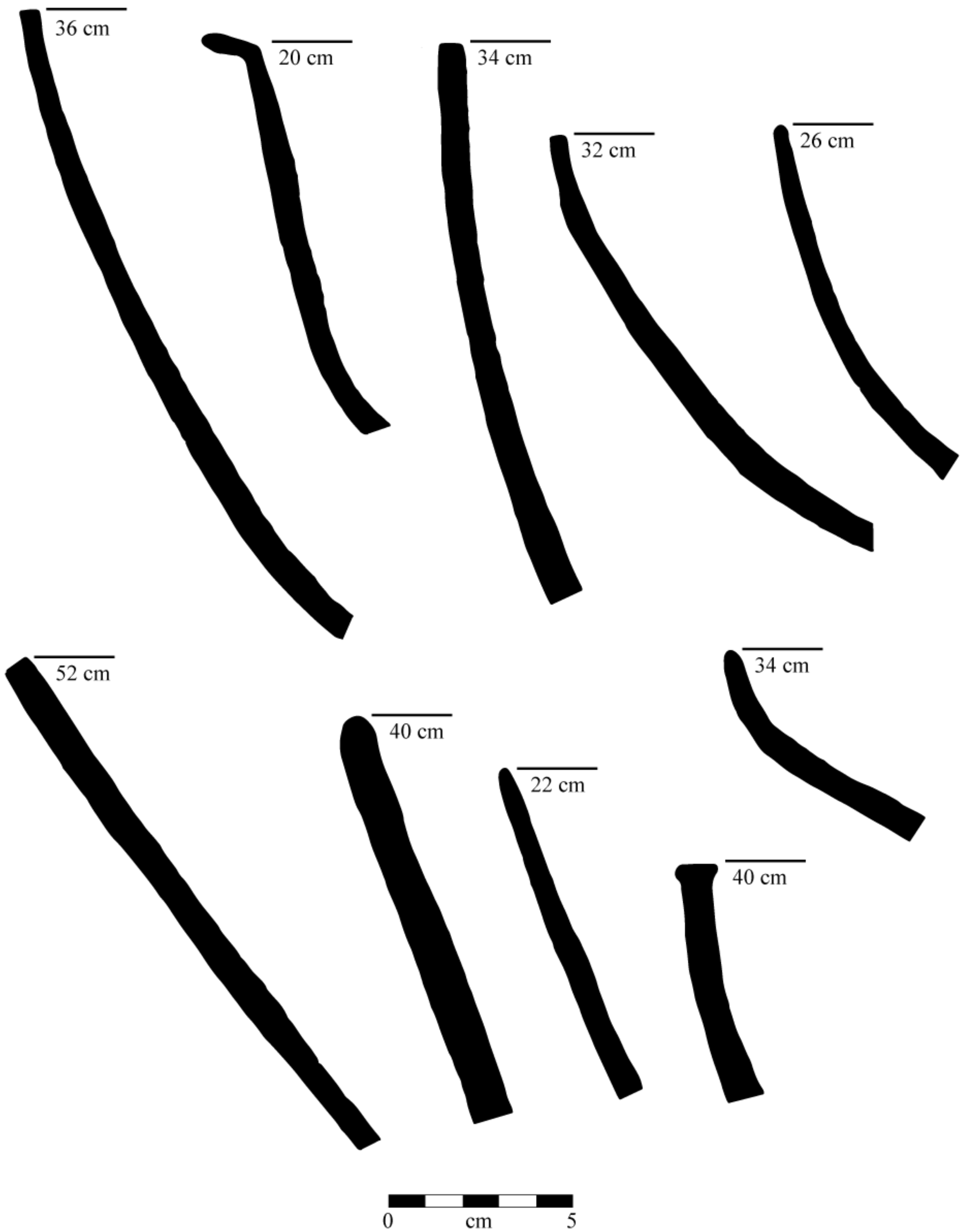

Figure 5-3. Open bowl profiles with estimated orifice diameters.

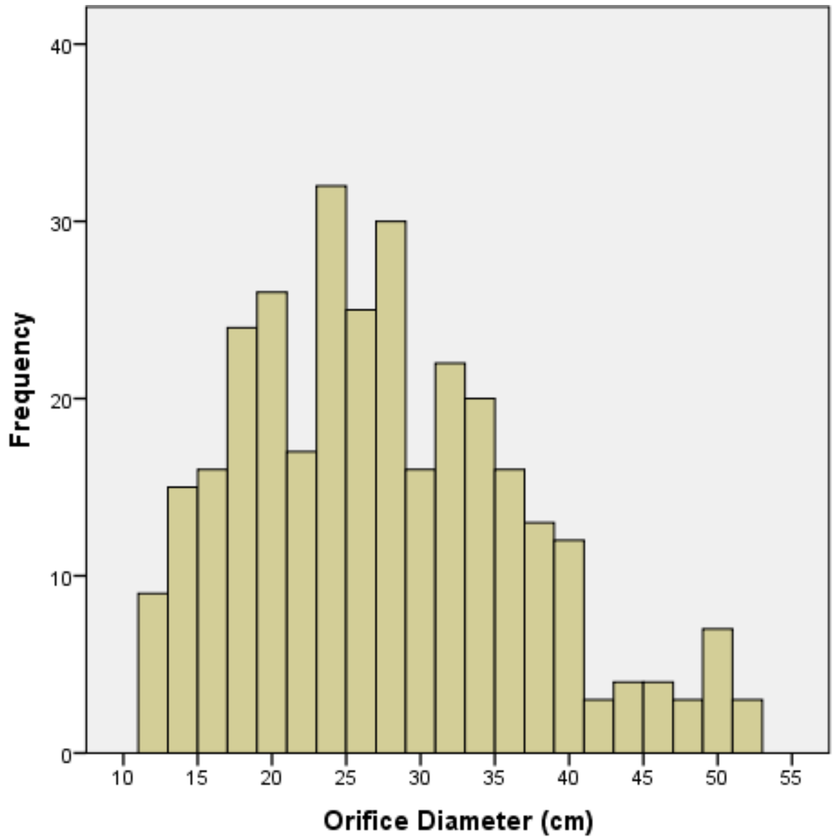

Figure 5-4. Open bowl distribution by orifice diameter.

are small (mean of 8.3 cm) and have a small range of 6 cm to 12 cm. Collared jars have a much wider range of 6 to 22 cm and a mean of 14.9 cm. Open pots average to a similar orifice diameter of 14.5 cm and have a range of 10 to 20 cm. Restricted pots, boat-shaped bowls, and the other vessel forms do not have large enough samples for these statistics to properly represent their data.

A Note on Unidentified Vessels. There are 381 unidentified vessels present in the collection. Though these cannot provide as much information as identified forms, they still say something about the collection. Of the total number of vessels, 44 percent are unidentified. There are 306 unidentified restricted vessels. Of these, 63 percent are sand-tempered (mostly sand-

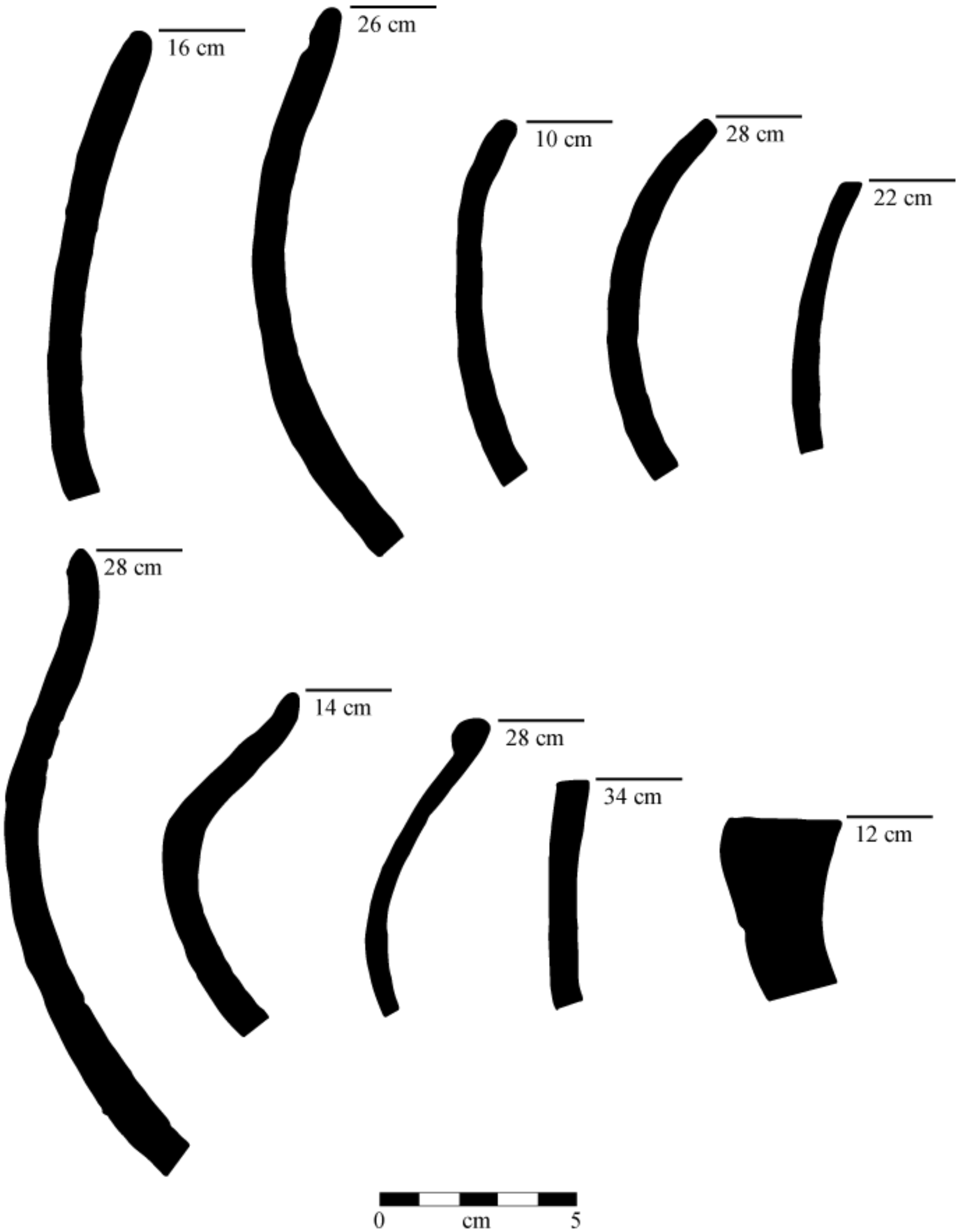

Figure 5-5. Restricted bowl profiles with estimated orifice diameters.

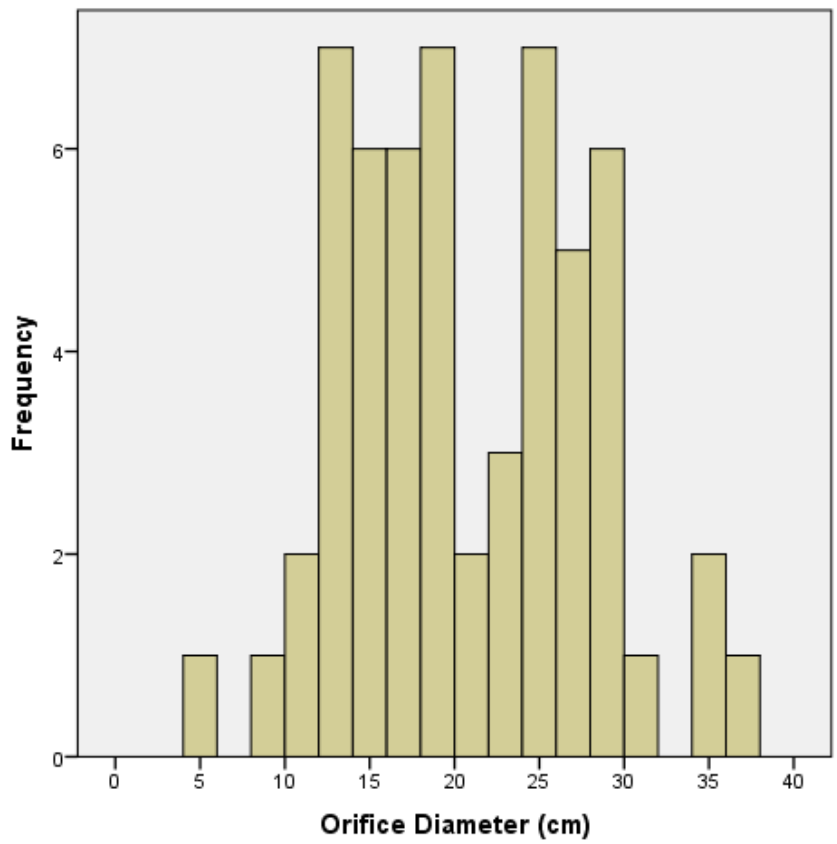

Figure 5-6. Restricted bowl distribution by orifice diameter.

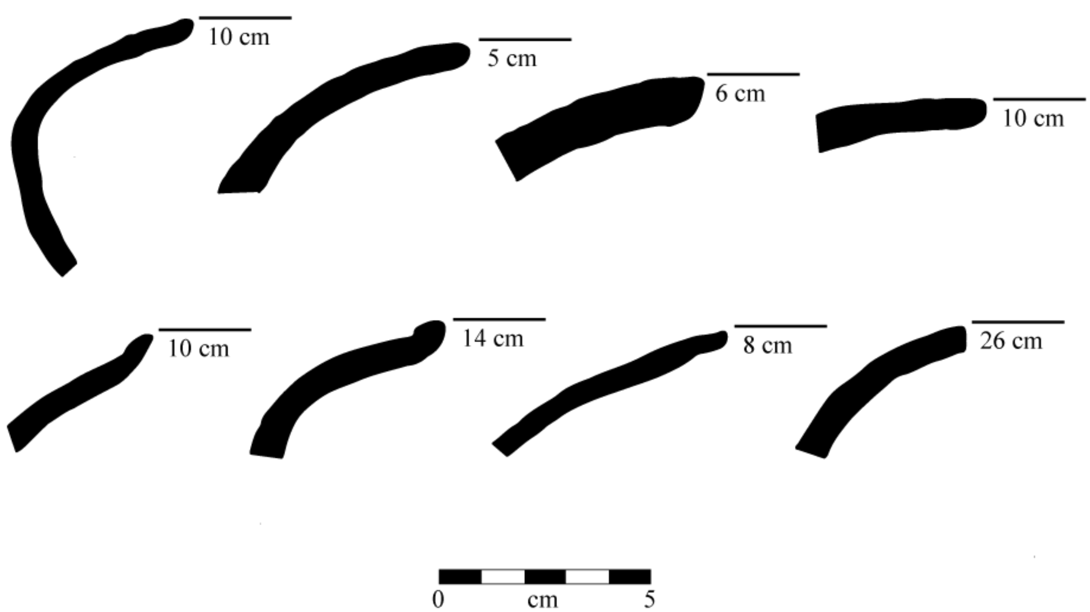

Figure 5-7. Flattened-globular bowl profiles with estimated orifice diameters.

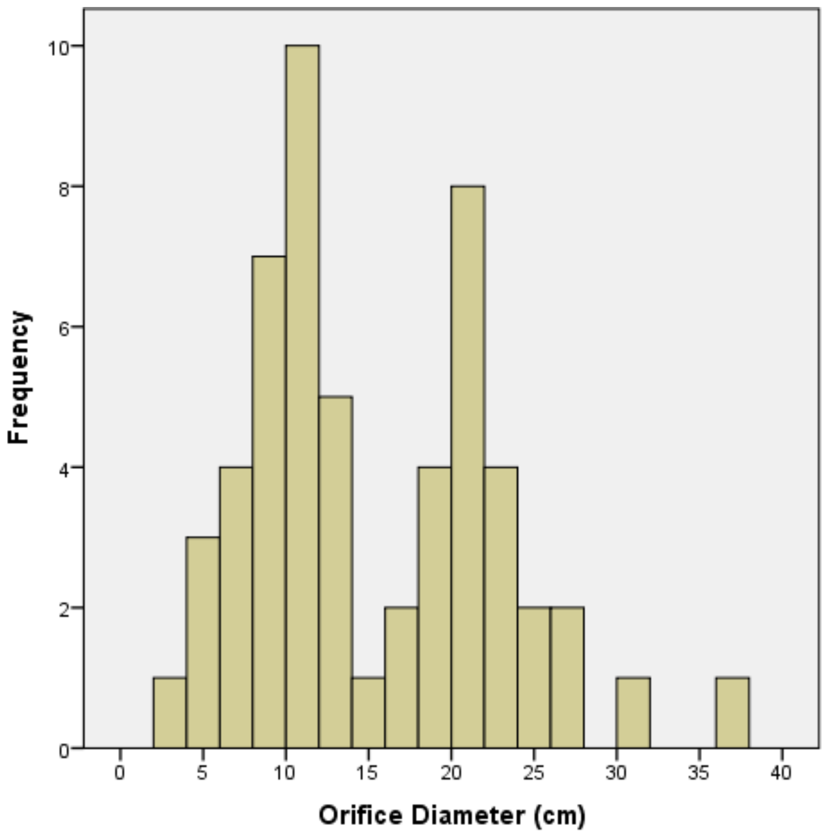

Figure 5-8. Flattened-globular bowl distribution by orifice diameter.

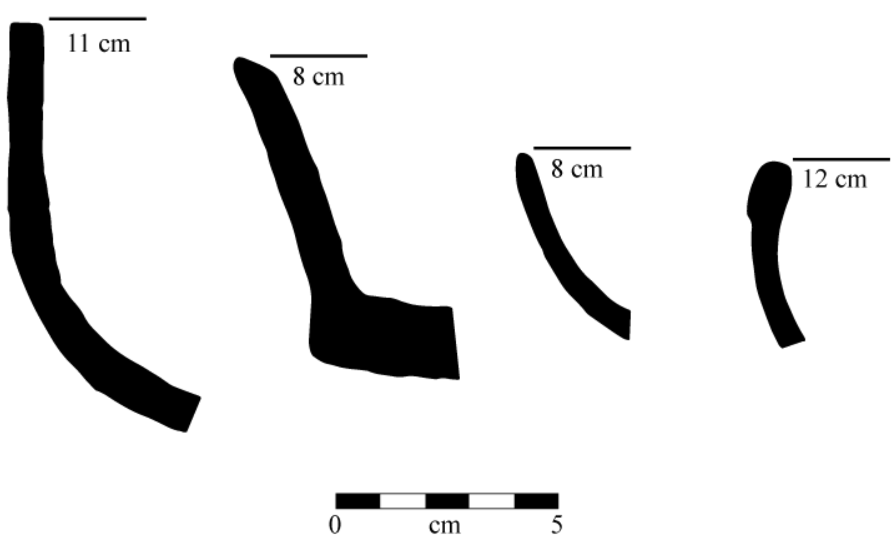

Figure 5-9. Cup profiles with estimated orifice diameters.

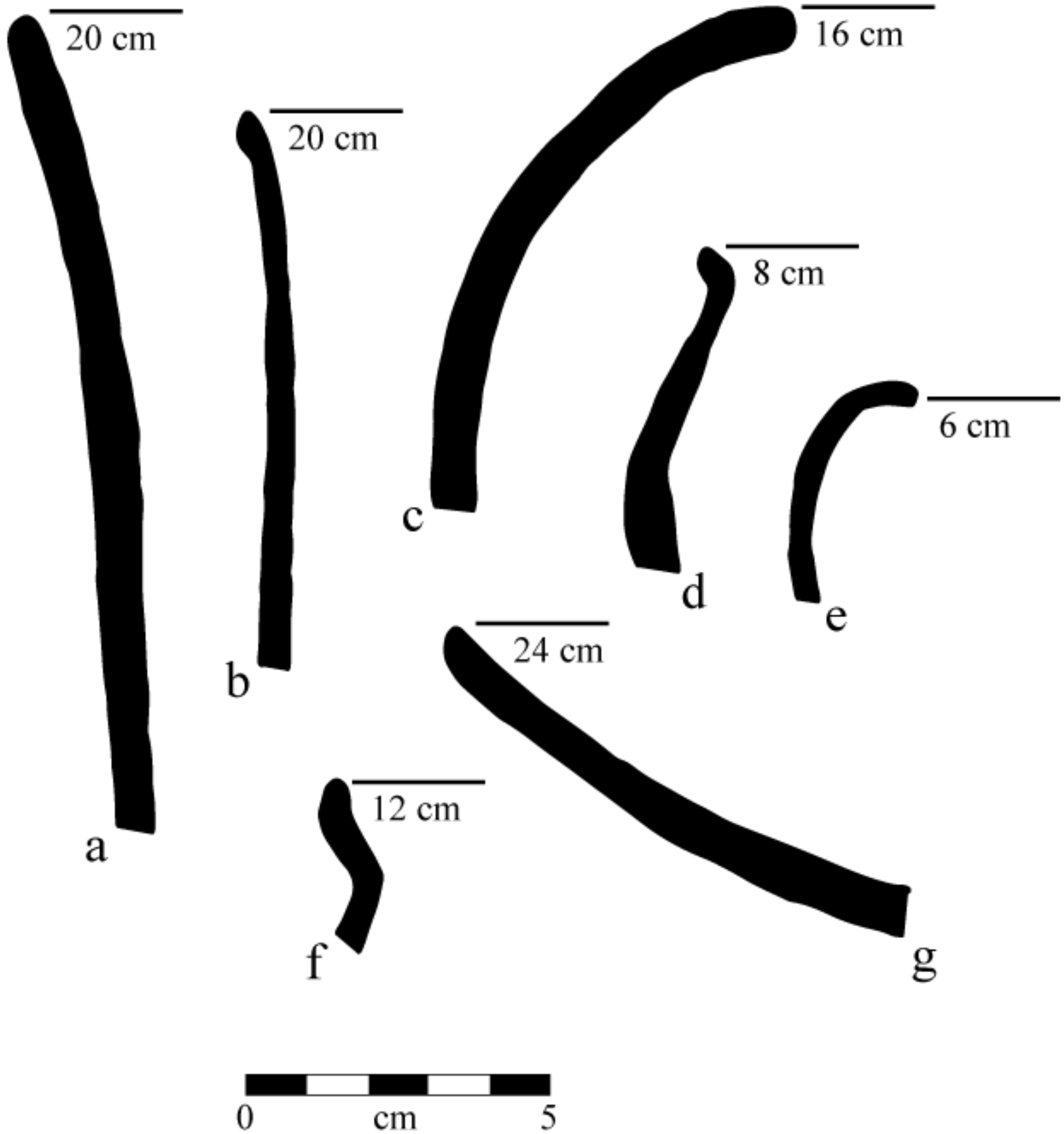

Figure 5-10. Rim profiles of open pots, restricted pots, small jars, collared jars, and plates with estimated orifice diameters. Open pot profiles (*a, b*). Restricted pot profile (*c*). Small jar profiles (*d, e*). Collared jar profile (*f*). Plate profile (*g*).

tempered plain and Weeden Island Plain), 16 percent are limestone-tempered (Pasco Plain), and 17 percent are sponge spicule-tempered (mostly St. Johns Plain and Dunn's Creek Red). There are far less unidentified unrestricted vessels (75). These vessels are fairly evenly spread between sand (36 percent), limestone (36 percent), and sponge spicule (21 percent) temper. The sand-tempered unidentified unrestricted vessels are separated between six different pottery types (mostly sand-tempered plain). Limestone-tempered unidentified unrestricted vessels are all Pasco Plain and sponge spicule vessels are mostly St. Johns Plain and Dunn's Creek Red.

In terms of use wear, approximately 50 percent of the vessels of both unidentified types are fire clouded. Soot is present on less than ten percent (15 vessels) of the vessels of each type and neither of these types have mend holes. Both vessel forms also each have six vessels that have both fire clouding and sooting. If the unidentified restricted vessels were mostly open pots used in cooking, it would be expected that many more sooted vessels would be present. This may be evidence that many of these vessels are restricted bowls used for storage or other non-cooking functions.

The UID restricted vessels have an orifice diameter range of 3 to 52 cm and a mean at 17.1 cm. Their distribution is unimodal with a grouping of vessels between 10 and 22 cm with a few larger outliers (Figure 5-11). UID unrestricted vessels have a similar range of 6 to 52 cm and a slightly larger mean at 22.8 cm. These vessels also have a unimodal distribution with large outliers (Figure 5-12). Most of these unrestricted vessels are between 12 and 32 cm in diameter.

Spatial Distribution of Vessels

As with the type/attribute analysis in the previous chapter, I will analyze these results based on each area at Crystal River. The collection is unevenly distributed across features at the site because past researchers focused mainly on the Main Burial Complex. This resulted in very few vessels being identified outside of this complex. The distribution of vessels across the site is shown in Table 5-10. The vessels used for this research project do not include whole and partial vessels collected by Moore but the majority still come from the Circular Embankment (66 percent) which he focused on, followed by E and F (17 percent), and Midden B (16 percent). Vessels from other features make up less than three percent of the collection. No vessels were identified from Mound K.

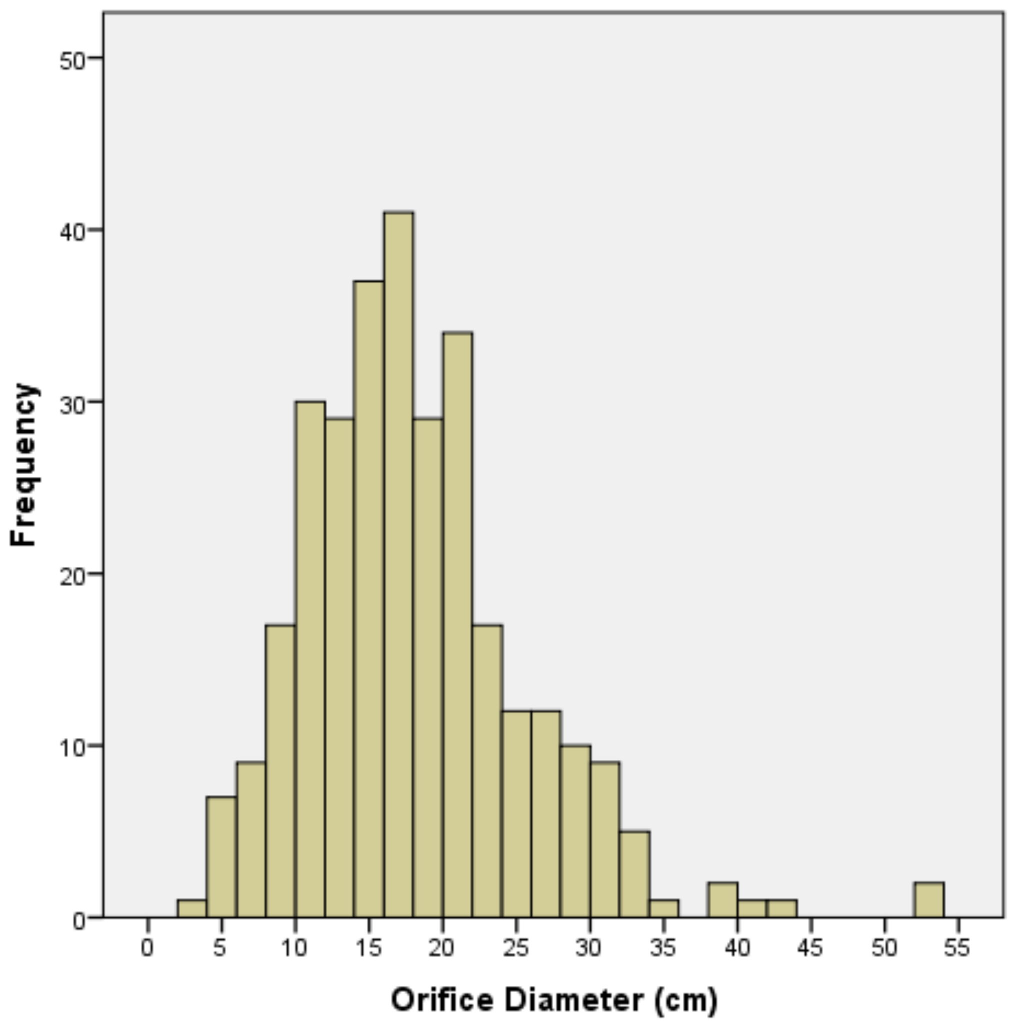

Figure 5-11. Unidentified restricted distribution by orifice diameter.

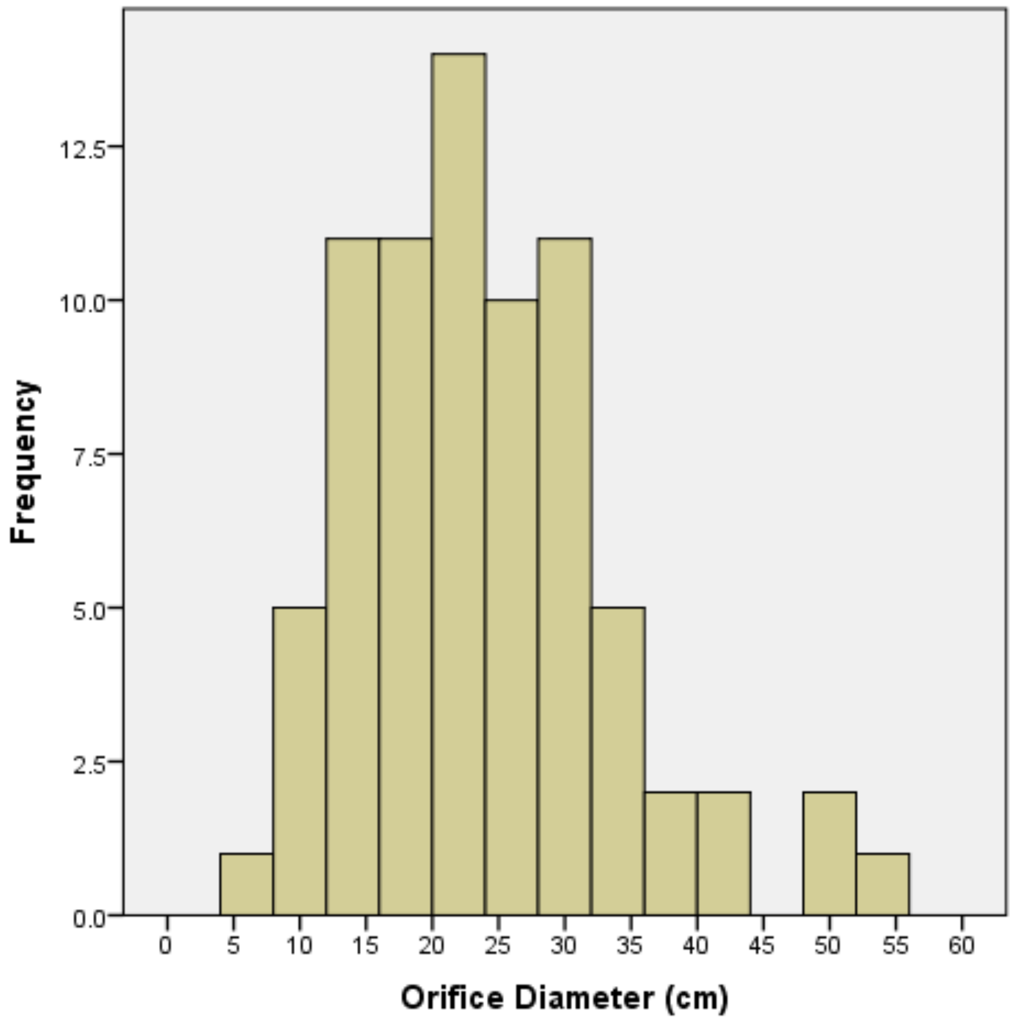

Figure 5-12. Unidentified unrestricted distribution by orifice diameter.

Midden B. The midden has a total of 75 identifiable vessels (Table 5-11). A large majority are open bowls (89 percent), followed by cups (seven percent), restricted bowls (three percent), and one collared jar (1 percent). In terms of vessel function, 74 of the 75 vessels are serving vessels. The outlier is a collared jar, the only storage vessel recovered. Thirty unidentified vessels were also present in the midden. All major temper types are represented in the 75 recorded vessels, but the bulk are limestone-tempered (76 percent). This is different than the overall collection which is dominated by sand-tempered vessels. This is most likely because the distribution of vessels is skewed toward the burial areas which are dominated by sand-

Table 5-10. Spatial Distribution of Vessels

Vessel Form	General Site	Mound G	Platform E and Mound F	Circular Embankment (C)	Midden B	Mound H	Total
Open bowl	3	3	50	193	67	1	317
Restricted bowl			5	49	2	1	57
Flattened-globular bowl			19	36			55
Cup			2	13	5		20
Collared jar			1	5	1		7
Small jar	1		2	4			7
Open pot				6			6
Restricted pot			1	1			2
Boat-shaped bowl				2			2
Other				2			2
Multi-compartment tray				1			1
Beaker			1				1
Plate/dish				1			1
Total	4	3	81	313	75	2	478
%	.8	.6	16.9	65.5	15.7	.4	100

Table 5-11. Midden B Vessel Distribution

Vessel Form	N	%
Open bowl	67	89.3
Restricted bowl	2	2.7
Cup	5	6.7
Collared jar	1	1.3
Total	75	100

tempered vessels. Sponge spicule wares make up 13 percent of the midden collection while nine percent of the vessels are sand-tempered. The only mixed temper vessel from Midden B is a Pasco with sand cup. The distribution of vessels by pottery type is shown in Table 5-12. Of the 57 Pasco Plain vessels, 51 are open bowls, four are cups, and two are restricted bowls. All of the

Dunn's Creek Red vessels (nine) and sand-tempered plain vessels are open bowls. The single St. Johns Plain vessel is also an open bowl.

A total of 21 vessels (31 percent) have fire clouding present while 10 vessels have sooting, about 15 percent of the vessels from Midden B (Table 5-13). All of the sooted vessels are open bowls and all but one of the fire clouded vessels (cup) are also open bowls. A total of seven vessels have exterior sooting while three have interior sooting. All of the sooted vessels are Pasco Plain. The vessels from the midden range in orifice diameters from 8 to 52 cm (Table 5-14). The majority are between 11 and 30 cm. The whole collection of Midden B vessels has a mean of 22.5 cm and a standard deviation of 8.5. Open bowls (Table 5-15) range from 12 cm to 52 cm and have a mean of 23.6 cm, slightly lower than the overall average of open bowls (27.5 cm). The majority of open bowls from the midden fit into the smaller bowl category discussed previously (between 11 and 40 cm in diameter). Most of the sooted open bowls fit into the smaller bowl category as well. Cups have a mean of 10 cm and range from eight to 12 cm. Restricted bowls have a range from 14 cm to 34 cm and a mean of 24 cm, slightly higher than the collection average of 19.8 cm.

Table 5-12. Midden B Vessels by Pottery Type

Type	Open bowl	Restricted bowl	Cup	Collared jar	Total	%
St. Johns Plain	1				1	1.3
Dunn's Creek Red	9				9	12.0
Pasco Plain	51	2	4		57	76.0
Sand-Tempered Plain	6				6	8.0
Pasco with Sand			1		1	1.3
UID/Other				1	1	1.3
Total	67	2	5	1	75	100
%	89.3	2.7	6.7	1.3	100	

Table 5-13. Soot Frequency by Area of Site

Area of Site	N	Total Vessels	%
Circular Embankment (C)	23	313	7.3
Platform E and Mound F	6	81	7.4
Midden B	10	75	13.3
General Site	-	4	-
Mound G	-	3	-
Mound H	-	2	-
Total	39	478	8.2

Table 5-14. Orifice Diameter Summary Statistics by Area

Area of Site	N	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum
Circular Embankment (C)	313	23.6	10.9	24	24	49	3	52
Platform E and Mound F	81	22.9	10.1	22	20	40	4	44
Midden B	75	22.5	8.5	22	20	44	8	52
General Site	4	23.5	10.8	22	22	26	12	38
Mound G	3	27.3	5.8	24	24	10	24	34
Mound H	2	30	5.7	30	26	8	26	34

Table 5-15. Midden B Orifice Diameter by Vessel Form

Vessel Form	N	Range	Mean	Standard Deviation	Median	Mode	Minimum	Maximum
Open bowl	67	40	23.6	8	22	20	12	52
Cup	5	4	10	1.4	10	10	8	12
Restricted bowl	2	20	24	14.1	24	14	14	34
Collared jar	1		12		12	12	12	12

Though Midden B is the only feature with data relevant to temporal distribution, the vessel form data adds little to the type/attribute analysis outlined in the previous chapter. From the two units Bullen dug in the midden in 1964, it seems that most of the open bowls are coming from later contexts at the site while the two 1951 units show that the level of open bowls is slightly higher in the middle occupation. The vessel sample from Midden B is simply too small to make any more specific temporal observations.

Mound G. Out of the 155 sherds that came from this feature, only four vessels were large enough to be recorded and identified. The three open bowls are sand-tempered plain, Pasco Plain, and a mixed temper Pasco with sand. One St. Johns Check Stamped unidentified unrestricted vessel also came from Mound G. The sand-tempered plain and Pasco with sand bowls are both 24 cm in diameter, mid-sized vessels in comparison with the range of all open bowls. The Pasco Plain bowl is 34 cm in diameter. All three open bowls, seemingly used for serving, have fire clouding present. No sooted vessels are present.

Mound H. An open bowl, a restricted bowl, and an unidentified unrestricted vessel are the only vessels identified from Mound H. All three are Pasco Plain. The open bowl has an orifice diameter of 34 cm and the restricted bowl is 26 cm in diameter. Both the open and restricted bowls are fire clouded. No sooted vessels are present.

Mound A. I recorded one vessel from Mound A, an unidentified restricted Pasco Plain vessel. It has an orifice diameter of 28 cm.

Platform E and Mound F. E and F have a total of 81 identifiable vessels. As shown in Table 5-16, the vessels are mostly open bowls (62 percent), followed by flattened globular bowls (23 percent), restricted bowls (6 percent), and cups and small jars (two percent each). There is one collared jar, one restricted pot, and one beaker as well. In terms of vessel function, 72 percent are serving vessels and 27 percent are cooking vessels (Table 5-17). The one collared jar is a storage vessel. A number of unidentified vessels (57) also came from E and F (the majority are sand-tempered). As with Midden B, all major temper types are represented. The majority of

Table 5-16. Platform E and Mound F Vessel Distribution

Vessel Form	Platform E and Mound F	%
Open bowl	50	61.7
Restricted bowl	5	6.2
Flattened globular bowl	19	23.5
Cup	2	2.5
Collared jar	1	1.2
Small jar	2	2.5
Restricted pot	1	1.2
Beaker	1	1.2
Total	81	100%

Table 5-17. E and F Vessels by Vessel Function

Vessel Function	N	%
Serving	58	71.6
Cooking	22	27.2
Storage	1	1.2
Total	81	100

vessels are sponge spicule (46 percent) and sand (33 percent) tempered, followed by limestone-tempered (19 percent) and few other/mixed temper vessels (three percent).

The distribution of vessels by pottery type is shown in Table 5-18. Sponge spicule vessels are split amongst St. Johns Plain (22) and Dunn's Creek Red (15). These are mostly open bowls and flattened-globular bowls but also include a restricted bowl and pot, and a cup. All but three of the limestone vessels are open bowls and are mostly Pasco Plain. Sand-tempered vessels are mostly sand-tempered plain and Weeden Island Plain, but also include other types such as Wakulla Check Stamped, Weeden Island Punctated, and Ruskin Dentate Stamped. The majority of sand-tempered types are open bowls and flattened-globular bowls. Open bowls are mostly St. Johns Plain (28 percent), Dunn's Creek Red (24 percent), Pasco Plain (22 percent), and other

Table 5-18. E and F Vessels by Pottery Type

Type/Description	Open bowl	Flattened globular bowl	Restricted bowl	Small jar	Cup	Restricted pot	Collared jar	Beaker	Total	%
Dunn's Creek Red	12	2	1						15	18.5
Grit-Tempered Plain								1	1	1.2
Keith Incised							1		1	1.2
Non-limestone Pasco	1								1	1.2
Pasco Plain	11		2						13	16.0
Pasco Red	1	1							2	2.5
Ruskin Dentate Stamped	1		1						2	2.5
Sand-Tempered Plain	6	2		2	1				11	13.6
St Johns-like Plain	14	6			1	1			22	27.2
Wakulla Check Stamped	3								3	3.7
Weeden Island Plain	1	5							6	7.4
Weeden Island Red			1						1	1.2
Weeden Island Zoned Punctated		3							3	3.7
Total	50	19	5	2	2	1	1	1	81	100
%	61.7	23.5	6.2	2.5	2.5	1.2	1.2	1.2	100	

sand-tempered types (22 percent). Flattened-globular bowls are more evenly spread amongst different pottery types. St. Johns Plain (32 percent), Weeden Island Plain (26 percent), and Weeden Island Punctated (16 percent) make up the majority of the flattened-globular bowls.

Quite a few vessels from E and F have use wear present (Table 5-19). In terms of use wear, 21 (42 percent) of the 50 open bowls have fire clouding, three have soot present, and one has a mend hole. Of these, two open bowls have both fire clouding and sooting. The size of sooted open bowls centers around 20 to 30 cm in diameter, on the back end of the smaller size category for these bowls. Almost half (42 percent) of the flattened-globular bowls have fire clouding but none have sooting or mend holes. Of the five restricted bowls, two have fire clouding and one of these is also sooted. Of the six total sooted vessels from E and F, three have exterior sooting (an open bowl, restricted bowl, and a collared jar), two have interior sooting (a cup and an open bowl), and one vessels has both exterior and interior sooting. It is interesting to

Table 5-19. E and F Evidence of Use Wear by Vessel Form

Vessel Form	Total	Fire Clouding		Sooting		Mend Hole	
		N	% of Total	N	% of Total	N	% of Total
Open bowl	50	21	42	3	6	1	2
Flattened-globular bowl	19	8	42.1				
Restricted bowl	5	2	40	1	20		
Small jar	2	1	50				
Cup	2	1	50	1	50		
Collared jar	1	1	100	1	100		
Restricted Pot	1						
Beaker	1						
Total	81	34		6		1	

note that all of the vessels from E and F with exterior soot are sand-tempered while the two with interior soot are limestone and sponge spicule-tempered.

Overall, the vessels from E and F have a size range of 4 to 44 cm (see Table 5-14). The whole collection of vessels from this feature has a mean of 22.9 and a standard deviation of 10.1. Open bowls (Table 5-20) range from 14 to 44 cm and have a mean of 28 cm (7.7 standard deviation). These bowls fit into two general size categories, a smaller category from 16 to 33 cm in diameter and a slightly larger category of 34 to 40 cm in diameter. No sooted vessels were recorded from the larger bowl category. Flattened-globular bowls have a range from six to 36 cm, a mean of 16.3 cm (slightly higher than the overall mean of 14.4 cm), and a standard deviation of 8.6 cm. The flattened-globular bowls from E and F fit into two size modes, one centered around 10 cm and the other around 20 cm. Restricted bowls documented from E and F have a range from12 to 28 cm and a mean of 17.6 (standard deviation 6.5).

*Circular Embankment***.** The Circular Embankment (C) has a total of 313 identifiable vessels (Table 5-21), by far the most out of all the features. The majority of these are open bowls (62 percent), followed by restricted bowls (16 percent), flattened-globular bowls (11 percent),

Table 5-20. E and F Orifice Diameter Summary Statistics by Vessel Form

Vessel Form	N	Range	Mean	Standard Deviation	Median	Mode	Minimum	Maximum
Open bowl	50	30	28	7.7	28	24	14	44
Flattened-globular bowl	19	30	16.3	8.6	18	20	6	36
Restricted bowl	5	16	17.6	6.5	18	12	12	28
Small jar	2		8		8	8	8	8
Cup	2	2	9	1.4	9	8	8	10
Restricted pot	1		4		4	4	4	4
Collared jar	1		12		12	12	12	12
Beaker	1		8		8	8	8	8

Table 5-21. Circular Embankment Vessel Distribution

Vessel Form	N	%
Open bowl	193	61.7
Restricted bowl	49	15.7
Flattened globular bowl	36	11.5
Cup	13	4.2
Collared jar	5	1.6
Small jar	4	1.3
Open pot	6	1.9
Restricted pot	1	.3
Boat-shaped bowl	2	.6
Other	2	.6
Multi-compartment tray	1	.3
Plate/dish	1	.3
Total	313	100

and cups (four percent). All other vessels types only make up seven percent of the total vessels from C. These include cups (13), open pots (six), collared jars (five), small jars (four), and others. A large number of vessels from the Circular Embankment (290) are also unidentified vessels. The distribution of vessels by vessel function is shown in Table 5-22. Unlike other

Table 5-22. Circular Embankment Vessels by Function

Vessel Function	N	%
Serving	259	82.7
Cooking	7	2.2
Storage	47	15
Total	313	100

features at the site, C has a larger number of storage and cooking vessels. Most of the vessels are for serving (83 percent), but 15 percent are storage and a minimal two percent are cooking vessels.

In terms of temper, 34 percent of the vessels are sand-tempered, followed by sponge spicule (38 percent), and limestone (27 percent). Open bowls are mostly Pasco Plain (38 percent), Dunn's Creek Red (25 percent), and St. Johns Plain (23 percent) (Table 5-23). Sand-tempered types such as sand-tempered plain and Weeden Island Plain collectively make up about 30 percent of the open bowls. Restricted bowls are majorly Weeden Island Plain (35 percent) but are also dominated by sponge spicule types Dunn's Creek Red (18 percent) and St. Johns Plain (12 percent). Pasco Plain makes up ten percent of the restricted bowls while all other sand-tempered types collectively make up another 18 percent. Flattened-globular bowls are also mostly sand-tempered types with 33 percent Weeden Island Plain and 19 percent sand-tempered plain. Dunn's Creek Red and St. Johns Plain make up only six and eight percent respectively. Only six percent are limestone-tempered (Pasco Red). The majority of the rest of the flattened-globular bowls are decorated sand-tempered types (22 percent). One flattened-globular bowl is a mixed temper vessel. All of the open pots are sand-tempered vessels.

Many of the Circular Embankment vessels have evidence of use wear (Table 5-24). Of the 193 open bowls, 54 percent have fire clouding, ten percent have sooting, and four vessels

Table 5-23. Circular Embankment Vessels by Pottery Type

Type/Description	Open bowl	Restricted bowl	Flattened globular bowl	Cup	Open pot	Collared jar	Small jar	Other	Boat-shaped bowl	Restricted pot	Plate/dish	Multi-compartment tray	Total	%
Deptford Check Stamped	1												1	.3
Dunn's Creek Red	48	9	2										59	18.8
Papys Bayou Plain	1												1	.3
Papys Bayou Punctated	1	1	1										3	1
Pasco Plain	65	5		3		1		1		1	1		77	24.6
Pasco Plain with sand					1								1	.3
Pasco Red		2	2	1									5	1.6
Pasco scored	1												1	.3
Ruskin Dentate Stamped	3												3	1
Ruskin Linear Punctated	1												1	.3
Sand-Tempered Plain	13	3	7	5	2	1	1		2				34	10.9
Sand-Tempered Plain residual red			3	1									4	1.3
Sand-Tempered Plain with Inclusions	1		1										2	.6
St. Andrews Complicated Stamped		1											1	.3
St. Johns-like Plain	44	6	3	1		1	1					1	57	18.2
Swift Creek Complicated Stamped					1								1	.3

Table 5-23 (continued)

Type/Description	Open bowl	Restricted bowl	Flattened globular bowl	Cup	Open pot	Collared jar	Small jar	Other	Boat-shaped bowl	Restricted pot	Plate/dish	Multi-compartment tray	Total	%
Tampa Complicated Stamped		1											1	.3
Wakulla Check Stamped	4	1		1	1								7	2.2
Weeden Island Plain	6	17	12			1							36	11.5
Weeden Island Red	2	1	1				2						6	1.9
Weeden Island Zoned Incised			1										1	.3
Weeden Island Zoned Incised/Punctated			1										1	.3
Weeden Island Zoned Punctated		1	2	1									4	1.3
West Florida Cord Marked						1							1	.3
Other	2	1			1			1					5	1.6
Total	193	49	36	13	6	5	4	2	2	1	1	1	313	100
%	61.7	15.7	11.5	4.2	1.9	1.6	1.3	0.6	0.6	0.3	0.3	0.3	100	

Table 5-24. Circular Embankment Evidence of Use Wear by Vessel Form

Vessel Form	Total	Fire Clouding		Sooting		Mend Hole	
		N	% of Total	N	% of Total	N	% of Total
Open bowl	193	105	54.4	20	10.4	4	2.1
Restricted bowl	49	33	67.3	2	4.1		
Flattened-globular bowl	36	18	50			1	2.8
Cup	13	6	46.2	1	7.7	1	7.7
Open pot	6	5	83.3			1	16.7
Collared jar	5	2	40				
Small jar	4	2	50				
Other	2	1	50				
Boat-shaped bowl	2	1	50				
Restricted pot	1	1	100				
Plate/dish	1	1	100				
Multi-compartment tray	1	1	100				
Total	313	176	55.1	23	5.1	7	1.2

have mend holes. Most of the sooted vessels range between 17 and 40 cm in diameter, fitting into the larger end of the small bowl category of open bowls. Of these vessels, 16 have both fire clouding and sooting and one vessel has fire clouding, sooting, and a mend hole (Pasco Plain vessel). Of the 49 restricted bowls from C, 67 percent have fire clouding and four percent have sooting (two of these vessels have both fire clouding and sooting). Half of the 36 flattened-globular bowls are fire clouded, none are sooted, and one has a mend hole. Of the 13 cups, 46 percent are fire clouded, one is sooted, and one has a mend hole. There are only six open pots but of these, five of which are fire clouded, and one of these also has a mend hole. None had evidence of soot. All of the remaining vessel forms are fire clouded on at least half of the vessels present and have no evidence of soot or mend holes. As with Midden B and E and F, sooted vessels have exterior or interior soot, or both. There are three exterior sooted vessels (an open bowl and two restricted bowls), 16 interior sooted vessels (all open bowls), and four vessels with both exterior and interior sooting (three open bowls and one cup). Similar to the pattern in E and F, all of the vessels with only exterior sooting are sand-tempered while all of the vessels with either interior only sooting or both interior and exterior sooting are sponge spicule or limestone-tempered.

Looking at vessel size (see Table 5-14), the overall collection from the Circular Embankment has an orifice diameter range of 3 to 52 cm and a mean of 23.6 (standard deviation of 11). Vessel size by form is shown in Table 5-25. Open bowls have a mean of 28.6 cm and a standard deviation of 9.8 cm. They range from 12 to 52 cm. Restricted bowls have a range of five to 36 cm, a mean of 19.8 cm, and a standard deviation of 6.9 cm. Flattened-globular bowls have a range of 3 to 26 cm and a mean of 13.4 cm (standard deviation of 6.5 cm). Cups have a mean of 9.5 cm, a standard deviation of 1.5 cm, and a range of eight to 12 cm in diameter. Open pots have a range of 10 to 20 cm, a mean of 14.5 cm, and a standard deviation of 4.5 cm. Collared jars have a mean of 16 cm, a standard deviation of 6.3 cm, and a range of six to 22 cm. Small jars have a range of six to 12 cm, a mean of 7.5 cm, and a standard deviation of three cm.

Table 5-25. Circular Embankment Orifice Diameter Summary Statistics by Vessel Form

Vessel Form	N	Range	Mean	Standard Deviation	Median	Mode	Minimum	Maximum
Open bowl	193	40	28.6	9.8	28	26	12	52
Restricted bowl	49	31	19.8	6.9	18	24	5	36
Flattened globular bowl	36	23	13.4	6.5	12	10	3	26
Cup	13	4	9.5	1.5	10	8	8	12
Open pot	6	10	14.5	4.5	13	20	10	20
Collared jar	5	16	16	6.3	18	6	6	22
Small jar	4	6	7.5	3	6	6	6	12
Other	2	4	14	2.8	14	12	12	16
Boat-shaped bowl	2		4		4	4	4	4
Restricted pot	1		16		16	16	16	16
Plate/dish	1		24		24	24	24	24
Multi-compartment tray	1		7		7	7	7	7

Conclusions

The vessel form data does not add much information to the type/attribute analysis from the previous chapter because of the small sample size and disproportionate distribution of vessels from each feature. However, I am able to make some general observations. The large number of serving vessels would be consistent with specialized occupations focused on feasting and ceremony, and perhaps indicate a less permanent occupation at the site. However, there are good reasons to doubt this; open bowls may have been often used for cooking judging from their high proportion of sooting (though many of the sooted open bowls do have interior sooting which could result from other activities). In addition, a lot of the restricted vessel forms were unidentifiable. Since these are more likely used for storage or cooking, the analysis may be biased to open vessels, presumed to function as serving vessels.

As with the type/attribute analysis, the vessel form analysis shows greater ceramic diversity in the mound features than in the midden. The midden is dominated by limestone vessels while Mounds E and F and the Circular Embankment are mostly sponge spicule and sand-tempered vessels. All three of these areas are dominated by open bowls. However, Midden B has only a few other vessel forms such as restricted bowls and cups while the Main Burial Complex has large numbers of flattened-globular bowls and a larger variety of vessel forms in general. This would fit with the proposed use of each of these features and corresponds with the data implications of a symbolic community (one in which a homogenous community lives at the site and interacts with other communities of practice) as discussed in Chapter 3. The lack of variation in Midden B and the dominance of variation in mound deposits suggests a homogenous local community which interacted with other incoming communities. However, this result could be skewed by the fact that much less of a vessel is needed to identify an open bowl than is needed to identify a restricted vessel. The high number of unidentified vessels in this collection suggests that this distribution would be very different had those vessels been identifiable. Most of the 377 unidentified vessels from these areas are majorly (81 percent) restricted vessels. In the Circular Embankment and E and F there are many more unidentified restricted vessels than there are unrestricted. In C, there are more unidentified restricted vessels than there are identified open bowls.

The large number of unidentified vessels could also throw off the summary of vessels by function. Among identifiable vessels, these three areas are dominated by serving vessels. Midden B has no cooking vessels and only one storage vessel. Midden B has 15 UID restricted and 15 UID unrestricted vessels which could be cooking or storage vessels. E and F have 22 cooking vessels and one storage vessel. This part of the burial complex has 44 UID restricted vessels and 13 UID unrestricted vessels. C has seven cooking vessels and 47 storage vessels. C has the largest amount of UID vessels as well, with 245 UID restricted and 45 UID unrestricted vessels. Many of these vessels could have functioned as storage and cooking vessels. This does not lend support to the popular idea that midden deposits contain utilitarian wares and burial contexts do not. Wallis (2011:10; Wallis et al. 2010:2609) notes many utilitarian style vessels in mounds and other contexts that are considered ceremonial. This distribution would be much different had the unidentified restricted vessels been identifiable and may have allowed for comment on findings such as those by Wallis.

In terms of vessel size, open bowls are relatively the same size in each area, with slightly higher means in C, E, and F. Restricted bowls have slightly larger orifice diameters in the midden and have larger standard deviations.

As for vessel function, the collection is clearly skewed towards serving vessels which could lend evidence to a number of people getting together to have large feasts, whether that be in a sustainable or symbolic community setting. If a large group of people was constantly living at the site we would expect there to be a much larger percentage of storage vessels. The lack of cooking vessels could result from the large number of unidentified vessels present in the collection and is also typical of Florida assemblages. The variability seen in this and previous analyses lend to the idea of many different communities of practice interacting but it will be up to the petrographic and chemical analyses to lend more support to this hypothesis.

CHAPTER 6:

CHEMICAL AND GROSS PASTE ANALYSES

Instrumental Neutron Activation Analysis (INAA) has proven useful for understanding ceramic provenance based on its ability to distinguish differing clay compositions. Creating sherd groupings based on these compositions and comparing them to raw clay samples can help to delineate the source and movement of pottery (Fie 2008; Glascock 1992, 2002; Neff 1992, 2000; Neff and Glowacki 2002; Rice 1980; Wallis 2011; Wallis et al. 2015; Weigand et al. 1977).

There are complications, however. One of these is the problem of differentiating raw clay from tempering materials. Clay can naturally include certain tempering materials and Native Americans most likely processed both raw clay and tempering agents before creating ceramic pastes (Rice 1987:72). These actions would change the composition of pottery and make a comparison to raw clay more difficult. However, previous studies show that the chemical makeup of clay is majorly affected only when very large amounts of temper are added to ceramic pastes (Glascock and Neff 2003; Neff et al. 1988, 1989). All of the ceramics in this study include tempering materials and as such I will not distinguish between temper and paste.

Fie (2008) carried out a study using INAA on Middle Woodland ceramics from Illinois, specifically six sites in the lower Illinois Valley, to determine what types of exchange networks the ceramics moved within. She found that sherds that were foreign and may have been widely traded throughout Middle Woodland sites were actually utilitarian types, usually considered to be the types that are locally made (Fie 2008:6). She also discovered that the special purpose vessels were being made locally.

Wallis (2011) uses petrographic, technofunctional, and INAA to determine that people along the Georgia and Florida Atlantic coasts were exchanging complicated stamped domestic cooking pots as a way to propagate social ties, possibly using these vessels in mortuary events instead of for ordinary uses. Foreign-made Swift Creek Complicated Stamped vessels were found in a greater frequency in mortuary mounds than in middens, suggesting that these foreign vessels were not being traded solely for everyday use at habitation sites (Wallis 2011:10; Wallis et al. 2010:2609). According to these findings, Wallis (2011:10; Wallis et al. 2010:2609) hypothesizes that these foreign vessels came to be important in ceremonial contexts, and thus go against the commonly held idea that utilitarian vessels are unimportant (symbolically and socially).

In both of these examples, INAA not only gave the author information on the origin location of ceramic samples but also provided data on the types of vessels, utilitarian versus specialized, that were made locally. These findings show that INAA can be valuable to a ceramics study such as the one presented in this thesis for providing source and composition information.

X-ray fluorescence spectrometry (XRF) can also be used to analyze ceramic chemical composition. Portable XRF (pXRF) differs from a laboratory XRF in that it is portable and cannot detect elements with lower atomic weights, but pXRF is still useful and provides comparable compositional data (to laboratory XRF) when used properly (Speakman et al. 2011: 3483-3484). While INAA detects many elements and uses a powdered sample for holistic compositional analysis, pXRF has a lower level of sensitivity to trace elements which the machine measures from the surface of an object (unless the sample is ground down) (Bishop et al. 1982:292; Rice 1987:394, 397: Speakman et al. 2011:3484). This can make proper detection of existing elements difficult and calls into question the usefulness of pXRF. Formerly used mainly to study metals and other materials such as obsidian, this method has been increasingly used to study ceramics (Baugh and Terrell 1982; Buxeda et al. 2003; Du Vernay 2011; Forster et al. 2011; Guerra 1998; Nostrom 2014; Rice 1987; Speakman et al. 2011; Tykot et al. 2013). pXRF analysis on an uneven, porous surface such as a sherd profile can be complex (Forster et al. 2011:390). However, a number of studies exhibit that pXRF can be useful in ceramic studies. In an analysis of ceramics from Turkey, Forster and colleagues (2011:397) show that the same ceramic compositional groupings were created with non-destructive, sectioned, or powdered XRF methods. The researchers conclude that pXRF is a reliable method of chemical analysis for ceramics when proper methods are used to compensate for surface variation (Forster et al. 2011:392-393,398).

More relevant to my research are pXRF studies on Florida pottery. Tykot et al. (2013) focus on a large sample of northwest Florida ceramics to test the utility of pXRF in pottery studies. Through this analysis, they conclude that people from sites in northwest Florida were possibly exchanging ceramics with people in Louisiana during the Late Archaic (Tykot et al. 2013:241). Du Vernay (2011:229-230) uses pXRF to suggest that Lamar and Fort Walton ceramics from the Yon mound and village site were made from different clay sources. Nostrom (2014) analyzes 133 ceramics from the Bayshore Homes site, which has a similar ceramic assemblage to Crystal River as stated in Chapter 4. She identifies three different compositional groups, hypothetically associated with different clay sources, which were spread across a number of proveniences and used in both the early and late occupations at the site (Nostrom 2014:71-72, 76). Though this project did not include any collection or testing of local raw clay sources to compare to the compositional groupings, Nostrom's (2014:20, 80) conclusions do serve as a useful pilot study to guide future research and analysis.

The analyses discussed above express the value of pXRF studies. If pXRF analysis was then combined with an analysis that measures more trace elements, such as INAA, the INAA group results could be compared to pXRF results to source materials (Goren et al. 2011; Speakman et al. 2011). Goren and associates (2011) supported this claim with their study of clay tablets from the Near East. Speakman et al. (2011) concluded that when comparing INAA and pXRF, their results do have some correlation with each other. However, the authors state that INAA is the superior method for sourcing pottery and that caution should be used when using pXRF as the sole analytical method. pXRF can also provide useful information when only non-destructive methods can be used (Speakman et al. 2011:3495).

The final step in my analysis of Crystal River ceramics tests the reliability of INAA and pXRF as ceramic analyses through a pilot study of 35 sherds. These chemical analyses are then compared to a gross paste analysis of the same sherd sample. Wallis (2011) and others (Bishop et al. 1982; Neff et al. 2006) show that comparing chemical sourcing results to petrographic studies can help to alleviate problems that occur with these methods when they are considered independently. Gross paste analysis can aid in differentiating between temper and naturally occurring materials in clay based on composition and grain size (Rye 1981:52). Based on four clay samples taken from Citrus County, two from the Crystal River site itself, one from nearby Shell Island, and one from elsewhere in the county, it seems that local clays have varying amounts of naturally occurring sand and no natural limestone inclusions. This information is important to remember when comparing raw clay to pottery sherds with varying paste compositions. Differing paste compositions can create groupings to compare to ray clay samples with known locations, possibly within general regions where certain inclusions are common. Studies have shown that this method can be a reliable way to get general source locations (e.g., Cordell 1980, 2013; Pluckhahn and Cordell 2011; Wallis 2011; Wallis et al. 2014; Wallis et al. 2015).

Through the use of INAA, pXRF, and gross paste analysis I hope to get a better understanding of the source locations of 35 Crystal River pottery samples. This is the first analysis of this kind performed on ceramics from Crystal River and as such it will serve as a pilot study for future researchers. Variation in the chemical and gross paste groupings should give insight into the different communities at the site. The source locations will help us judge the scale of interaction these prehistoric people were acting in. The analysis may be limited by the small sample size but the information gained will help us to better understand the ceramic collection and the types of communities that may have created them.

Methods

The sample consists of a total of 35 rim or rim-associated sherds, except for a Keith Incised specimen which had no rim sherds large enough for the study (Table 6-1). I used rim sherds to make sure that the samples came from different vessels. Though the sample size is small, this study helps to augment a larger study of plain and Swift Creek pottery and clay samples from Crystal River and other sites in the region currently being conducted by Wallis and Pluckhahn (2011). For this phase of analysis, the sample was stratified first by gross paste category, then by type. Sand-tempered, limestone-tempered, and sponge spicule-tempered pottery are the focus of the sample, 25 in total, which is meant to be a representative sample of

Table 6-1. Sherd Sample for Chemical and Gross Paste Analyses

Sample #	Type
PK001	Weeden Island Plain
PK002	Ruskin Dentate Stamped
PK003	Sand-tempered Plain
PK004	Weeden Island Red
PK005	St. Johns Plain
PK006	Dunn's Creek Red
PK007	Sand-tempered Plain
PK008	Weeden Island Zoned Punctated
PK009	Sand-tempered Plain with inclusions
PK010	St. Johns Plain
PK011	St. Johns Stamped
PK012	Pasco Plain with sand
PK013	Sand-tempered Plain with inclusions
PK014	Pasco Plain
PK015	Carrabelle Incised
PK016	Carrabelle Punctated/Keith Incised
PK017	Pasco Plain
PK018	Weeden Island Zoned Red
PK019	Sand-tempered Plain with inclusions
PK020	Keith Incised
PK021	Pasco Plain
PK022	Deptford Simple Stamped
PK023	Sand-tempered Plain
PK024	Wakulla Check Stamped
PK025	St. Johns Plain
PK026	Pasco Plain
PK027	St. Johns Plain
PK028	Sand-tempered Plain with inclusions
PK029	Deptford Check Stamped
PK030	Pasco Red
PK031	Papys Bayou Punctated
PK032	Pasco Plain
PK033	St. Johns Plain
PK034	Pasco Plain
PK035	Swift Creek Complicated Stamped

the entire ceramics collection. Based on the availability of rim sherds, the sample was taken from contexts across the entire site. The other 10 sherds for the sample are mixed temper sherds which are abundant throughout the collection.

The archaeological samples were compared to three clay samples from Crystal River and its environs collected by Pluckhahn and converted to tiles by Cordell for the Swift Creek pottery study conducted by Wallis and Pluckhahn (2011). For each sampled sherd and clay tile, a rock saw was used to cut a section measuring roughly 2 x 2 cm. This sample was cut again to produce two sub-samples: a smaller sub-sample measuring about 0.5 x 2 cm, and another larger subsample measuring 1.5 x 2 cm. The larger sub-samples were submitted to the Archaeometry Laboratory at the University of Missouri Research Reactor (MURR) for INAA. The smaller sub-samples were analyzed for elemental composition using a Bruker III-SD pXRF device in the Laboratory of Archaeological Science at the University of South Florida (USF). As this technique is non-destructive, the smaller sub-samples were retained for possible use as thin sections or other analyses in the future.

The samples were analyzed by INAA at MURR by Cody C. Roush and Michael D. Glascock (2013) using methods set up by Glascock (1992) and Glascock and Neff (2003). For detailed information on the methods and results of the INAA, see Roush and Glascock (2013). The samples were irradiated (exposed to neutrons in order to make them radioactive) twice in a pneumatic tube irradiation system and then counted three times for gamma rays. After the first irradiation, lasting 5 seconds, a 720 second gamma count was done. The second irradiation lasted longer, 24 hours, and was followed by two longer gamma counts (Glascock 1992; Glascock and Neff 2003; Neff 2000).

The elemental data, provided in an Excel spreadsheet (in Appendix A), from these irradiations were then interpreted using principal components analysis (PCA) in order to see patterns in the chemical data and create groupings (Glascock 1992; Neff 1994; Neff and Glowacki 2002; Roush and Glascock 2013). According to Roush and Glascock (2013:6-7) the small sample and group sizes do not allow for group membership to be statistically verified or for Mahalanobis distances to be calculated. Probabilities for group membership are provided and are the basis of the analysis. The PCA plot and compositional groupings created by Roush and Glascock (2013:Figure 1) can be seen in Figure 6-1.

The sherds were also compared to other sherd samples held at MURR from other sites in Florida, Georgia, and Ohio. These sherd samples are the closest matches in terms of composition, based on the database of samples at MURR (Roush and Glascock 2013:6). When

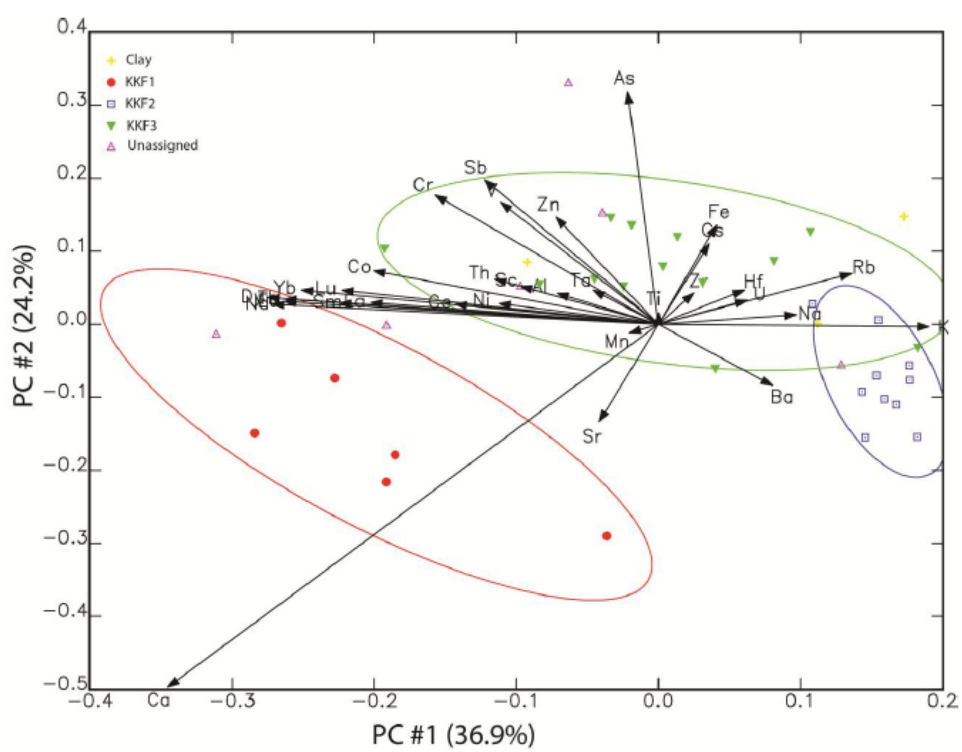

Figure 6-1. PCA plot showing the three INAA compositional groupings. From Roush and Glascock (2013).

interpreting these sherd matches it is important to remember that even though the sample sherds are similar to sherds from certain sites, this does not mean that those sherds were locally made at those sites. Sherd associations do not speak to the locations where sherds were originally made or prove that pottery moved from one site to another. The associations simply mean that the sherds are chemically similar to each other.

The groupings resulting from the INAA were then compared to the compositional regions developed by Wallis et al. (2015) using raw clay sources. These regions were created using INAA groupings on 130 fired clay briquettes. The authors show that interpolations of certain elemental concentrations from these samples have spatial patterning across the state (Wallis et al. 2015). The authors come up with 14 different compositional regions based on this patterning. For example, the northern Florida and Apalachicola region has samples dominated by K and Na and depleted in Sr and U while the central Gulf coast to southwestern Georgia region has clays enriched in Tb, Eu, Dy, Lu, and La.

The pXRF analysis was performed by Matthew W. Touchton (2013) under the direction of Robert Tykot at the University of South Florida using a Bruker III-SD device, at settings of 40 kV and 11 μA for 120 seconds. The 35 sherds and three clay samples were washed in deionized water. The sherd samples were analyzed on the exterior and interior surfaces and on the fresh cut edge made by the rock saw (three in total) using a filter, which emphasizes the results for trace elements such as Ba, Th, Rb, Sr, Y, Zr, and Nb. The clay samples were only analyzed twice. Calibrated elemental data were provided in an Excel spreadsheet (in Appendix B). As with the INAA, the pXRF results were interpreted using PCA, based on trace elements Y, Zr, Sr, Nb, and Rb, which created sherd groupings for analysis and are provided in Figure 6-2 (Touchton 2013:Figure 7).

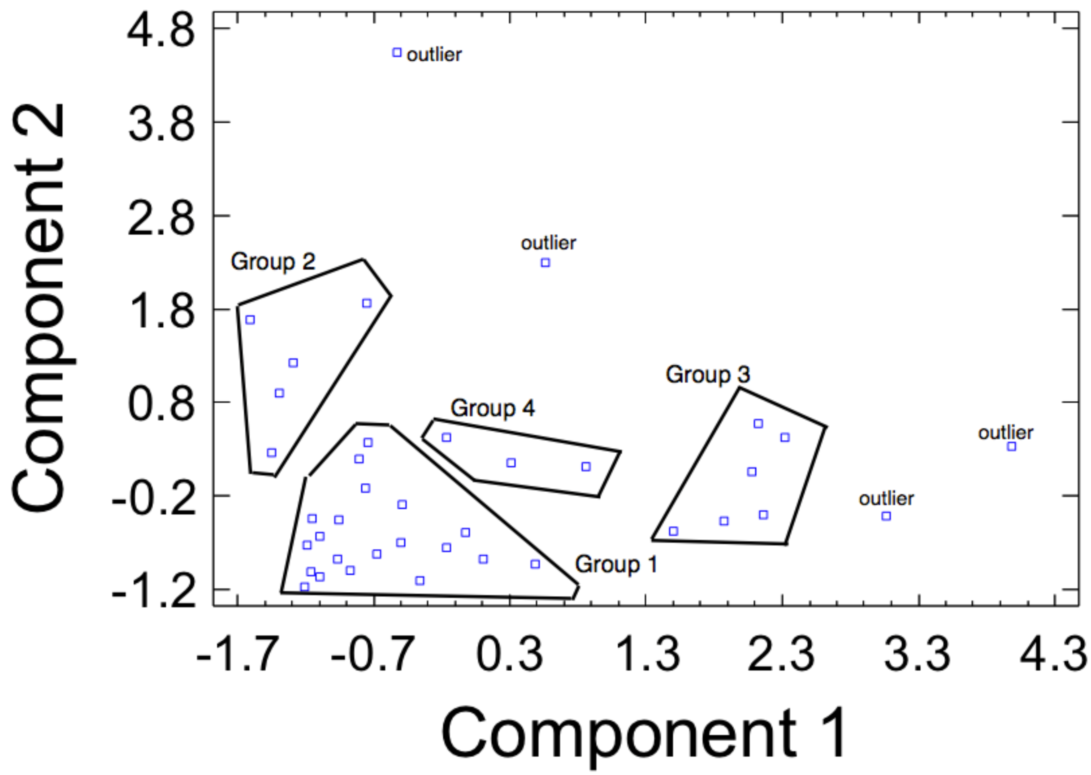

Figure 6-2. PCA plot showing the pXRF compositional groupings using Y, Zr, Sr, Nb, and Rb. From Touchton (2013).

The gross paste analysis was conducted at the FLMNH and USF. A Dino-lite digital microscope with DinoCapture 2.0 software was used to take digital images of the samples. The microscope was set at 50.1x magnification in order to identify relative abundance of grains and other paste inclusions. Images were taken of the rock saw cut profile edge of the sherd in an area on the profile that best represented the overall makeup of the paste. These images were then analyzed by grain size, using the Wentworth (1922, 1933) scale, and relative abundance (Mathew et al. 1991). Predominate constituent categories included fine sand (0.01 to .24 mm), medium sand (0.25 to 0.49 mm), coarse sand (≤ 0.5 mm), fine limestone (0.01 to .24 mm), medium limestone (0.25 to 0.49 mm), coarse limestone (0.5 to 1.99 mm), granule limestone (≤ 2.0 mm), sponge spicules, and other (charcoal, shell, grog, etc.). Proper counts of sponge spicules were not possible at the 50x magnification; therefore sponge spicules were recorded simply as either present or absent. The abundance of these categories, per Cordell (1980), Pluckhahn and Cordell (2011); Wallis et al. (2014); and Wallis et al. (2015), were measured by none, rare (1 to 4 percent), occasional (5 to 9 percent), frequent (10 to 19 percent), and abundant (≤ 20 percent). The amount of voids were also recorded by this scale. The degree of coring was noted as a percentage of the whole profile. This will provide an indication of firing temperature and relative organic content of the paste.

Once evaluated by these methods, I took the sherds and placed them in groups based on major constituents, with grouping criteria adapted from Wallis et al. (2015). These groups include B (mainly quartz sand with none to rare inclusions), LMS (limestone), and SPC1 (frequent sponge spicules with rare fine sand). I also created additional groups to highlight the variety in the sample. These groups included MB (mostly quartz sand mixed with limestone), MLMS (mostly limestone mixed with quartz sand), and SPC2 (frequent sponge spicules with frequent fine sand and rare or occasional medium sand). These groupings were also compared with the compositional groupings outlined in Wallis et al. (2015). Finally, I took the groupings created by Roush and Glascock (2013) and Touchton (2013) and compared them with each other and with the gross paste analysis.

Results

INAA

The INAA resulted in three compositional groupings shown in Table 6-2. These groupings seem to be based on temper categories (Roush and Glascock 2013:6) but a few sherds do not match with this pattern. Group 1 makes up 17 percent of the sample (n=6) and is

Table 6-2. INAA Groupings and Compositional Associations

Sample #	Type	Group #	Closest Association	Secondary Association
PK001	Weeden Island Plain	3	Graveyard Island	Safford Mound
PK002	Ruskin Dentate Stamped	3	Safford Mound	Graveyard Island
PK003	Sand-Tempered Plain	3	Safford Mound	Graveyard Island
PK004	Weeden Island Red	3	Graveyard Island	McKeithen
PK005	St. Johns Plain	2	McKeithen	Tucker
PK006	Dunn's Creek Red	2	McKeithen	none
PK007	Sand-Tempered Plain	UNAS	Graveyard Island	Safford Mound
PK008	Weeden Island Zoned Punctated	3	Safford Mound	Graveyard Island
PK009	Sand-Tempered Plain with inclusions	3	Safford Mound	Graveyard Island
PK010	St. Johns Plain	2	McKeithen	Graveyard Island
PK011	St. Johns Stamped	2	McKeithen	other - Ohio site
PK012	Pasco Plain with sand	3	Graveyard Island	Safford Mound
PK013	Sand-tempered Plain with inclusions	3	Safford Mound	Graveyard Island
PK014	Pasco Plain	1	Graveyard Island	Block-sterns
PK015	Carrabelle Incised	3	Graveyard Island	Safford Mound
PK016	Carrabelle Punctated/ Keith Incised	UNAS	Graveyard Island	Tucker
PK017	Pasco Plain	UNAS	Block-sterns	Safford Mound
PK018	Weeden Island Zoned Red	3	Graveyard Island	McKeithen
PK019	Sand-tempered Plain with inclusions	UNAS	Safford Mound	Graveyard Island
PK020	Keith Incised	3	Graveyard Island	Safford Mound
PK021	Pasco Plain	1	Block-sterns	Tucker
PK022	Deptford Simple Stamped	3	Graveyard Island	McKeithen
PK023	Sand-tempered Plain	UNAS	McKeithen	Tucker
PK024	Wakulla Check Stamped	3	Graveyard Island	none
PK025	St. Johns Plain	2	McKeithen	other - Ohio site
PK026	Pasco Plain	1	Tucker	Block-sterns
PK027	St. Johns Plain	2	Graveyard Island	McKeithen
PK028	Sand-tempered Plain with inclusions	1	Block-sterns	other - Ohio site
PK029	Deptford Check Stamped	2	McKeithen	Kolomoki
PK030	Pasco Red	UNAS	Tucker	Graveyard Island
PK031	Papys Bayou Punctated	2	McKeithen	none
PK032	Pasco Plain	1	Block-sterns	Tucker
PK033	St. Johns Plain	2	Tucker	other - Ohio site
PK034	Pasco Plain	1	Tucker	Graveyard Island
PK035	Swift Creek Complicated Stamped	2	Graveyard Island	McKeithen

Note: Unassigned vessels are labeled UNAS

characterized by high levels of Ca, K, and La. This group is made up of mostly limestone pottery, five Pasco Plain sherds and one sand-tempered plain with inclusions sherd, explaining the high levels of Ca. Comparing this group to the compositional regions outlined in Wallis et al. (2015), the high levels of Ca match with the southwestern Florida category. However, these regions are based on raw clay. The southwestern Florida region has clays with naturally occurring sources of Ca. The sherds in this sample have limestone that was purposely added as temper and do not seem to be naturally occurring. If this is the case, the Ca in the sample cannot be used to determine source location. The elevated levels of K could suggest that the sherds belong to the Central Peninsula region defined by Wallis et al. (2015) but the other characteristic elements of this region (U or Sr enrichment, Na depletion) do not match Group 1. The same can be said for the enrichment in La; La enrichment is characteristic of the central Gulf coast to southwestern Georgia region defined by Wallis et al. (2015) but the other characteristic elemental distributions (enrichment in Lu, Tb, Eu, and Dy) do not match this group.

Based on this, the Group 1 samples cannot be confidently placed in any one group but it can be said that they may come from the northern Gulf coast or central peninsular Florida. Sherds similar to those in Group 1 come from sites in this general region as well. The top two sites with the closest similarity to the samples are provided in Table 6-2. All of the sites that are similar to the sample are from a similar time period and have similar ceramic assemblages to Crystal River. Group 1 sherds are similar to sherd samples from the Block-Sterns, Tucker, and Graveyard Island sites. These sites (shown in Figure 6-1) are located in the central Gulf coast and northern Florida near Apalachicola. Again, it is important to remember that these sherd associations do not prove source location or movement of ceramics. Sherd associations do not speak to the locations where sherds were originally made. Therefore, these sherd similarities may suggest a central Gulf coast and northern Florida location, but the sherds could have been made and traded anywhere (one sherd from this group is related to a sherd from an Ohio site).

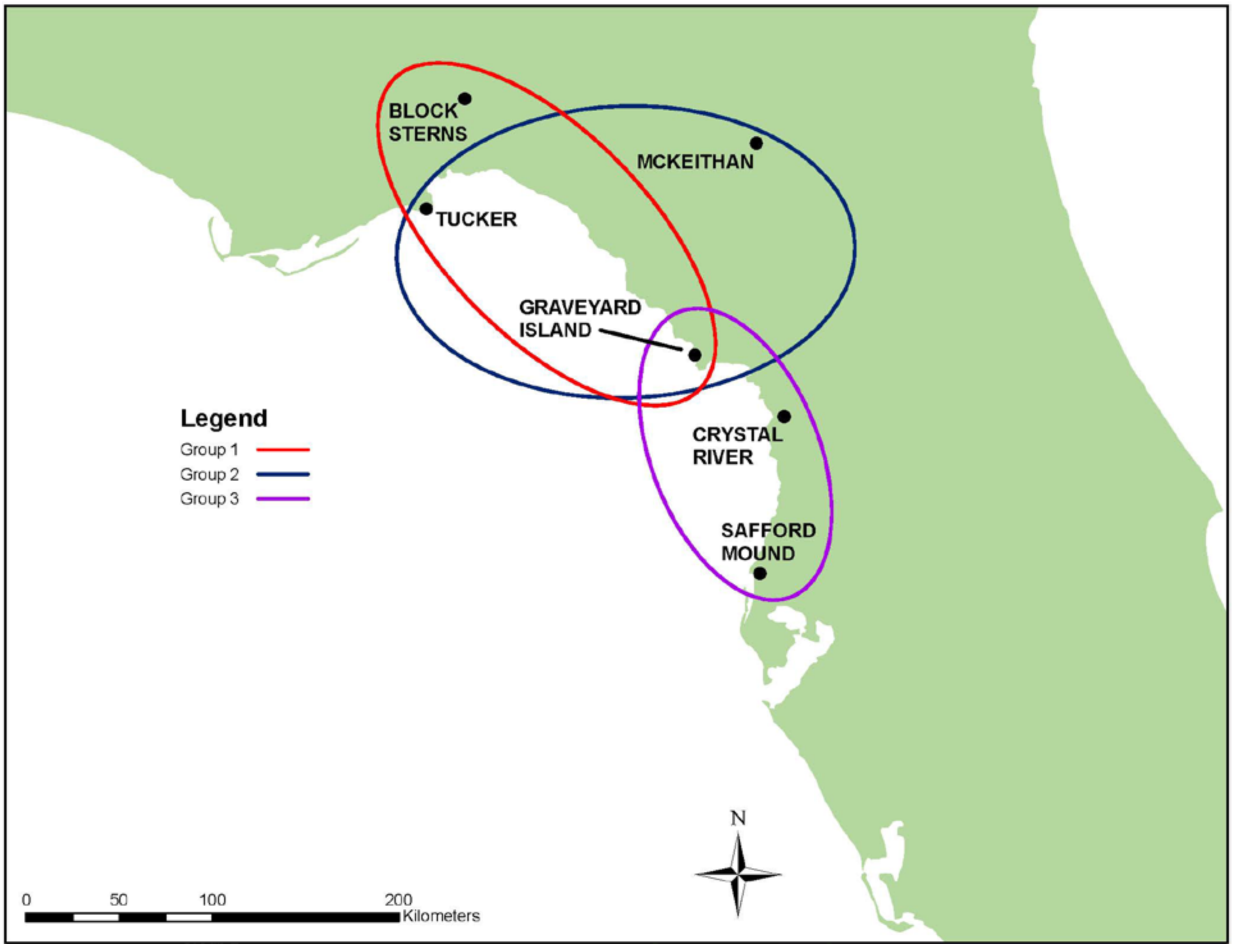

Figure 6-3. INAA sherd compositional affiliation locations.

Group 2 contains ten specimens (29 percent of the sample) and consists mainly of sponge spicule wares such as St. Johns Plain and Dunn's Creek Red (see Table 6-2). Only two of the specimens do not visibly contain sponge spicules and are both sand-tempered (Deptford Check Stamped and Swift Creek Complicated Stamped). This group is low in elements Tb, Eu, and Dy but enriched in K and Na. Based on the K and Na enrichment, this group matches the northern Florida category outlined by Wallis et al. (2015). Group 2 samples are affiliated with sherds from the McKeithen, Graveyard Island, and Tucker sites. These sites are located in northern Florida and central peninsular Florida (see Figure 6-1) and are within the northern Florida compositional region per Wallis et al. (2015). It is interesting to note here that most of the sherds match the McKeithen site which has been shown in other studies (Cordell 1980; Pluckhahn and Cordell 2011; Rice 1980) to have locally and non-locally made ceramics with varying uses. Pluckhahn and Cordell (2011) show that some of the vessels could have been made at Kolomoki. A Deptford Check Stamped sherd from this sample is associated with two Kolomoki sherds and three St. Johns sherds are similar to sherds from sites in Ohio.

Group 3 accounts for 37 percent of the sample (n=13) and is made up of mostly sand-tempered sherds. Sand-tempered pottery types represented in this group include sand-tempered plain, Weeden Island Plain, and Weeden Island Red and decorated types such as Deptford Simple Stamped, Keith Incised, and Wakulla Check Stamped (see Table 6-2). This group also contains three mixed temper sherds (sand-tempered plain with inclusions and Pasco Plain with sand) and a Ruskin Dentate sherd that is sand-tempered mixed with limestone. The elemental composition shows that Group 3 ceramics are enriched in Tb, Eu, Dy, and Sr and are depleted in K and Na. The depletion in K and Na matches characteristics of the central peninsula region from Wallis et al. (2015). The Tb, Eu, and Dy enrichment suggests that Group 3 may also have come from the central Gulf coast to southwestern Georgia region. The sherd associations from the INAA report (Roush and Glascock 2013) show that Group 3 ceramics are most similar to those found at Graveyard Island and Safford Mound (see Figure 6-1), which are within the central Gulf coast region.

Some of the sherds within the sample were considered outliers and were unassigned to any of the three groups. These sherds (17 percent of the sample) include sand-tempered plain, Pasco Plain, Pasco Red, and sand-tempered plain with inclusions. None of the local clay samples were assigned to any of the three groups by Roush and Glascock (2013). However, inspection of their PC scatterplots and membership probabilities show that one of the clay samples (PK38) is within the range of the Group 3 ceramics, further suggesting that Group 3 is a local phenomenon.

pXRF

The pXRF analysis resulted in four compositional groupings shown in Table 6-3. The original report (Touchton 2013) gave numbers one through four to the groupings but in order to minimize confusion with the INAA groupings, these groups will be referred to here with letters A through D. Group A contains 19 sherds (54 percent of the sample) and consists of sand-tempered and sponge spicule-tempered sherds. This group is split mostly between sand and sponge spicule types but also includes one limestone sherd (Pasco Plain) and three mixed temper sherds (two sand-tempered plain with inclusions and one Pasco Plain with sand). Pottery types represented in this group include St. Johns Plain (the most abundant type), Weeden Island Plain, and an array of Weeden Island decorated types. According to Touchton (2013), this group matches with one of the clay samples (PK36) suggesting local manufacture. However, the diverse nature of this group and discrepancies with the INAA (discussed below) make this determination unclear without further evidence to support it.

Group B makes up 14 percent of the sample (n=5) and is mostly sand-tempered ceramics. This group contains Weeden Island Red, Weeden Island Zoned Red, Keith Incised, sand-tempered plain, and Deptford Check Stamped sherds. Touchton (2013) states that this group does not match with any of the three clay samples directly but is closely associated with one (PK38).

Group C has six sherds (17 percent of the sample) and is made up of limestone and sand mixed with limestone sherds. This group is mostly Pasco Plain sherds with one sand-tempered

Table 6-3. INAA and pXRF Groupings

Sample #	Type	INAA Group #	pXRF Group #
PK001	Weeden Island Plain	3	A
PK002	Ruskin Dentate Stamped	3	C
PK003	Sand-tempered Plain	3	A
PK004	Weeden Island Red	3	B
PK005	St. Johns Plain	2	A
PK006	Dunn's Creek Red	2	A
PK007	Sand-tempered Plain	UNAS	D
PK008	Weeden Island Zoned Punctated	3	A
PK009	Sand-tempered Plain with inclusions	3	A
PK010	St. Johns Plain	2	A
PK011	St. Johns Stamped	2	A
PK012	Pasco with sand	3	A
PK013	Sand-tempered Plain with inclusions	3	A
PK014	Pasco Plain	1	C
PK015	Carrabelle Incised	3	A
PK016	Carrabelle Punctated/Keith Incised	UNAS	D
PK017	Pasco Plain	UNAS	UNAS
PK018	Weeden Island Zoned Red	3	B
PK019	Sand-tempered Plain with inclusions	UNAS	UNAS
PK020	Keith Incised	3	B
PK021	Pasco Plain	1	C
PK022	Deptford Simple Stamped	3	A
PK023	Sand-tempered Plain	UNAS	B
PK024	Wakulla Check Stamped	3	A
PK025	St. Johns Plain	2	A
PK026	Pasco Plain	1	C
PK027	St. Johns Plain	2	A
PK028	Sand-tempered Plain with inclusions	1	C
PK029	Deptford Check Stamped	2	B
PK030	Pasco Red	UNAS	D
PK031	Papys Bayou Punctated	2	A
PK032	Pasco Plain	1	C
PK033	St. Johns Plain	2	A
PK034	Pasco Plain	1	A
PK035	Swift Creek Complicated Stamped	2	A

plain with inclusions and a Ruskin Dentate Stamped (this type is normally sand-tempered but this sherd is limestone dominant). This group did not match any local clays in the pXRF analysis.

Group D contains only three sherds (nine percent of the sample), a sand-tempered plain, a Carrabelle Punctated/Keith Incised variant, and a Pasco Red sherd. These sherds are all sand-tempered and one contains some limestone. Group D also did not match any clay samples and therefore cannot provide any information on origin location. A Pasco Plain and a sand-tempered plain were unassigned to any of these groups.

Gross Paste Analysis

The gross paste analysis data are presented in Table 6-4. This analysis defined six paste groups, some of which are adapted from Wallis et al. (2015). These paste groupings are outlined in Table 6-5. Examples of the digital microscope images are provided in Figure 6-2. The first Group B, mainly quartz sand with none to rare inclusions, includes 14 sherds (40 percent of the sample). Most of these sherds (nine in total) have abundant or frequent sand, frequent or occasional medium sand, and rare coarse sand. This shows that most of the sand tempered sherds are not well sorted. Pottery types include sand-tempered plain, Weeden Island Plain, Deptford Simple Stamped, and other somewhat uncommon Weeden Island types at Crystal River such as Keith Incised and Carrabelle Punctated. A Wakulla Check Stamped sherd and Weeden Island Plain sherd both have occasional fine sand while a sand-tempered plain sherd and Weeden Island Red sherd have no coarse sand. The Deptford Check Stamped sherd in this group is the only one with occasional coarse sand which is characteristic of this type (Willey 1949:355). Many of these sherds have rare inclusions and rare voids. According to Wallis et al. (2015), fabric Group B is spread throughout Florida and cannot be used alone to determine spatial location. However the authors do state that the majority of the sandiest clays originate from north-central Florida

Table 6-4. Gross Paste Analysis Raw Data

Sample #	Type	Feature	Fine Sand (0.01 - .24 mm)	Medium Sand (0.25-0.49 mm)	Coarse Sand (0.5 and above)	Fine Limestone (0.01 - .24 mm)	Medium Limestone (0.25-0.49 mm)	Coarse Limestone (0.5 - 1.99 mm)	Granule Limestone (2.0 mm and above)	Sponge spicules	Voids	Other	Coring in %
PK001	Weeden Island Plain	C	occasional	occasional	rare	none	none	none	none	none	rare	rare	88
PK002	Ruskin Dentate Stamped	C	occasional	occasional	rare	frequent	rare	occasional	none	none	rare		78
PK003	Sand-Tempered Plain	C	abundant	abundant	none	none	none	none	none	none	rare	rare	None
PK004	Weeden Island Red	C	abundant	frequent	rare	none	none	none	none	none	rare		26
PK005	St. Johns Plain	C	frequent	occasional	none	none	none	none	none	abundant	rare	rare	None
PK006	Dunn's Creek Red	C	frequent	rare	none	none	none	none	none	abundant	occasional	rare	78
PK007	Sand-Tempered Plain	C	frequent	frequent	rare	none	none	none	none	none	rare	rare	None
PK008	Weeden Island Zoned Punctated	C	abundant	frequent	rare	none	none	none	none	none	rare		83
PK009	Sand-Tempered Plain with Inclusions	C	abundant	frequent	rare	none	none	rare	none	none	rare		None
PK010	St. Johns Plain	C	frequent	none	none	none	none	none	none	abundant	rare		None
PK011	St. Johns Stamped	C	frequent	none	none	none	none	none	none	abundant	rare		33
PK012	Pasco with sand	C	frequent	occasional	none	occasional	rare	rare	none	none	rare		None
PK013	Sand-Tempered Plain with Inclusions	C	abundant	occasional	none	none	rare	rare	none	none	rare		74
PK014	Pasco Plain	C	none	none	none	frequent	occasional	occasional	rare	none	rare	rare	None
PK015	Carrabelle Incised	C	frequent	occasional	rare	none	none	none	none	none	rare	rare	90
PK016	Carrabelle Punctated/Keith Incised	C	frequent	occasional	rare	none	none	none	none	none	rare	rare	76
PK017	Pasco Plain	C	none	none	none	abundant	frequent	occasional	none	none	rare		none
PK018	Weeden Island Zoned Red	C	abundant	rare	none	none	none	none	none	none	rare		29%
PK019	Sand-Tempered Plain with Inclusions	C	frequent	frequent	rare	none	none	rare	rare	none	rare		43%
PK020	Keith Incised	C	abundant	occasional	rare	none	none	none	none	none	rare	rare	40%

Table 6-4 (continued)

Sample #	Type	Feature	Fine Sand (0.01 - .24 mm)	Medium Sand (0.25-0.49 mm)	Coarse Sand (0.5 and above)	Fine Limestone (0.01 - .24 mm)	Medium Limestone (0.25-0.49 mm)	Coarse Limestone (0.5 - 1.99 mm)	Granule Limestone (2.0 mm and above)	Sponge spicules	Voids	Other	Coring in %
PK021	Pasco Plain	C	occasional	rare	none	frequent	occasional	occasional	rare	none	rare	rare	68%
PK022	Deptford Simple Stamped	E and F	frequent	occasional	rare	none	none	none	none	none	rare	rare	none
PK023	Sand-Tempered Plain	K	abundant	frequent	rare	none	none	none	none	none	rare	rare	90%
PK024	Wakulla Check Stamped	E and F	occasional	frequent	rare	none	none	none	none	none	rare	rare	52%
PK025	St. Johns Plain	E and F	occasional	none	none	none	none	none	none	abundant	rare	rare	none
PK026	Pasco Plain	E and F	none	none	none	frequent	occasional	frequent	none	none	rare	rare	none
PK027	St. Johns Plain	E and F	rare	none	none	none	none	none	none	abundant	occasional	rare	66%
PK028	Sand-Tempered Plain with Inclusions	E and F	frequent	frequent	rare	none	rare	rare	rare	none	rare	rare	71%
PK029	Deptford Check Stamped	C	frequent	occasional	occasional	none	none	none	none	none	rare		30%
PK030	Pasco Red	C	occasional	occasional	rare	rare	rare	occasional	none	none	rare		82%
PK031	Papys Bayou Punctated	C	rare	none	none	none	none	none	none	abundant	occasional	rare	91%
PK032	Pasco Plain	H	frequent	rare	none	rare	frequent	occasional	rare	none	rare		none
PK033	St. Johns Plain	Midden B	frequent	rare	none	none	none	none	none	abundant	occasional	rare	60%
PK034	Pasco Plain	A	rare	rare	none	frequent	occasional	frequent	rare	none	occasional		80%
PK035	Swift Creek Complicated Stamped	C	abundant	occasional	rare	none	none	none	none	none	rare	rare	68%

Table 6-5. Gross Paste Analysis Groupings

Sample #	Type	Fabric Group	NAA Group #	pXRF Group #
PK001	Weeden Island Plain	B	3	A
PK002	Ruskin Dentate Stamped	MLMS	3	C
PK003	Sand-Tempered Plain	B	3	A
PK004	Weeden Island Red	B	3	B
PK005	St. Johns Plain	SPC 2	2	A
PK006	Dunn's Creek Red	SPC 2	2	A
PK007	Sand-Tempered Plain	B	UNAS	D
PK008	Weeden Island Zoned Punctated	B	3	A
PK009	Sand-Tempered Plain with Inclusions	MB	3	A
PK010	St. Johns Plain	SPC 2	2	A
PK011	St. Johns Stamped	SPC 2	2	A
PK012	Pasco Plain with sand	MB	3	A
PK013	Sand-Tempered Plain with Inclusions	MB	3	A
PK014	Pasco Plain	LMS	1	C
PK015	Carrabelle Incised	B	3	A
PK016	Carrabelle Punctated/Keith Incised	B	UNAS	D
PK017	Pasco Plain	LMS	UNAS	UNAS
PK018	Weeden Island Zoned Red	B	3	B
PK019	Sand-Tempered Plain with Inclusions	MB	UNAS	UNAS
PK020	Keith Incised	B	3	B
PK021	Pasco Plain	MLMS	1	C
PK022	Deptford Simple Stamped	B	3	A
PK023	Sand-Tempered Plain	B	UNAS	B
PK024	Wakulla Check Stamped	B	3	A
PK025	St. Johns Plain	SPC 1	2	A
PK026	Pasco Plain	LMS	1	C
PK027	St. Johns Plain	SPC 1	2	A
PK028	Sand-Tempered Plain with Inclusions	MB	1	C
PK029	Deptford Check Stamped	B	2	B
PK030	Pasco Red	MLMS	UNAS	D
PK031	Papys Bayou Punctated	SPC 1	2	A
PK032	Pasco Plain	MLMS	1	C
PK033	St. Johns Plain	SPC 2	2	A
PK034	Pasco Plain	MLMS	1	A
PK035	Swift Creek Complicated Stamped	B	2	A

through the panhandle into southwestern Georgia. If we consider the abundance of sand in some of the samples this may suggest a north-central Florida source location.

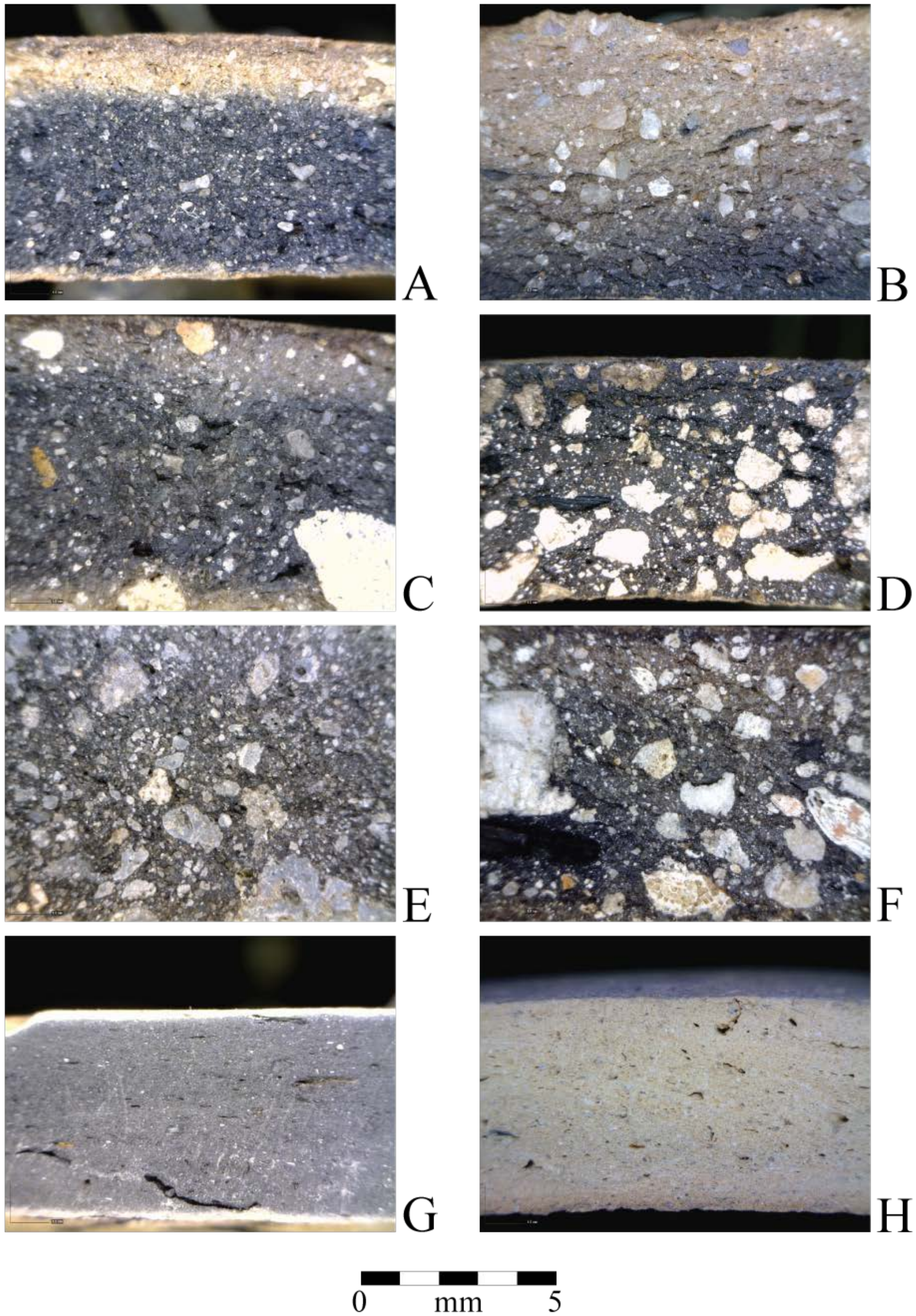

Figure 6-4. Digital microscope images of gross paste groups at 50.1x magnification. (*A*) Group B (sample PK035, Swift Creek Complicated Stamped); (*B*) Group B (sample PK029, Deptford Check Stamped); (*C*) Group MB (sample PK028, sand-tempered plain with inclusions); (*D*) Group LMS (sample PK014, Pasco Plain); (*E*) Group MLMS (sample PK032, Pasco Plain); (*F*) Group MLMS (sample PK021, Pasco Plain, note shell and possible charcoal inclusions); (*G*) Group SPC1 (sample PK031, Papys Bayou Punctated); (*H*) Group SPC2 (sample PK010, St. Johns Plain). Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat Nos. 98922, 99245, 99209, 98917, 99259, 98933, 99252, and 98913.

Only three pure limestone samples (nine percent of the sample) are recorded in the LMS (limestone) group. All of these are Pasco Plain sherds with rare voids and rare occurrences of other materials in the paste. These sherds also all have fine (abundant or frequent), medium (frequent or occasional), and coarse limestone (frequent or occasional). One sherd has rare granule size limestone. According to Wallis et al. (2015), LMS clays are associated with either southwestern or northwestern Florida. The INAA results suggested that these sherds may have come from southwestern Florida as well but this seems skewed based on the amount of natural limestone in the clay. Since these sherds seem to have purposefully added limestone, it is difficult to determine a specific region they may have originated from, leaving both southwestern and northwestern Florida as possibilities.

All sponge spicule samples have varying amounts of sand. However, there is a notable separation between them. SPC1 includes three samples (nine percent) that have sponge spicules and only rare fine sand. These include two St. Johns Plain sherds and one Papys Bayou Punctated sherd. These sherds have rare or occasional voids and rare inclusions. SPC2 makes up 14 percent of the sample (n=5) and consists of sherds with frequent fine sand and three samples with rare or occasional medium sand. Pottery types represented are St. Johns Plain, Dunn's Creek Red, and St. Johns Stamped. These sherds have rare or occasional voids and some sherds have rare inclusions. According to Wallis et al. (2015) the SPC group has sand that may vary in texture, but is similar in sand composition. These sponge spicule sherds do not express the homogeneity the authors speak of, at least in the case of SPC 2. Instead, it seems that the sand in SPC 2 may have been purposefully added or represents a paste that was not well sorted. Unfortunately like paste Group B, SPC is spread throughout Florida and cannot provide a spatial origin for these sherds. It is however interesting to note that these sherds were not noted to be mixed temper during the type/attribute analysis.

I created two additional paste groupings that highlight the variation in the sample. Both of these groups include sand and limestone but are separated based on their dominant temper. MB (mostly quartz sand mixed with limestone) includes five sherds (14 percent of the sample) which have fine, medium, and coarse sand in varying percentages combined with varying amounts of fine, medium, coarse, and granule limestone. These sherds are mostly sand-tempered plain with inclusions with one Pasco Plain with sand sherd. The placement of the Pasco sherd here instead of in the limestone dominant category suggests that this sherd was either improperly classified or that the magnified image does not properly show the percentage of limestone in the paste. Sand is the dominant inclusion in MB, ranging from abundant to rare in most samples. Limestone ranges from occasional to rare in most samples.

MLMS (mostly limestone mixed with quartz sand) also makes up 14 percent of the sample (n=5) and includes sherds with fine (frequent or rare), medium (frequent, occasional, or rare), or coarse (occasional or frequent) limestone. The sand in these sherds is mostly fine (frequent and occasional) and medium (occasional or rare), with rare to no coarse sand. Group MLMS has rare to occasional voids and rare other, including shell and charcoal which were not seen in other samples. This group includes three Pasco Plain sherds, a Pasco Red sherd, and a Ruskin Dentate sherd. It is interesting to note here that none of these sherds were noted to be mixed temper in the Type/Attribute analysis, as was also seen in SPC2. This suggests that gross paste analysis on a larger sample may reveal more variation in the assemblage than is currently recorded. From these two mixed temper groups, it is clear that variation in sand and limestone grain size and abundance exists. This matches variation seen in the Type/Attribute and Vessel

Form analyses in previous chapters. Instead of evidence for source location of pottery, this seems to support the local creation of ceramics by differing community groups (mixing pottery traditions).

Overall, the gross paste analysis does not provide a lot of new information for sourcing these sample sherds. Groups B, SPC1, and SPC 2 occur throughout Florida and the mixed temper groups MB and MLMS do not have region-specific origins. According to Wallis et al. (2015), LMS suggests origins in northwestern or southwestern Florida. The takeaway from this analysis is that the variability shown in the assemblage from other analyses is supported here.

A Comparison of INAA and pXRF Results

The INAA and pXRF results are very closely related (see Table 6-3). The main difference is that the INAA groupings are organized mostly by temper while the pXRF groupings are more mixed. The raw elemental data is difficult to compare for these analyses because the pXRF was conducted using an elemental filter that filtered out most of the elements needed for comparison. The INAA Group 1 (n=6) seems to correlate with the pXRF Group C (n=6). Both of these groups are mainly limestone-tempered and contain five of the same sherds. Group 1 contains a Pasco Plain sherd that belongs to pXRF group A, and pXRF Group C contains a Ruskin Dentate Stamped which belongs to INAA Group 3. Both of these sherds contain limestone. The pXRF analysis did not add any information to a source location for this group of sherds. However, the INAA did suggest this group is made up of locally made ceramics which is not refuted by this comparison. The Pasco Plain sherd (PK34) in INAA Group 1 did match to one of the local clay samples (PK36) in the pXRF analysis, further supporting the local origin of this group of sherds.

The large pXRF Group A (n=19) is a mix of sponge spicule and sand-tempered sherds. This group matches up with INAA Groups 2 and 3. I suggest that Group A should be split into groups A1 and A2. According to the PC scatterplot in Touchton (2013), shown in Figure 6-5 with my group alterations, the sponge spicule-tempered wares (n=8) and one Swift Creek Complicated Stamped sherd that are part of Group A are clustered more closely together than the other ten sherds in this group. These nine sherds, now considered Group A1, directly correlate with INAA Group 2 (n=10). Only one sherd that belongs to Group 2 is not within Group A1; a

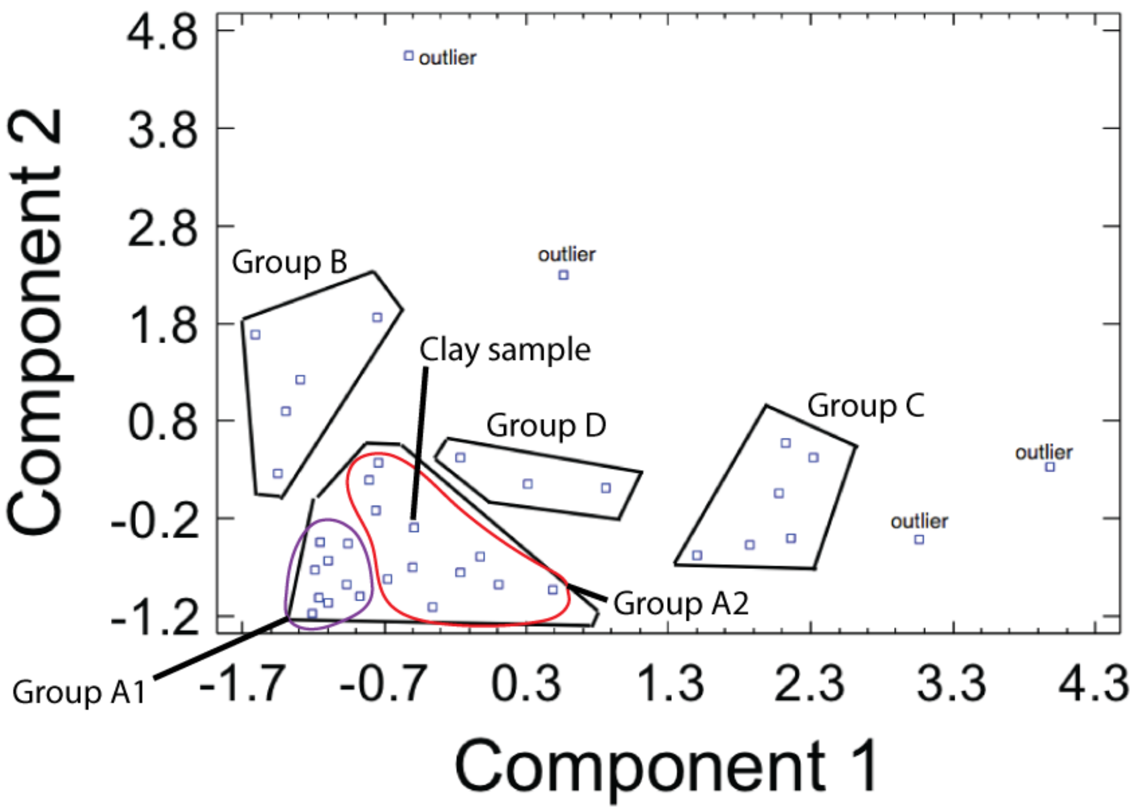

Figure 6-5. Altered pXRF compositional groupings.

Deptford Check Stamped sherd which is in pXRF Group B. Both Group 2 and Group A1 represent sponge spicule-tempered wares. INAA Group 2 is associated with the northern Florida compositional region outlined by Wallis et al. (2015) and also has connections to sites such as McKeithen and Kolomoki. The pXRF data does not provide corroborating source evidence for this suggestion.

Group A2 (n=10) correlates with INAA Group 3 (n=13), except for one Pasco Plain sherd which is part of INAA Group 1. The other four sherds belonging to Group 3 are part of pXRF groups B and C. Groups A2 and 3 are made up of sand-tempered and mixed sand and limestone-tempered sherds. INAA Group 3 is associated with the central Gulf coast region outlined by Wallis et al. (2015). The pXRF results seem to support this claim. After splitting pXRF Group A into two groups it is clear that the clay sample (PK36) matched to Group A is part of Group A2. The INAA also showed that one of the clay samples (PK38) is within the range of the Group 3 ceramics. These matches with local clays from Crystal River suggest a central Gulf coast origin. This corroborating evidence implies that the INAA Group 3 and pXRF Group A2 ceramics are locally made.

pXRF Groups B and D are less correlated to INAA groupings. Group B (n=5) has three sherds from INAA Group 3, one from Group 2, and one is unassigned in the INAA. Group D sherds (n=3) are all unassigned in the INAA groupings. A Pasco Plain sherd and a sand-tempered plain sherd were unassigned in both analyses. The reason that these sherds are unassigned is unclear. These unassigned sherds were chemically similar to sherds from regional sites such as Block-sterns and Safford Mound but possibly these sherds came from areas not referenced during this study where more raw clay samples are needed.

Overall, it seems that the pXRF analysis was able to create source groupings similar to that of INAA but with less precision. The corroboration of most of the groupings does support the preliminary conclusions made by the INAA. Though the groupings correlate mostly with temper type, there are some sherds with differing tempers included within the stark temper groupings. This suggests that these groupings are based on more than just temper type and reflect clay composition. If we continue to think of the sherds based on the INAA groupings and use the pXRF data as another line of evidence, certain deductions can be made. Group 1 and Group 3 seem to be locally made ceramics based on their association with the central Gulf coast region and a clay sample from Crystal River. These sherds may have been made at Crystal River or a site within the local Gulf coast region. Group 2 is more closely related to the northern Florida region and matches well with sherds from the McKeithen site. This group may have been made at sites regionally associated with Crystal River or, based on sherd associations with Ohio sites and Kolomoki, may have come from sites further away. The gross paste analysis will help to refine these preliminary conclusions.

A Comparison of Gross Paste Analysis with INAA and pXRF

The gross paste groupings align fairly closely with those from INAA (pXRF groupings are assumed to align with INAA here to streamline the discussion) as can be seen in Table 6-5. The major difference is that the chemical analyses did not differentiate the mixed temper sherds from their major constituent. Also, the gross paste analysis also revealed much more variation in the sample than was previously recorded. The limestone dominant INAA Group 1 (n=6) has two LMS samples, three MLMS samples, and one MB sample. These all have either limestone or mixed sand and limestone. From the INAA, it is clear these sherds belong in the same group, the five Pasco Plain at least, except for the sand-tempered plain with inclusions sherd. Seeing the variability in the seemingly limestone only Pasco Plain sherds in the gross paste analysis explains why these are grouped similarly. Based on the INAA, these sherds originated from the central Gulf coast to southwestern Georgia region, which spans the northern Florida region suggested by the gross paste analysis. The pXRF analysis shows that one of the sherds from INAA Group 1 matched a local clay from Crystal River further supporting that this group has a local origin. If Group 1 is seen to be local, then the variability in this group shown in the gross paste analysis may be evidence of different communities interacting at the site and melding their different pottery traditions.

INAA Group 3 contains 13 sherds. These sherds are mostly sand tempered and include nine paste Group B sherds, three MB sherds, and one MLMS sherd. All of these contain sand while some are mixed with limestone. All but one of the mixed temper sherds, the Ruskin Dentate Stamped, were recorded as such in previous analyses. Ruskin Dentate Stamped sherds are usually sand-tempered. Like Group 1, this group seems to be locally made based on the INAA and pXRF analyses. The chemical analyses imply a central Gulf coast to southwestern Georgia origin region. This is further reduced when one considers that Group 3 is associated with two local Crystal River clays. Wallis et al. (2015) suggests that the sandiest clays come from north-central Florida up into southwestern Georgia which overlaps with the region defined by the chemical analyses. The gross paste analysis does not lend much more information to the source locations of this group but the evidence very strongly points to a local origin.

The INAA Group 2 (n=10) is mostly sponge spicule-tempered and therefore includes all eight SPC1 and SPC2 samples. In addition to these, two paste Group B samples are included in this group, a Deptford Check Stamped and a Swift Creek Complicated Stamped. From the INAA it is unclear why two sand-tempered sherds would be included in a sponge spicule dominant group as no sponge spicules are visible in the profile images. The gross paste analysis clearly shows however that all of the sponge spicule wares have sand. This relates the SPC wares to Group B, but does not explain why all of the sand tempered sherds are not included in this group. I believe that these two sand-tempered sherds are placed in this group because the INAA is picking out more than just temper difference. These two Group B sherds might have clay chemically similar to that in the SPC groups. As mentioned above, INAA Group 2 is related to the northern Florida region and may have been made at sites regionally associated with Crystal River or come from sites further away (based on sherd associations with Kolomoki and Ohio sites). The gross paste analysis does not add a lot of information to the source location of this group, but it does further support the variation seen in other analyses. All of the SPC sherds are seen to contain sand, which was not previously known. This variation could lend to the idea that many different communities were interacting at Crystal River, whether they originated from local or regional sites.

Other patterns in the sample not based on simple chemical or paste makeup groupings were difficult to determine. The sample was skewed toward the Main Burial Complex and so a comparison of composition based on location at the site was not possible. No patterns in vessel type, other than those named by temper association, or vessel form were seen.

Conclusions

Based on this, two of the INAA groups seem to be locally occurring while one seems to come from a larger, regional area centered on Crystal River. The local groups show a lot of variation in paste composition, suggesting they were made by different interacting communities of practice as in the sustainable and symbolic communities. A sustainable community is one in which people interact but do not necessarily have a shared identity or tradition. Archaeologically, this would create lots of variation through time. Symbolic communities have interacting peoples, but also a homogenous community that lives at the site, resulting in less variation than would be seen in a sustainable community (Carr 2006b). The variation in the sample is not necessarily contained to certain proveniences across the site, as seen in a symbolic community (however they are skewed because the datasets from Midden B and other mound features are rather small). Because of this and the persistent variation seen in these analyses, this points toward Crystal River as a sustainable community. There is not enough data to suggest that a homogenous group persisted through time at Crystal River while still interacting with other communities of practice. This does lend support to the idea that a number of communities of practice were consistently interacting at the site. There is a high proportion of mixed temper sherds in the type/attribute analysis. Also the gross paste analysis suggests there might be many more mixed temper sherds in the collection that are not observable without magnification (a trait seen at the Pineland site in southwestern Florida (Cordell 2013:503).

All of the observed variation, and the potential of more unseen, shows that there is a significant degree of mixing amongst the different pottery traditions and thus supports interaction of numerous communities of practice. The association of INAA Group 2 with more regional sites and clay locations could also support that Crystal River is a sustainable community. This group's associations with long-distance sites allow for unexpected inferences to be made. Though Group 2 did have compositional affinities with Kolomoki and some Ohio sites, I do not think the connection is strong enough to suggest that Crystal River is a symbolic community within the Hopewell Sphere. If the site was strongly connected to Hopewell through religious affiliations, pottery traditions, and symbology as is the case with symbolic communities, more of the pottery samples would have matched with Hopewell sites.

However, this does not rule out that Crystal River functioned as a symbolic community within a community of regionally associated sites. Through sherd associations in the INAA, the site is connected with many regional sites in Florida (see Figure 6-1) which are all from similar time periods and have similar pottery assemblages. But do similar pottery assemblages represent a shared religious affiliation or symbology? I think that to consider these sites connected into a sphere of symbolic communities, much more information is needed. Based on what we already know, it can however be suggested that Crystal River may have served as a sustainable community within this region. This hypothesis seems more likely and is better supported by the data that is currently available. Sustainable communities do not necessarily have shared religion or symbology but do interact regionally with other sites. The fact that some of the sherds in this analysis seem locally made while others may have more regional origins supports this claim.

CHAPTER 7:

DISCUSSION AND CONCLUSIONS

The goal of this research project was to understand the scale of social interaction at Crystal River. To do this, I looked for evidence of interacting communities of practice within the pottery assemblage. I explored the results in terms of Carr's (2006b) three community types: residential, sustainable, and symbolic. In order to determine if Crystal River functioned as any of these three types, outlined in Chapter 3, certain patterns in the pottery assemblage needed to occur. I determined that for Crystal River to be considered a residential community, ceramic variability would need to decrease through time, especially in the village area. For the site to have functioned as a sustainable community, we would expect variability in the assemblage to be maintained throughout the occupation sequence. If Crystal River was a symbolic community, I established that the pottery assemblage would exhibit homogeneity in midden ceramics but greater diversity in assemblages associated with mounds or other ceremonial features. Based on the results of the study outlined here, I was able to comment on the possibility that Crystal River functioned as one of these community types.

Data Synthesis

The variation noted in the ceramic assemblage by previous researchers (Moore 1900, 1903, 1907, 1918; Greenman 1938; Weisman 1995; Willey 1948, 1949; Willey and Phillips 1944) is also amply demonstrated by all three of the analyses conducted for this research project.

Variation is present in the temper, decoration, and vessel form/function of the pottery. This provides substantial evidence that Crystal River had a diverse population, or at least a diverse community of potters.

Although the evidence suggests that Crystal River was home to different communities of practice, the results of the type/attribute analysis show that this was not uniformly the case over time. Variation in decoration and temper is minimal in the earliest phase at the site, and generally increases through time (Cordell [2013:503] notes this same pattern in the pottery assemblage from Pineland). This suggests that the early village at Crystal River may be best characterized as a residential community in Carr's sense of the term. This community most likely began to interact more and more with other communities of practice leading to greater ceramic variation in the middle phases of occupation. This is consistent with reconstruction of the settlement history at Crystal River by Pluckhahn and colleagues (2015), who observed an increase in the size of the midden during Phase 2, probably indicative of a larger population. Isotopic studies of oysters from the midden from this phase suggest this population was permanent during Phase 2 (Thompson et al. 2015).

The gross paste analysis supports the diversity in practice observed in temper and also suggests that much more temper mixing occurred than is observable in the type/attribute analysis. Many sherds of mixed sand and limestone temper are noted in the type/attribute analysis, but even from the limited gross paste sample it is clear that more sherds have temper mixing than are evident with non-microscopic analyses. This inference is further supported by the apparent mixing of sand and sponge spicule temper in gross paste samples which was not recorded in the type/attribute analysis. The chemical analysis shows that the seemingly locally made ceramics have considerable paste variation. These findings indicate that Crystal River may have had a number of communities of practice interacting at the site (as in a sustainable community) but do not speak to the existence of shared religious affinity amongst the communities (as is seen in a symbolic community).

The amount of variation observed in the analysis of vessel form and function lends some additional support to the idea that Crystal River grew into a sustainable community. The considerable diversity of vessel forms in the mound assemblages compared to the minimal variation (in form and decoration) in the midden suggests that while the community of potters who lived at Crystal River were fairly homogenous in terms of ceramic production practices, people of more diverse pottery production traditions came to the site on occasion for ceremonies (as is the case in a symbolic community). The dominance of serving vessels in the collection implies the sort of specialized occupations focused on feasting and ceremony which would be commonplace in both sustainable and symbolic communities.

The chemical analysis suggests that some ceramics may have been made locally while others are compositionally similar to pottery from further afield in north and northwestern Florida. The occurrence of both locally made ceramics and others from further flung pottery making traditions seems to support Crystal River as a symbolic community. However, as described above, the local paste groupings exhibit a good deal of paste variation. This does not support the existence of a homogenous local community. What is more likely is that the local ceramics were created by numerous people within different ceramic communities (i.e., a sustainable community).

The chemical analysis advocates that Crystal River may have been part of a regionally based interaction sphere that encompassed communities from the southern Gulf coast and into northwestern Florida. The INAA Group 2 ceramics had compositional affinities to Kolomoki and sites in Ohio but there is not sufficient evidence to say that the ceramics were part of an interaction network including these sites. Compositional similarities between sherds from Crystal River and others from McKeithen, Safford Mound, Graveyard Island, and even more northern sites like Block-sterns suggest possible ties to other communities with large earthworks. This cautiously proposes that Crystal River may have served as a symbolic community within a broader regional network of ceremonial centers. However, to say that Crystal River was a symbolic community would require additional lines of evidence.

Pluckhahn et al. (2015) poses that the population at Crystal River began to wane in Phase 3. This change is not apparent in the limited pottery assemblage I have from midden contexts, which is the only gross provenience at my disposal for considering change through time. The percentages of limestone (77 percent) and sand-tempered (13 percent) wares present in middle occupation levels (roughly corresponding with Phase 2) are nearly identical to those seen in later levels (corresponding to Phase 3) (70 percent limestone and 11 percent sand). In fact, the pottery assemblage from later levels has an increase in sponge spicule wares (19 percent) than that seen in middle levels (6 percent sponge spicule-tempered). The reason for this persistence into a seemingly waning occupation is unclear and suggests that further ceramic analysis is needed.

What can be concluded from this research project is that Crystal River seems to have been a site for a number of interacting communities who were not necessarily permanent residents of the site. People from locally and regionally associated sites may have traveled to Crystal River for feasting and ceremonial practices. Though the site may have started out as a relatively residential community, the lingering tradition seems to be that numerous communities interacted there up until its decline. The data resultant from this project would benefit from a comparison to other similar sites in the area to determine if this variability is characteristic of other assemblages. If that is the case, there may have been a much larger and complex interaction sphere in place in Middle Woodland Florida than we thought existed previously.

CHAPTER 8:

APPLICATIONS AND FUTURE RESEARCH

Though there are benefits to looking at an existing artifact collection, there are also limitations. The assemblage used for this study was crudely excavated by the standards of today and documentation of Bullen's excavations is also minimal; he took few or no notes and there are also no maps showing the locations of his excavation units. The provenience information that survives is mostly relative. Thus analysis had to be based on gross provenience, although photographs provide some insight into the unit locations and several have recently been located through both geophysical investigations and excavation. It should also be noted here that this research does not include an analysis of any ceramics from Crystal River held in museums or collections outside of the FLMNH. These ceramics should be compared to the findings outlined here.

The assemblages from most proveniences were not large enough to talk about in a statistically meaningful way. The collection was biased towards the Main Burial Complex with little information concerning midden deposits. However, these issues can be alleviated by comparing this data to recent excavations by Pluckhahn and others (Blankenship et al. 2011; Pluckhahn et al. 2009; Pluckhahn and Thompson 2009; Pluckhahn et al. 2010b; Thompson and Pluckhahn 2010) which are focused on the midden deposits. This would allow for more information on intra-site organization and interactions, and would allow for more data concerning Crystal River as a symbolic community. Current research at the site also includes fieldwork at other sites around Crystal River, especially the nearby Roberts Island Shell Mound Complex. In order to see how the Crystal River ceramic assemblage differs, this thesis research should be compared with ceramic assemblages from these sites and others in the region such as those that were compositionally affiliated with the site in the INAA.

Another major limitation of the project is the small sample size for INAA, pXRF, and the gross paste analysis. The 35 sherd sample for these analyses serves as a pilot study for a much larger sample. I was able to make some observations from these analyses but a much larger sample would allow for stronger conclusions and would provide more information on paste variation and source locations. Collecting more local clay samples, and some from other sites in the region, is integral for future INAA and pXRF analyses. In order to further support the paste variation seen in the gross paste analysis, it would be beneficial for a sample of sherds to be thin sectioned and studied by point count analysis (see Wallis 2011; Wallis et al. 2015; Pluckhahn and Cordell 2011). Higher magnification studies such as these make it possible to better identify the constituents and inclusions.

Benefits

One of the main benefits of this research project was to yield new information from an existing, insufficiently reported collection. This research used traditional, macroscopic ceramic techniques combined with more modern analyses to update and sufficiently document pottery assemblages from past excavations. We now have a better understanding of the Crystal River ceramic assemblage and the way in which the site may have functioned within local and regional interaction spheres based around ceramic manufacture and exchange. The information gathered during this study can be used as a comparative reference for pottery assemblages at other Florida sites and for future pottery research at Crystal River.

The use of INAA and pXRF on the same sherd sample allowed for a comparison of the results of these two methods on prehistoric pottery. This created an opportunity to test these two analyses against one another, which to my knowledge is a little explored avenue in the Southeast.

This research helps us to better understand the people of Crystal River and what their interactions may have been like. It provides a greater understanding of Woodland period cultures in Florida and the relations of Woodland sites along the Gulf coast. The information gathered will also be incorporated into a continuing research project by Pluckhahn and colleagues (2010a) studying conflict and cooperation at Crystal River.

These data can also be used to better inform the public about the Crystal River site. The information obtained can aid in updating the museum exhibits and pamphlets at the Crystal River Archaeological State Park, allowing for my research to be relevant to the park visitors. The pottery exhibits at the museum are focused mainly on culture history seriations and showcasing the different pottery types found at the site. This research can add information about the different communities that interacted at the site and created the diverse pottery collection. It could also provide information on the different types of activities that may have occurred at the site based on the vessel forms present (i.e. feasting and ceremonial activities). The information gathered during this project will also aid the FLMNH in resolving any discrepancies in the collection records.

This research has also been personally beneficial to me. The skills required to complete this project helped me to become knowledgeable about pottery in Florida and pottery techniques which I am using to work on projects through my job at the Florida Public Archaeology Network

(FPAN). These skills have and will continue to be used in my outreach and education work at FPAN. I have had the opportunity to give talks about this research to archaeological societies and library groups. Using this knowledge, I also developed a workshop entitled "Archaeology Works: Pottery," part of a series of FPAN Archaeology Works workshops (Figure 8-1). This workshop teaches the public how prehistoric pottery in Florida was made and how archaeologists use it to learn about past peoples. I have created many hands-on activities that we use on a regular basis using the techniques learned during this research project. I have also created a number of educational handouts and other materials (Figure 8-2). Finally, I have had the opportunity to use my knowledge about Crystal River and its ceramic assemblage to help develop outreach and education materials for the FPAN center located at the Crystal River site.

Figure 8-1. Archaeology Works: Pottery workshop presentation and activities.

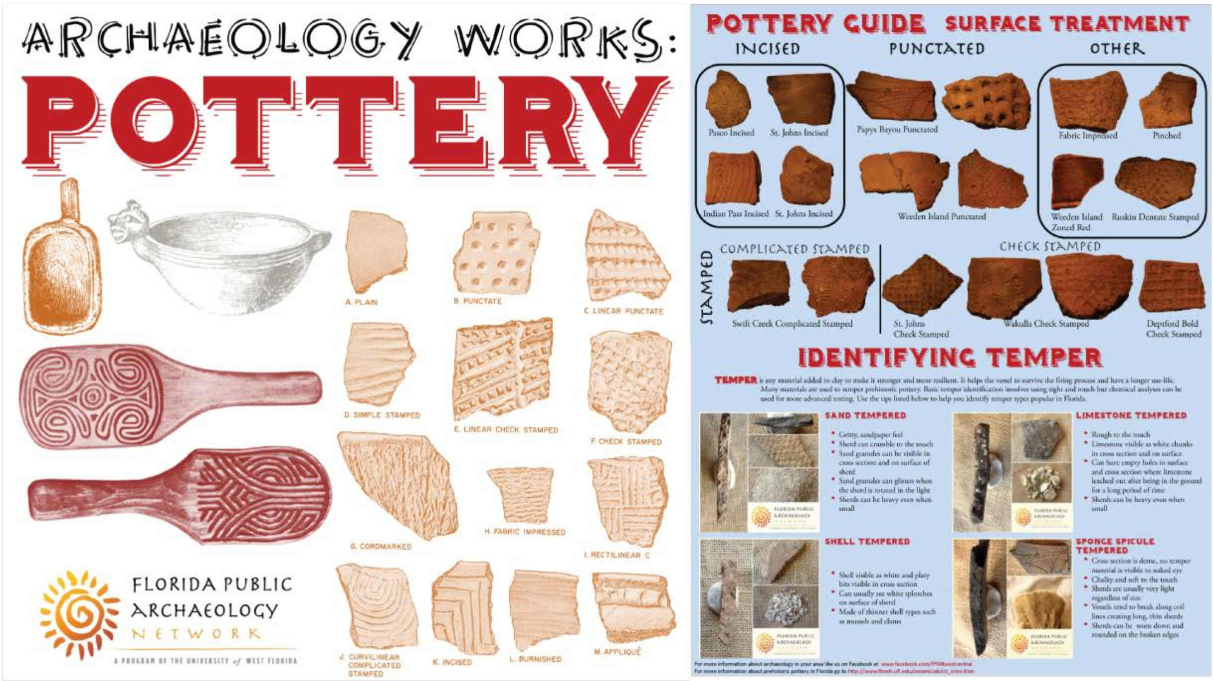

Figure 8-2. Archaeology Works: Pottery workshop graphic and handouts. Used with permission from the Florida Public Archaeology Network.

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APPENDICES

Appendix A: INAA Elemental Data

Table A-1. INAA Elemental Data 1

Sample #	Pottery Type	As	La	Lu	Nd	Sm	U	Yb	Ce	Co	Cr	Cs
PK-001	Weeden Island Plain	18.4177	41.4936	0.4991	71.5177	8.4811	1.9051	3.8538	95.8616	5.7552	95.4371	2.2457
PK-002	Ruskin Dentate Stamped	3.3395	97.4866	1.2563	124.1132	19.4064	4.0713	9.7799	150.9510	8.6496	201.0539	1.7797
PK-003	Sand-Tempered Plain	4.4525	46.4326	0.5713	68.6403	8.2116	1.6574	4.3923	70.5024	1.5312	395.8663	1.4944
PK-004	Weeden Island Red	3.4443	22.8183	0.2258	13.9651	2.3957	4.1685	1.0617	39.7231	2.2938	183.6329	1.6703
PK-005	St. Johns Plain	1.3868	27.4595	0.2468	24.3915	4.3965	2.8127	1.9931	54.9405	0.8572	63.0365	1.5954
PK-006	Dunn’s Creek Red	1.9509	30.6574	0.3537	26.0170	5.2681	3.7239	2.2543	61.3477	1.0817	69.6964	3.1240
PK-007	Sand-Tempered Plain	44.2955	66.6665	1.0002	84.1833	13.1465	4.1465	7.4991	101.4553	4.1013	592.5535	3.3412
PK-008	Weeden Island Zoned Punctated	7.8841	52.5441	0.6790	41.8462	8.4047	3.6690	5.2021	84.6749	2.4156	515.5393	2.2074
PK-009	Sand-Tempered Plain with Inclusions	11.6888	60.1370	0.6342	45.1384	9.0992	2.2911	5.1152	80.0598	2.1255	621.9912	2.0726
PK-010	St. Johns Plain	0.0000	27.4656	0.3424	25.2831	4.9849	4.1748	2.3216	56.0685	1.1896	71.7437	0.8659
PK-011	St. Johns Plain	1.6655	33.6702	0.3301	25.6522	5.6016	3.4983	2.4908	67.4413	1.0349	76.7343	1.7209
PK-012	Pasco Plain with Sand	3.5769	39.2736	0.4706	61.3711	6.9747	2.2329	3.3396	96.5098	7.6711	85.0348	1.7257
PK-013	Sand-Tempered Plain with Inclusions	4.1595	51.9332	0.8220	85.5843	11.2392	1.9709	6.1470	75.1858	1.7940	418.0630	1.5588
PK-014	Pasco Plain	1.9303	109.9369	1.2265	145.7010	21.5001	2.1098	9.3798	139.4207	5.0021	198.2646	1.0175
PK-015	Carrabelle Incised	3.8104	51.3601	0.7397	38.8208	8.7508	3.3368	5.6066	74.5318	2.2645	521.5435	2.0690

Table A-1 (continued)

Sample #	Pottery Type	As	La	Lu	Nd	Sm	U	Yb	Ce	Co	Cr	Cs
PK-016	Carrabelle Punctated/ Keith Incised	6.5244	58.5888	0.7926	54.8354	10.7113	5.9680	5.7401	88.3160	3.4858	413.2723	4.0113
PK-017	Pasco Plain	4.5137	118.3934	1.6975	155.1729	24.7665	3.4181	13.0829	171.1985	8.2123	261.4201	1.6078
PK-018	Weeden Island Zoned Red	4.8476	28.7420	0.3363	29.4712	6.5069	6.0045	2.4028	63.0129	2.1922	147.2406	3.0304
PK-019	Sand-Tempered Plain with Inclusions	4.7563	90.0104	1.5344	105.5002	16.7733	3.3124	11.7461	121.5058	5.9680	172.6386	0.9009
PK-020	Keith Incised	8.4424	31.7910	0.5166	24.0617	5.6275	3.0467	3.9581	60.8148	1.4368	336.5844	1.2881
PK-021	Pasco Plain	2.3143	67.5099	0.7808	84.3970	13.0449	1.9667	6.5025	98.8650	4.8178	132.1102	1.1235
PK-022	Deptford Simple stamped	2.6198	34.6399	0.4773	33.6086	5.8652	3.8138	3.0763	63.9883	5.7503	87.4799	1.9514
PK-023	Sand-Tempered Plain	2.1807	24.3817	0.2824	24.2411	4.9600	5.1106	1.4204	43.6533	1.8998	249.2697	4.2709
PK-024	Wakulla Check stamped	7.9747	52.8049	0.5974	41.2651	8.8696	5.2475	4.2558	89.8208	4.2775	234.6642	2.1902
PK-025	St. Johns Plain	1.3074	28.0803	0.3193	23.8972	4.6348	2.5321	2.2847	55.6712	1.5829	70.9064	0.5506
PK-026	Pasco Plain	7.1545	103.0736	1.1768	119.9063	17.8755	1.7937	9.1549	135.1439	9.4671	278.7280	3.5830
PK-027	St. Johns Plain	0.0000	26.4422	0.3082	24.5418	4.6705	3.9618	2.0656	53.3364	1.4608	72.0924	0.9336
PK-028	Sand-Tempered Plain with Inclusions	2.4074	101.8099	1.0299	110.5513	15.5816	3.7238	8.3020	134.5901	8.0420	253.1810	2.7928
PK-029	Deptford Check Stamped	1.8817	33.2825	0.4394	27.0478	5.5526	4.9724	2.9744	66.0659	4.5215	63.1324	3.0441
PK-030	Pasco Red	37.9434	55.8885	0.6761	49.9507	9.5948	10.3484	4.4611	102.2118	7.0872	139.3547	5.0584
PK-031	Papys Bayou Punctated	1.6861	30.4923	0.3775	29.3896	5.3676	7.9022	2.3731	62.2981	1.2941	88.4963	1.5665
PK-032	Pasco Plain	1.7377	65.2062	1.1066	109.9012	13.1752	2.7977	8.6565	90.1731	3.0158	140.4632	0.6389
PK-033	St. Johns Plain	2.9578	29.1933	0.3289	24.1565	4.9187	3.6271	2.3645	57.8703	1.8816	71.1300	7.9661
PK-034	Pasco Plain	1.0829	32.7612	0.4434	32.8033	7.1601	2.7645	3.3852	56.0817	2.6934	60.0970	1.7888
PK-035	Swift Creek Complicated Stamped	4.0248	35.3118	0.3464	28.3862	5.6936	3.6335	2.6896	65.5661	3.4138	99.0424	2.3347
PK-036	n/a; raw clay sample	6.1168	30.1337	0.5152	25.0320	5.8135	2.0358	3.6789	38.9777	1.9708	81.8390	1.1364
PK-037	n/a; raw clay sample	21.5306	25.3570	0.3659	17.8279	4.1338	5.1208	2.3042	45.7019	5.3850	151.4789	6.3462
PK-038	n/a; raw clay sample	4.0423	70.7353	1.3074	102.7695	15.6623	1.1403	10.0471	82.4210	3.7362	160.0146	1.9042

Table A-2. INAA Elemental Data 2

Sample #	Pottery Type	Eu	Fe	Hf	Ni	Rb	Sb	Sc	Sr	Ta	Tb	Th
PK-001	Weeden Island Plain	1.6463	25047.2	4.4621	22.46	5.69	0.4376	11.7708	0.00	0.8881	1.1050	12.8828
PK-002	Ruskin Dentate Stamped	4.0984	15512.3	8.7944	66.04	7.06	0.7129	18.5447	0.00	1.3588	3.1129	22.7420
PK-003	Sand-Tempered Plain	1.6072	12491.4	7.9480	20.12	5.71	0.3562	9.1089	0.00	0.7748	1.2192	11.4340
PK-004	Weeden Island Red	0.3036	7365.2	11.4596	20.81	6.85	0.8316	7.2126	65.94	1.1167	0.2623	11.2029
PK-005	St. Johns Plain	0.8062	17514.6	6.8577	0.00	11.26	0.1194	8.2338	359.41	0.7759	0.5940	7.8814
PK-006	Dunn’s Creek Red	0.9376	15932.2	6.8484	24.77	17.17	0.1555	9.4489	76.11	0.8045	0.6855	9.1110
PK-007	Sand-Tempered Plain	2.9976	46760.1	7.5272	0.00	15.57	1.8805	15.8826	0.00	1.1307	2.2389	18.5777
PK-008	Weeden Island Zoned Punctated	1.6796	22680.1	8.9001	0.00	4.88	0.6276	11.9426	46.53	0.9861	1.4728	14.3199
PK-009	Sand-Tempered Plain with Inclusions	1.9225	22541.4	5.8095	0.00	8.69	0.5127	14.2465	0.00	1.0152	1.3923	17.0125
PK-010	St. Johns Plain	0.8512	18893.8	7.4322	0.00	6.71	0.1524	8.6352	73.51	0.7473	0.5652	9.1021
PK-011	St. Johns Plain	1.0189	17853.8	7.8368	0.00	12.21	0.1636	10.0614	167.07	0.7913	0.6909	10.1031
PK-012	Pasco Plain with Sand	1.2401	25865.8	11.4830	0.00	9.39	0.4194	10.2208	25.56	1.0860	0.8904	11.0080
PK-013	Sand-Tempered Plain with Inclusions	2.3401	12675.7	7.9505	44.82	4.75	0.4105	9.4090	0.00	0.6992	1.9319	11.5769
PK-014	Pasco Plain	4.4760	13087.6	3.9160	46.07	4.06	0.4529	18.0429	143.04	1.0321	3.1077	19.8641
PK-015	Carrabelle Incised	1.7820	17621.5	7.6436	0.00	5.94	0.4442	12.6340	52.82	0.8526	1.3718	14.8190
PK-016	Carrabelle Punctated/ Keith Incised	2.1193	21751.7	8.5608	42.09	14.77	1.1113	11.7843	110.87	0.9390	1.7009	14.2359
PK-017	Pasco Plain	5.5060	20027.2	6.1851	71.54	6.22	0.6146	24.3723	150.76	1.4398	4.1070	25.9333
PK-018	Weeden Island Zoned Red	1.0280	20868.7	11.6111	0.00	14.71	1.0007	13.9456	0.00	0.9594	0.8884	13.9201
PK-019	Sand-Tempered Plain with Inclusions	3.8165	9946.5	9.1842	50.06	4.24	0.4521	13.2051	220.45	1.1850	3.1161	17.7572
PK-020	Keith Incised	0.9353	12960.0	18.2424	0.00	5.78	0.4463	8.9285	31.17	1.0886	0.8276	14.1795
PK-021	Pasco Plain	2.7180	10474.1	4.5671	34.22	5.35	0.3833	12.7797	202.41	0.9106	1.8858	14.4719
PK-022	Deptford Simple stamped	1.1356	21163.6	9.8136	24.77	8.95	0.5168	7.9230	121.86	0.7799	0.7802	7.2713
PK-023	Sand-Tempered Plain	0.8725	17452.9	11.2733	0.00	14.29	0.3882	8.5870	247.96	0.8066	0.6111	7.9832
PK-024	Wakulla Check stamped	1.6973	19362.7	6.2459	30.16	7.26	0.5708	13.0872	53.17	1.0229	1.3311	14.1425
PK-025	St. Johns Plain	0.8379	21038.8	7.7521	0.00	7.89	0.1624	8.9113	172.79	0.8089	0.6810	9.2565
PK-026	Pasco Plain	3.6863	25683.9	6.5093	95.61	5.73	0.6865	21.3759	72.51	1.2673	2.6644	21.2178
PK-027	St. Johns Plain	0.8721	18918.5	6.3561	0.00	8.53	0.1558	9.0559	103.68	0.7794	0.6105	8.7046
PK-028	Sand-Tempered Plain with Inclusions	3.2190	8325.9	7.0533	53.55	7.46	0.6143	15.1454	155.43	1.3609	2.3326	21.1523

Table A-2 (continued)

Sample #	Pottery Type	Eu	Fe	Hf	Ni	Rb	Sb	Sc	Sr	Ta	Tb	Th
PK-029	Deptford Check Stamped	0.8411	19838.9	11.7619	0.00	31.39	0.2952	11.4011	0.00	1.1858	0.7482	13.0168
PK-030	Pasco Red	1.7452	37993.8	6.3391	0.00	16.76	1.0410	18.1769	0.00	1.3655	1.3182	18.0480
PK-031	Papys Bayou Punctated	0.9327	18438.9	7.0040	11.08	12.61	0.1541	9.7095	133.12	0.8224	0.7464	9.1269
PK-032	Pasco Plain	2.6560	5741.0	4.8336	34.79	0.00	0.3665	11.2567	339.87	0.7586	2.2751	13.4989
PK-033	St. Johns Plain	0.8979	20031.7	6.8253	0.00	20.52	0.1463	9.4843	188.38	0.8141	0.7321	8.6947
PK-034	Pasco Plain	1.4590	5924.4	5.8095	24.25	6.57	0.2630	6.9667	256.72	0.5364	1.0922	8.3868
PK-035	Swift Creek Complicated Stamped	0.9942	22713.9	6.7982	0.00	6.10	0.3653	10.3736	0.00	0.8187	0.7264	11.7583
PK-036	n/a; raw clay sample	1.1713	9281.6	11.3578	0.00	9.77	0.3829	4.7127	33.83	0.4324	0.9359	6.5483
PK-037	n/a; raw clay sample	0.6446	40356.0	11.1848	0.00	97.77	2.0090	15.0035	215.49	1.1605	0.4202	14.4313
PK-038	n/a; raw clay sample	3.3714	19958.1	7.7522	65.34	17.06	0.4840	10.9171	78.60	0.7864	2.8507	14.2167

Table A-3. INAA Elemental Data 3

Sample #	Pottery Type	Zn	Zr	Al	Ba	Ca	Dy	K	Mn	Na	Ti	V
PK-001	Weeden Island Plain	113.75	105.28	68833.7	104.3	1641.3	6.6392	952.8	32.92	753.4	3879.4	78.70
PK-002	Ruskin Dentate Stamped	219.98	236.20	100929.0	87.2	4719.5	19.0504	1190.1	55.51	585.2	4985.8	165.76
PK-003	Sand-Tempered Plain	79.34	187.38	51262.5	49.8	1878.0	7.9537	650.5	27.42	663.7	2849.2	131.68
PK-004	Weeden Island Red	51.73	265.50	68967.7	72.2	7288.0	2.6606	1587.6	60.41	409.0	4010.5	123.94
PK-005	St. Johns Plain	113.77	169.48	50856.0	301.3	9258.6	3.0429	3094.7	53.50	1458.4	4382.0	32.70
PK-006	Dunn’s Creek Red	86.56	172.47	60796.3	201.5	4469.1	3.8541	5556.7	52.05	1692.9	4450.5	56.56
PK-007	Sand-Tempered Plain	95.62	225.36	94289.5	63.3	363.2	14.1024	1878.5	67.34	1305.5	4532.6	320.14
PK-008	Weeden Island Zoned Punctated	122.32	217.42	63487.6	101.4	2220.8	8.2205	1090.1	35.71	841.5	4240.8	194.30
PK-009	Sand-Tempered Plain with Inclusions	144.11	156.39	76625.8	61.6	2850.7	9.1632	1477.8	36.14	1213.1	4416.8	249.89
PK-010	St. Johns Plain	33.27	202.73	52265.3	150.9	3284.4	4.0863	2208.9	46.74	1362.3	3979.4	41.36
PK-011	St. Johns Plain	126.71	176.60	62830.2	314.7	6845.6	4.6487	3397.9	62.49	1649.2	5370.4	53.55
PK-012	Pasco Plain with Sand	49.24	285.64	82515.0	50.6	2729.2	5.7245	1191.2	88.46	374.2	5416.5	97.36
PK-013	Sand-Tempered Plain with Inclusions	101.00	217.89	48259.9	86.2	4149.0	12.3190	605.5	29.94	365.8	3781.6	131.66

Table A-3 (continued)

Sample #	Pottery Type	Zn	Zr	Al	Ba	Ca	Dy	K	Mn	Na	Ti	V
PK-014	Pasco Plain	63.42	128.84	89288.1	63.9	172060.1	19.6835	939.8	59.14	1100.1	3994.8	107.21
PK-015	Carrabelle Incised	209.14	197.92	66563.7	117.0	5219.1	9.0986	928.0	63.13	539.8	3734.5	135.43
PK-016	Carrabelle Punctated/ Keith Incised	101.26	231.37	65273.7	54.0	18395.2	10.7313	1949.1	59.96	863.8	4203.0	185.71
PK-017	Pasco Plain	177.26	184.23	129938.0	174.9	57614.1	27.5400	943.1	108.58	997.0	5881.0	176.24
PK-018	Weeden Island Zoned Red	109.64	304.37	84634.0	80.0	1420.7	4.8992	1888.0	26.82	591.8	4256.4	171.62
PK-019	Sand-Tempered Plain with Inclusions	37.72	280.57	73452.7	108.7	8355.2	21.1371	778.6	26.10	348.3	4334.0	84.87
PK-020	Keith Incised	89.16	427.31	50226.1	66.2	2542.1	4.6279	1362.0	38.09	651.6	4309.2	98.25
PK-021	Pasco Plain	37.15	121.67	72385.1	91.5	137667.6	12.7257	933.6	54.26	511.9	3675.9	98.56
PK-022	Deptford Simple stamped	45.42	242.63	53615.1	94.3	12318.3	5.2382	1384.3	41.35	434.5	3902.1	84.94
PK-023	Sand-Tempered Plain	60.94	282.95	48637.9	139.5	10684.1	3.0065	3097.1	44.52	795.9	3999.2	116.01
PK-024	Wakulla Check stamped	55.37	161.35	74280.4	67.3	7238.3	7.6546	1873.7	45.19	1069.5	4624.5	121.78
PK-025	St. Johns Plain	58.21	200.51	56344.9	225.4	10089.5	3.6227	2711.7	101.78	1382.8	4745.7	26.41
PK-026	Pasco Plain	263.91	206.08	117814.0	120.2	90232.7	17.3751	1923.8	105.31	1015.6	4863.7	219.67
PK-027	St. Johns Plain	23.17	148.80	55787.7	142.9	6565.3	3.4404	2893.1	39.13	1756.9	4194.3	61.28
PK-028	Sand-Tempered Plain with Inclusions	99.53	205.85	84619.2	124.0	56881.1	14.8136	845.2	149.19	329.2	4440.3	84.70
PK-029	Deptford Check Stamped	79.45	271.65	68735.5	209.5	2533.6	4.3197	6518.8	99.42	1685.1	5793.3	88.92
PK-030	Pasco Red	161.70	198.09	118440.7	136.0	4995.5	7.7213	2128.5	173.55	889.7	5988.7	135.08
PK-031	Papys Bayou Punctated	89.04	200.26	60782.7	168.5	4814.4	3.8458	2558.2	78.18	1632.8	4791.7	54.58
PK-032	Pasco Plain	19.41	161.37	54605.9	101.3	117518.6	16.2209	723.0	47.00	489.2	3613.6	58.58
PK-033	St. Johns Plain	30.29	160.52	59038.9	341.5	11178.7	3.5997	4120.8	61.13	1653.9	4517.1	57.10
PK-034	Pasco Plain	17.94	159.04	43515.7	50.0	223620.0	6.6951	1773.2	51.80	469.9	3452.0	71.24
PK-035	Swift Creek Complicated Stamped	176.38	165.67	63344.8	81.7	2552.4	4.1060	0.0	387.87	768.7	4498.0	66.78
PK-036	n/a; raw clay sample	10.74	256.19	20286.7	42.6	2325.5	6.4456	847.8	23.00	921.8	2225.7	49.64
PK-037	n/a; raw clay sample	51.33	257.50	65878.4	106.0	3013.2	3.1544	16128.9	64.90	1416.3	5347.1	192.77
PK-038	n/a; raw clay sample	27.21	222.04	41963.9	28.7	2023.0	16.8364	1060.4	38.27	1342.3	3159.8	76.93

Appendix B: pXRF Calibrated Elemental Data

Table B-1. pXRF Calibrated Elemental Data

Sample #	Pottery Type	Ba	Fe	Th	Rb	Sr	Y	Zr	Nb
PK-001	Weeden Island Plain	1203	29942	8	13	33	36	143	13
PK-002	Ruskin Dentate Stamped	1001	18902	11	14	62	99	218	22
PK-003	Sand-Tempered Plain	825	17444	7	10	33	41	212	12
PK-004	Weeden Island Red	976	8437	8	14	96	17	315	12
PK-005	St. Johns Plain	1210	16589	5	16	234	20	188	8
PK-006	Dunn’s Creek Red	911	16169	5	20	91	24	188	11
PK-007	Sand-Tempered Plain	1520	34422	9	19	50	69	198	17
PK-008	Weeden Island Zoned Punctated	1140	25204	8	10	53	41	288	13
PK-009	Sand-Tempered Plain with Inclusions	1147	24541	10	12	48	51	200	14
PK-010	St. Johns Plain	1046	22901	5	12	87	22	193	10
PK-011	St. Johns Plain	1178	18800	5	15	222	22	183	7
PK-012	Pasco Plain with Sand	1287	26756	8	14	40	33	299	15
PK-013	Sand-Tempered Plain with Inclusions	773	17819	6	10	46	68	172	14
PK-014	Pasco Plain	1602	20236	13	15	172	88	142	18
PK-015	Carrabelle Incised	883	19733	7	11	60	37	207	13
PK-016	Carrabelle Punctated/ Keith Incised	1169	23131	10	20	109	56	270	13
PK-017	Pasco Plain	1532	20801	12	14	250	113	138	18
PK-018	Weeden Island Zoned Red	1420	22511	8	21	112	25	367	13
PK-019	Sand-Tempered Plain with Inclusions	1626	12691	8	12	314	134	206	21
PK-020	Keith Incised	1086	14200	8	12	58	33	487	14
PK-021	Pasco Plain	1543	17501	9	17	262	77	179	18
PK-022	Deptford Simple stamped	1314	21035	7	17	129	33	278	12

Table B-1 (continued)

Sample #	Pottery Type	Ba	Fe	Th	Rb	Sr	Y	Zr	Nb
PK-023	Sand-Tempered Plain	1203	19818	6	21	217	21	350	10
PK-024	Wakulla Check stamped	1194	20370	9	11	84	46	172	14
PK-025	St. Johns Plain	1167	21009	5	12	167	22	233	9
PK-026	Pasco Plain	1264	25862	12	13	109	78	153	17
PK-027	St. Johns Plain	1021	22442	6	12	111	21	182	9
PK-028	Sand-Tempered Plain with Inclusions	1586	11984	12	19	262	71	208	20
PK-029	Deptford Check Stamped	2186	27757	10	**30**	41	29	339	17
PK-030	Pasco Red	1672	32167	10	23	55	42	178	17
PK-031	Papys Bayou Punctated	1085	18737	6	16	118	23	207	10
PK-032	Pasco Plain	1456	**7970**	9	13	341	82	180	14
PK-033	St. Johns Plain	886	20499	6	22	91	22	185	10
PK-034	Pasco Plain	1539	13352	9	21	299	31	148	9
PK-035	Swift Creek Complicated Stamped	1028	24741	7	12	32	27	177	12
PK-36	n/a; raw clay sample	709	10756	6	15	39	61	245	11
PK-37	n/a; raw clay sample	1315	26618	11	**73**	186	36	344	15
PK-38	n/a; raw clay sample	1163	23763	10	**49**	141	69	249	15

Table B-2. pXRF Data Summary Statistics

	Ba	Fe	Th	Rb	Sr	Y	Zr	Nb
Mean	1233	20463	8	18	128	48	227	14
Standard Deviation	295	5974	2	11	89	29	75	4
Minimum	709	7970	5	10	32	17	138	7
Maximum	2186	34422	13	73	341	134	487	22