BLACK GLASS ON THE GEORGIA COAST: THE UTILITY OF BLACK GLASS TRADE BEADS IN REFINING SITE CHRONOLOGY AND DETECTING COLOR PREFERENCE AT SEVENTEENTH CENTURY MISSION SANTA CATALINA DE GUALE

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ABSTRACT

Historical and archaeological research has established that European glass beads are high-resolution temporal markers for colonial sites in North America. Additionally, recent studies have demonstrated that compositional analyses of certain bead types can refine the chronological resolution of these artifacts. This study contributes to this growing body of knowledge by extending these methods to drawn beads manufactured from black glass. Using X-ray fluorescence spectrometry and a sample of simple black glass trade beads (n=940) recovered from the cemetery of Mission Santa Catalina de Guale (St. Catherines Island, Georgia), I identify diachronic patterns in the recipes that guided their manufacture during the seventeenth century. The concentrations of temporally diagnostic opacifiers (i.e., tin [Sn] and antimony [Sb]) found within beads assemblages from individual contexts are then used to refine the existing site chronology and contribute to ongoing studies of the occupation and use of the mission. I argue that the seventeenth century mission complex was built during multiple stages of construction separated by decades. Furthermore, relative dates for a number of burial contexts have been proposed, which provide insight into diachronic variation in indigenous Guale burial practices. In this study, I specifically address differences in color patterning between the newly dated burial contexts as a means of identifying and comparing the preferential consumption of five culturally salient bead colors and their relationship to indigenous identities.
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CHAPTER 1:
INTRODUCTION

While exploring and later settling the New World, Europeans gifted and traded a wide variety of European-made goods with Native Americans. However, few of these items were embraced as enthusiastically and ubiquitously as glass trade beads. Glass trade beads were highly prized within native communities and often exchanged for seemingly exorbitant sums. For example, when trading with the Powhatan, John Smith of Virginia notes that they were willing to part with “2 or 300 bushels of corne” for “a few blew beads” and “yet parted good friends” (cited in Miller and Hamell 1986:311). Although in conflict with Euro-American value systems, such encounters highlight the importance of beads within indigenous systems of value and help to explain why they are present in the archaeological record in such great quantities.


Glass trade beads also possess considerable value as indices of indigenous preference. Archaeological studies of bead preference (Blair 2017; Panich 2014; Smith 1983, 1987; Spector 1976; Wiegand 2013) have revealed patterned variability in the consumption of various types of beads that coincide with temporal, geographic, and social boundaries. It has been suggested that the popularity of beads may be attributed to religious and cosmological beliefs, which emphasize the divine power of light and value color as an expression of important social attributes (Hamell 1983, 1987, 1992; Hudson 1976; Miller and Hamell 1986; Saunders 1988, 1998, 1999).

Oftentimes, beads were worn on the body or sewn into clothes so that the wearer could display these attributes and thus would have been highly visible referents of culturally salient identities, values, and beliefs (Larson 1978; Loren 1999, 2000, 2009, 2010, 2013).
This widespread consumption and use of glass trade beads appears to have been especially prevalent among the Guale of coastal Georgia. Excavations led by David Hurst Thomas and the American Museum of Natural History from 1980 to 1991 at Mission Santa Catalina de Guale (St. Catherines Island, Georgia) recovered nearly 70,000 glass trade beads spread throughout the remains of the mission buildings and cemetery (Blair et al. 2009:9; Thomas 1988:99, 2010a:102). Furthermore, evidence (i.e., the in situ distribution of beads and ethnohistoric documentation) suggests that the Guale regularly used beads as bodily ornaments (Larson 1978). Archaeological evidence from Mission Santa Catalina de Guale indicates that some aspects of aboriginal Guale life survived European contact with minimal change (Thomas 2010a:103; Worth 2002:58). As such, I hypothesize that preference for certain colors may represent the persistence of traditional belief systems, which value light and color as manifestations of divine wellbeing (Hamell 1987:73-75). Furthermore, specific colors may have been preferred by certain segments of the population seeking to embody their associated social values.

The study presented in the following chapters builds upon previous analyses of the bead assemblage recovered from Mission Santa Catalina de Guale (Blair 2015a, 2015b, 2016, 2017; Blair et al. 2009) by examining the chemical composition of 940 American Museum of Natural History type 17 (Kidd and Kidd IIa6, IIa7, IIa8) simple, drawn, manganese black glass trade beads drawn from 22 unique contexts. X-ray fluorescence spectrometry is used to identify relative concentrations of temporally diagnostic opacifiers (see Blair 2015a, 2015b; Dalton-Carriger and Blair 2013, 2015; Hancock et al. 1997; Sempowski et al. 2000; Templin and Blair 2016) in order to refine the existing site chronology and identify diachronic change in the preferential consumption of bead colors, which may be linked to Guale practices and beliefs.
This study represents the largest elemental analysis of a single bead type ever conducted and contributes broadly to the existing body of knowledge related to the manufacture of black glass trade beads exported by the Spanish during the seventeenth century. Additionally, it provides greater insight into the consumption of glass trade beads in Spanish colonial contexts and, more specifically, at Mission Santa Catalina de Guale.

In chapter 2, I provide background information relevant to understanding the archaeological context from which the bead assemblage was recovered. I begin by discussing the history of Spanish colonialism in *La Florida*, the role of missionization in the overarching colonial strategy, and its effects on the region’s indigenous inhabitants. I then examine the lifeways of the aboriginal Guale and the degree to which they persisted following European contact. I suggest that the compatibility of Guale social structure with the Hispano-Franciscan colonial model allowed some indigenous cultural patterns to persist with relatively modest change due to colonialism (Blair and Thomas 2014:29-30; Hall 2007, 2009; Thomas 2010:103, 2013b:119; Worth 2002:58). Lastly, I provide a general overview of archaeology on the Georgia Coast before discussing efforts to locate Mission Santa Catalina de Guale and the results of the American Museum of Natural History’s archaeological excavations at the mission from 1980 to 1991.

In chapter 3, I discuss the results of the elemental analysis of the 940 black glass trade beads used in this study. The chapter opens with an overview of historic glass production and composition in southern Europe. Special attention is given to the techniques of the Venetian bead making guilds due to their influence on bead production throughout the region. I then provide an overview of prominent archaeological bead taxonomies, their contributions to the American Museum of Natural History classification system used in this study, and outline the defining
characteristics of type 17 glass trade beads. Having covered the requisite background information, I continue the chapter by outlining and supporting the methods used to collect and analyze compositional data from the bead assemblage. Lastly, I present evidence of elemental patterning within the data and demonstrate that the temporally diagnostic shift from lead-tin to calcium antimonite opacification during the seventeenth century is also applicable to type 17 black glass trade beads. By comparing concentrations of temporally diagnostic opacifiers in beads from across the mission, I am then able to refine the current site chronology for Mission Santa Catalina de Guale.

In chapter 4, I use the refined site chronology established in chapter 3 to better assess evidence of variability in bead color preference throughout the life of the mission. I begin by suggesting that humans possess an inherent attraction to and fascination with light and color, which influences the creation and consumption of material culture. This trait is particularly well exemplified by Native American cultures, which shared a basic underlying shamanic cosmology that associated light and color with divine or supernatural power and social states of being (Classen 1990; Hamell 1983, 1987, 1992; Hudson 1976; Miller and Hamell 1986; Saunders 1988, 1998, 1999; Turgeon 2004). Based upon the wide distribution of these beliefs throughout the Americas, I argue that the Guale at Mission Santa Catalina likely embraced a culturally specific variant of this cosmology. Cultural comparisons with other Native American groups are used to propose potential social values for culturally salient colors (i.e., black, white, red, yellow-green, and blue) derived from analyses of Muskogean color terms and supported by Kay and Maffi’s (1999) evolutionary color term schema. Furthermore, I suggest that the black beads recovered from burial contexts at Mission Santa Catalina de Guale likely reflected common Native American associations between the color black and death, liminality, and ill omens. Using
the five color terms identified by linguistic analogy, I recode the bead assemblages associated with 77 burial contexts from the mission cemetery in order to assess how colored beads are distributed by date of interment, sex, and age of the deceased. I conclude the chapter by providing plausible ideological contexts for the creation of the grave good assemblages recovered from Mission Santa Catalina de Guale.

In chapter 5, I conclude the study by presenting an overview of its findings. First, I address the significance of the compositional analysis. The elemental data produced using the assemblage of type 17 beads not only provides new insight into the processes and choices, which influenced European glass manufacture during the seventeenth century, but also provides new lines of evidence with which to assess the site chronology at Mission Santa Catalina de Guale. I then discuss the significance of the color analysis and its implications for current understandings of Guale identity in the face of colonialism. Lastly, I present potential avenues by which future studies can expand upon these findings.
CHAPTER 2: 
AN HISTORICAL AND ARCHAEOLOGICAL OVERVIEW 
OF MISSION SANTA CATALINA DE GUALE

Introduction

The 940 simple, drawn, manganese black glass trade beads (Kidd and Kidd IIa6, IIa7, and IIa8), which serve as the focus of this study, were recovered during excavations at Mission Santa Catalina de Guale (St. Catherines Island, Georgia). Archaeological and historical investigations there have provided considerable insight into the daily operations of the Spanish missions dispersed throughout the Southeast. In this chapter, I provide a brief outline of Spanish colonialism and its effects on the indigenous peoples of La Florida. Special attention is given to the Guale who inhabited the northeastern Georgia coast and nearby barrier islands, including St. Catherines. I also give an account of past archaeological investigations into the prehistoric and protohistoric Guale, which contributed to the eventual rediscovery of Mission Santa Catalina de Guale. Lastly, I provide an overview of Mission Santa Catalina de Guale, its layout, and associated artifacts.

Spanish Colonialism in La Florida

Mission Santa Catalina de Guale and other missions like it served an important role as points of contact and sociocultural articulation between the burgeoning Spanish colonial
government and native peoples of *La Florida*. Spain’s first forays into the Southeast had begun with the sixteenth century *entradas* (Spanish missions of conquest) of Juan Ponce de León (1513, 1521), Pánfilo Narváez (1527), Hernando de Soto (1539), Tristán de Luna (1559), and Juan Pardo (1566) (Rodning et al. 2013:231; Thomas 2013b:118; Worth 2002:46, 2013:131). These early expeditions attempted to replicate the successes achieved during the conquests of Central and South America by using military might and political manipulation to extract material wealth (e.g., gems, minerals, exotic trade goods, and slaves) from the land and its inhabitants. However, such tactics ultimately proved ill suited to subjugating the Southeast. The Spanish found the region to be largely devoid of the mineral wealth which had flowed so abundantly from the mines of Central and South America and its inhabitants well accustomed to defending themselves against violent coercion (Francis and Kole 2011:18; Rodning et al. 2013:235-240; Thomas 2013a:252-253).

As a result, the Spanish were forced to adopt a new strategy in order to secure *La Florida* before rival nations, such as France and Britain, could establish a foothold threatening Spanish colonial interests in the Caribbean and throughout the New World. Pedro Menéndez de Avilés arrived in *La Florida* in 1565 with the goal of securing the land for Spain. That same year, Menéndez founded St. Augustine as a permanent hub for further colonial expansion. Spanish efforts were driven largely by a desire to convert the peoples of the Southeast into productive Christian servants of the Spanish Empire who would willingly provide the resources and labor necessary to maintain a permanent colonial presence in the region (Thomas 2013b:118; Worth 2013:135).

Christianization followed a series of prescribed steps defined by increasingly strict adherence to Spanish Catholic doctrines (Polzer 1976:29-58; Spicer 1962:288-297; Thomas
1988:117). The first phase (entrada) stressed exposure to Catholic symbols, including vestments, crucifixes, iconography, and artwork. Missionaries would attempt to establish relationships with indigenous communities and introduce them to the ritual and symbolic aspects of the sacraments (Thomas 1988:117). The second phase (pre-parochial) was characterized by the construction of mission compounds in politically advantageous communities. At the missions, would-be converts were educated in the basic beliefs and practices of Catholicism, which oftentimes involved public participation in ritualized behaviors, such as prayer and processionals (Thomas 1988:117-118). Missionaries are known to have distributed a variety of religious objects (e.g., rings, medallions, etc.) in order to aid the conversion process. Although such objects could be viewed as idolatrous when used in accordance with traditional indigenous practices (e.g., in place of gorgets or as grave goods), missions were governed by the belief that improper use could be corrected and was not grounds for abolishing such items, if they could ultimately bring about full conversion (Ewing 1949:103; Thomas 1988:119). The final phase (parochial) would have seen Christian converts given the same status as Spaniards and Creoles in the eyes of the Church. Missionaries would have transferred their duties to secular clergy (Bolton 1917:46; Polzer 1976:5; Thomas 1988:121). The newly formed parishes would have taken on greater responsibility for their own wellbeing and become reliant upon personal tithes rather than assistance from the Spanish Crown (Sluiter 1985:6; Thomas 1988:121). However, as noted by Thomas (1988:122) it is currently unknown whether any of the missions actually graduated to the parochial phase prior to the withdrawal of the Spanish from La Florida.

In order to accomplish this task, Menéndez provided for a number of Jesuit missionaries to accompany him to the New World. However, within a decade (ca. 1572) the Jesuits had abandoned all hope of converting the indigenous peoples citing their naturally indolent
temperament and departed La Florida for other parts of the empire (Blair 2015b:18; Cushner 2006; Gray 2014; Marotti 1984, 1985; Paar 1999). The Franciscans would take over Christianization efforts in La Florida the following year marking the beginning of the Franciscan Mission period (A.D. 1573-1763). Franciscan missionaries led by Diego Moreno settled in the province of Guale in 1574. However, Moreno and his subordinates left La Florida the following year citing conflicts with then governor Diego de Velasco (Lyon 1992:96). Without the missionaries present, the Guale revolted against the Spanish in the provinces of Guale and Orista/Escamaçu in 1576 (Blair 2015b:12, 17). Surviving records indicate that the Guale turned violent upon the cessation of gift-giving and suffering increasingly oppressive treatment by the colonial government, against which the Franciscans traditionally served as buffers (Held 1949; Lyon 1984, 1987, 1992; Worth 2013). The Guale-Orista revolt resulted in the destruction of the Spanish garrison at Santa Elena and numerous coastal settlements (Francis and Kole 2011:25; Hoffman 1990:270-271; Lyon 1984, 1987). The Franciscans returned to La Florida in 1587 to continue their ministration. Missions were initially limited to the Mocama and Agua Salada provinces in Florida, but the Franciscans soon extended their influence northward into Georgia to include the province of Guale by 1597 (Blair 2015b:17). The Guale would rebel against the Spanish again in 1597. However, this time they targeted the missions, razing them to the ground, murdering five friars, and holding a sixth captive. Traditional interpretations of extant records have attributed the violence to social and political interference from the Franciscans, but recent analyses by Francis and Kole (2011) suggest that it was more likely the result of chiefly cycling and power mongering exacerbated by the disruptive influences of the newly arrived Spanish.

Following the redistribution of friars and rebuilding of missions following the 1597 revolt, the Franciscans in La Florida would ultimately provide the template for successfully
integrating native communities into the Spanish colonial economy. Using years of experience Christianizing the New World, the Franciscans developed an effective model of conversion that would spread Spanish influence throughout the Southeast. In order to expedite conversion, Franciscan missionaries were expected to act as cultural brokers and ambassadors in addition to their formal roles as representatives of the Church. Missionaries maintained peaceful relations between the indigenous peoples they ministered and the Spanish colonial government by abstaining from interfering in local politics and offering valuable services to local elites. For example, they often acted as technical advisors, advocated for the rights of indigenous peoples, and distributed European goods throughout the community. Indigenous peoples were more than willing to attend catechism and receive the sacraments in exchange for these benefits (Worth 2013:138).

Elites, in particular, were provided with strong incentives to pledge loyalty to the Spanish Crown, even if only nominally. Power among the Southeastern chiefdoms was often demonstrated publicly through the acquisition and redistribution of economic surpluses (Blair and Thomas 2014:28; Thomas 2008a:25). By allying with the Spanish, chiefs and their retinues were granted access to foreign markets, which allowed them to convert excess crops and labor into highly valued European goods, such as cloth, tools, and beads, that could then be displayed ostentatiously or redistributed in traditional displays of authority (Francis and Kole 2011:91; Thomas 2013a:259, 2013b:119). Those loyal to the Crown also received a powerful military ally in the form of the Spanish garrison at St. Augustine, which provided added security against usurpation by political rivals (Francis and Kole 2011:10-11; Worth 2002:58). However, rather than transforming many of the native inhabitants of La Florida into loyal Christian servants of the Spanish Empire, the goods and services acquired through missionization served to reify

Guale Culture and Social Structure

The Guale were among the earliest Southeastern peoples to make contact with European explorers (Blair 2015b:17; Bushnell 1994; Hoffman 1990; Paar 1999; Sturtevant 1962; Swanton 1922; Worth 2004, 2009, 2015). Most Guale settlements were located on or near the tidal rivers, estuaries, and salt marshes that dot the coast and nearby barrier islands between the Ogeechee and Altamaha rivers (Larson 1978:121; Thomas 1987:55, 2008a:22; Worth 2004:239-240). As such, the Guale landscape was dominated and unified by the ubiquity of water and marine resources (Worth 2004:239). Faunal analyses suggest that the Guale consumed large quantities of fish and shellfish, including oyster, clam, scallop, whelk, shrimp, and crab, and hunted terrestrial game, such as deer, raccoons, opossums, rabbits, squirrels, bears, bobcats, turkey, foxes, lizards, frogs, and birds, in order to supplement their diets (Jones 1978:193; Larsen 1990:12; Larson 1978:122, 1980:226-227; Moore and Jefferies 2014:86; Reitz et al. 2010; Saunders 2000b:35; Thomas 2008a:23). Botanical remains indicate that the protohistoric Guale also exploited a number of species of wild plant. Archaeological excavations have identified carbonized fragments of fungi, hickory nut, acorn, chinquapins, black walnuts, beach nuts, blueberries, palmetto berries, persimmons, boneset, goosefoot, poor man’s pepper, three-seeded mercury, undifferentiated grasses, dock, and wild grape (Larsen 1990:12; Moore and Jefferies 2014:90).
Early interpretations of sixteenth century historic documents written by Jesuit missionaries, led many to believe that the pre-mission Guale relied almost exclusively on hunting, fishing, and foraging to fulfill their dietary needs. In letters addressed to the Spanish Crown, Jesuit priests, such as Father Rogel (1570) and Father Sedeño (1570), often lamented the perceived dispersal of the Guale population, which they attributed to a lack of suitably prepared agricultural lands and appropriate technologies (Larson 1978:122-123; Thomas 1987:58-59). However, these early accounts have been reinterpreted in light of the Jesuit Order’s need to rationalize their failure to convert the Guale. More recent archaeological studies examining diachronic changes in settlement patterns and health suggest that the Guale had been engaging in maize agriculture since at least 1400 (Thomas 2014:169). Larsen (1990:12-15) has noted a number of major changes in skeletal morphology/pathology during this time consistent with the adoption of maize agriculture, residential nucleation, and sedentism, including an increase in the occurrence of nonspecific bone infections, an increase in the occurrence of dental caries, a decrease in the occurrence of degenerative joint disease, decreased craniofacial, tooth, and postcranial size, decreased skeletal robusticity and bone strength, and decreased body size and stature.

The adoption of maize agriculture and more sedentary lifeways were likely contributing factors in the creation and maintenance of the historically documented Guale chiefdoms (Worth 2004:241). At the time of contact, the Guale population was distributed across approximately 50 discrete towns that were associated with one of six chiefdoms active throughout the sixteenth and seventeenth centuries, including the Asao-Talaje, Espogochee-Tupique, Guale-Tolomato, Aluste, Tulufina, and Satuache polities (Figure 1.1) (Blair 2015b:6; Worth 2004:239). Although the Guale were politically unified under the rule of a paramount chief or mico mayor, individual
chiefdoms were administered by a leadership council composed of a mico (chief), a number of caciques (political leaders), and other lesser officials drawn from socially and politically dominant matrilineages, which were supported by the agricultural and foraging activities of commoners (Blair and Thomas 2014:28; Thomas 2008a:23). In exchange for their support, subordinates received access to productive lands controlled by elites, were periodically gifted redistributed goods, and maintained access to the benefits of ritual activities conducted by elites claiming unique access to the supernatural powers inhabiting the world (Blair and Thomas 2014:28; Thomas 2013b:115; Worth 2004:242).

Leadership councils exercised political power from one or two principal towns identifiable by the presence of a large, round community building and adjacent chunkey field. However, it is important to note that Guale towns were understood by their inhabitants to consist of a consensually governed group of people who collectively participated in social and economic activities independent of its specific geographic location. As such, individual towns are known to have changed physical locations multiple times throughout the Spanish Mission period (Thomas 2008a:23)

Archaeology of the Guale Coast

Archaeological investigations into the prehistoric and protohistoric inhabitants of the Georgia Coast began with nineteenth century avocational archaeologist C. C. Jones, Jr. According to Jones’ own testimony, he excavated upwards of 100 prehistoric mounds along the Georgia Coast and assembled a sizeable private artifact collection. C. B. Moore would succeed Jones’ as the most significant nineteenth century contributor to Georgia archaeology following
Figure 2.1: Locations of Mission Provinces and Indigenous Towns (Blair 2015b: 5, Figure 1.1), reproduced courtesy of Elliot H. Blair
his documentation and excavation of countless major archaeological sites throughout the Southeast. From 1896-1897, Moore excavated more than 50 burial mounds on the Georgia Coast, seven of which lie on St. Catherines Island (Blair 2015b:20; Thomas 2008a:9-12).

The twentieth century witnessed an increase in research led by professional archaeologists operating under the aegis of the Works Projects Administration, which had been created to combat unemployment in the 1930s (Claassen 1993:137). Between 1937 and 1940, archaeologists led by Joseph Caldwell excavated 265 burials from the Irene Mound site located at the mouth of the Savannah River and defined a new archaeological period (A.D. 1300-1580) named for the site (Caldwell and McCann 1941; Claassen 1993:137; Larsen 1990:26).


One of the earliest vocational archaeologists to contribute to understandings of the protohistoric/historic inhabitants of the Guale coast was Joseph Caldwell. While conducting research at the Darien Bluff site (9MC10) located at the confluence of Lower Bluff creek and Black Island creek at the mouth of the Altamaha River, Caldwell (1943) identified the remains of a number of aboriginal structures, 100 olive jar sherds, coffins, and the remains of 14 European and indigenous individuals. Sheila K. Caldwell (1953, 1954) continued to build upon Joseph Caldwell’s work at Darien Bluff with her identification of two distinct residential layouts at the site. S. K. Caldwell found evidence of early wattle-and-daub construction devoid of Spanish influence. These early homes were set into shallow wall trenches and built using small, round
postholes. Post-contact structures were differentiated from these earlier architectural examples through their use of ridgepoles and more regular spatial organization (Thomas 1987:95-96).

Attempts to locate the remains of Mission Santa Catalina de Guale began with Lewis Larson’s visit to St. Catherines Island in 1952 as part of a Georgia Historical Commission investigation. Larson suspected that Mission Santa Catalina was likely located at the head of the Wamassee Creek drainage, but was unable to obtain evidence of mission structures at that time. Following subsequent reports corroborating Larson’s findings, particularly those of John W. Griffin, Joseph R. Caldwell with the University of Georgia conducted three field seasons of research on St. Catherines Island from 1969 to 1971, during which time he recovered olive jar, majolica, fragments of Spanish iron, and glass trade beads from Wamassee Creek and its immediate vicinity (Thomas 2008a:12, 14-15).

In 1972 the American Museum of Natural History took charge of archaeological excavations on St. Catherines. The Museum’s initial research was primarily concerned with the Refuge and Deptford mortuary complex (1000 B.C. – A.D. 350) (Thomas 2008a:16, 2008b:423; Thomas and Larsen 1979:5). However, the combined results of a 20 percent systematic randomized sample of the island and remote-sensing surveys demonstrated that sixteenth and seventeenth century Spanish materials clearly clustered around the Wamassee Creek drainage (Thomas 1987:108-117, 1993:6-8). The regional analysis confirmed earlier suspicions about the location of the mission, but the nature and extent of the archaeological deposits remained a mystery. As a result, research between 1980 and 1991 centered on the excavation of the mission compound, which in turn produced a number of studies clarifying the nature of mission life (Blair 2015b; Blair et al. 2009; Larsen 1990; Reitz et al. 2010; Saunders 2000a, 2000b; Thomas 1987, 1988, 1993, 2008a:17).
Mission Santa Catalina de Guale (9LI274)

The American Museum of Natural History’s excavations (1980-1991) at Wamassee Head (9LI13) resulted in the identification of a number of structural features associated with the second mission complex (1605-1680) and to a lesser extent the previous sixteenth century mission as well as the surrounding indigenous neighborhoods (Saunders 1990; Thomas 1987, 1988, 1993, 2008a, 2009:27). The previous sixteenth century mission had been destroyed during the Guale Uprising of 1597. Beginning in the fall of that year, Guale from throughout the region attacked the Spanish missions murdering five friars, capturing a sixth, and razing the churches and friaries to the ground (Blair and Thomas 2014:31; Francis and Kole 2011).

The layouts of Spanish missions and towns during the seventeenth century were constrained by cultural expectations regarding the ideal use of space and legal provisions (e.g., 1573 Laws of the Indies, City Planning Ordinances) dictating the arrangement of structures within communities (Blair 2015b:45-46; Bolton 1917; Crouch, Garr, and Mundigo 1982; Crouch and Mundigo 1977; Mundigo and Crouch 1977; Saunders 1990; Thomas 1987:76-77, 2011:60-61). Comparisons between the layouts of Mission Santa Catalina de Guale (Figure 2.2) and other seventeenth century missions suggest that they were organized in much the same way consisting of a church (iglesia), kitchen (cocina), and friary (convento) (Blair 2015b:45; Thomas 1988:94-96).

The mission complex at Santa Catalina de Guale is defined by the presence of four principle structures organized around a central plaza, including the church (Structure 1), friary (Structure 4), kitchen (Structure 2), and two wells (Structures 3 and 2/4). Additional structures
(i.e., 1W, 5, 6 and 7) have also been identified outside the proposed perimeter of the mission’s stockade (Blair 2015b:44; Thomas 1988:94, 1993:9-21).

The Mission Church (St. 1) and Cemetery

The church was the largest and most prominent of the structures set within the mission’s walls. It was designed according to a single nave plan and measured 20 meters long and 11 meters wide. Parishioners entering the building would have been greeted by a 15 square meter shell lined atrium (*atrio*) and whitewashed wattle and daub façade, which likely extended above the roof in order to exaggerate its grandeur. Once inside, the church was divided into three

The mission cemetery (campo santo) was located beneath the floor of the church (Figure 2.3). A minimum of 431 Christianized Guale were interred beneath the floors of the church (Blair 2015b:44; Larsen 1990; Saunders 1990; Thomas 1987, 1988, 1993, 2009). Fifty-two percent of these individuals were found in primary context, in a supine position with feet facing the altar and hands across the chest or abdomen. The remaining individuals were found only partially intact in the upper grave fill, disturbed by a century of overlapping, intrusive burials (Thomas 1988:99, 2009:26, 2011:37). In addition to human remains, a wide array of grave goods were buried in the cemetery, including complete majolica vessels, a chunky stone, a rattlesnake shell gorget, metal and wooden crosses, devotional medals, medallions made of gold and silver, silver pins, mirrors, finger rings, hawks bells, shroud pins, cacina paraphernalia, and 67,184 glass trade beads (Thomas 1988:99, 2009:186, 2010a:102).

The Friary (St. 4) and Kitchen (St. 2)

Archaeological evidence suggests that the original sixteenth century friary served multiple purposes, including kitchen, refectory, missionary housing, and storage (Thomas 1988:100). However, following the destruction of the original mission compound in 1597, Fray Ruiz separated the kitchen and friary during reconstruction. The second friary was constructed on the site of the original using wattle and daub. The new building measured 12 meters long and 8 meters wide, making it approximately 15 percent smaller than the earlier structure (Thomas 1988:103, 2011:45). The friary’s interior was subdivided into a number of smaller rooms and flanked by porches on its southwest and southeast walls (Thomas 1988:103, 2009:28).
Figure 2.3: Map Showing Burial Locations with Beads at Mission Santa Catalina de Guale Cemetery (Blair 2009a:136, Figure 15.10), reproduced courtesy of the Division of Anthropology, American Museum of Natural History.
The seventeenth century kitchen was erected 20 meters northwest of the friary and measured 4.5 meters long and 6 meters wide. The southern wall was left open in order to assist with ventilation and access. Refuse was presumably discarded outside of the mission’s walls. However, small middens accumulated outside of the kitchen and small pieces of debris were found imbedded in the floor (Thomas 1988:104, 2009:29, 2011:46).

The Well (St. 2/4)

The seventeenth century well, located between the friary and the kitchen, was built using two hollowed out cypress logs that had been lowered into the 4-meter wide excavation pit and nailed together. Upon completion, the well would have been approximately 2 meters in diameter and 2.5-meters deep making it one of the largest in La Florida. Excavations uncovered a large number of artifacts and botanical remains, which had been deposited in the well during its use. These included the remains of an iron hatchet, two wooden balls, five aboriginal vessels, two olive jars, seeds belonging to various species of plants, and pieces of burnt wood (Thomas 2009:29).

The Guale Pueblo

Extant historical documents from the mission do not often record secular matters, such as indigenous residential practices (Thomas 1993:22, 2009:29, 2010b:41). However, excavations have demonstrated that an extensive indigenous residential area surrounded the mission from sixteenth century through the seventeenth century (Thomas 2010b:41). Five indigenous neighborhoods have been identified in the areas surrounding the mission compound. These
include Fallen Tree, Wamassee Head, the Pueblo East, the Pueblo North, and 9Li210 (Blair 2015b).

Fallen Tree is located to the south of the freshwater creek and adjacent to Wamassee Creek. The neighborhood is defined by the presence of numerous, irregularly distributed shell middens. However, as one moves northward the middens become better bounded and more regularly spaced. Additionally, resistivity surveys have identified a number of low resistance areas, which may represent structural deposits contemporaneous with the mission (Blair 2015b:66).

The Wamassee Head neighborhood is located to the south of the mission compound across the freshwater creek from Fallen Tree. Wamassee Head is identifiable by the presence of at least seven distinct shell middens. Resistivity surveys also identified a number of high resistance features that may be the remains of compacted floors from structures (Blair 2015b:68-69).

The Pueblo East consists of the residential areas located to the east of the mission compound. Although midden deposits appear regularly spaced throughout the southern portion of the Pueblo East, it may have been less densely populated than the other neighborhoods. Magnetometry and resistivity surveys identified several linear features in the Pueblo East. The most prominent is aligned along the northwest/southwest axis of the northeastern wall of the friary. It has been suggested that this feature may be the remains of the mission stockade or a fence line associated with the friary and kitchen. A second linear feature has also been identified. However, due to its size, shape, and location, its purpose has yet to be conclusively determined (Blair 2015b:70-71).
The Pueblo North corresponds to the residential neighborhoods to the north and west of the mission compound. Structural features appear to have been aligned according to a grid extending from the mission quadrangle and been separated by streets (Blair 2015b:72). If the residential structures in the Pueblo North and other neighborhoods were similar to the indigenous colonial structures identified by Caldwell (1953, 1954) at Fort King George, as suggested by their alignment on the existing Spanish grid structure, the Guale residences would likely have been built using shallow wall trenches and small round postholes, while their interiors were subdivided into a number of smaller, specialized rooms (Thomas 1993:23-24). Midden deposits within the neighborhood are believed to correspond to individual households or small groups of households. However, there is also a conspicuous circular configuration of middens surrounding a relatively clear area. It has been suggested that this clearing may have been used as the primary mission plaza or served as a ball court (Blair 2015b:72-73).

Conclusion

Mission Santa Catalina de Guale provided the Spanish with the means to actively engage with the native Guale living on St. Catherines Island, Georgia by integrating themselves into the existing sociopolitical hierarchy without overtly challenging traditional forms of chiefly authority. As a result, Franciscan missionaries were able to elicit voluntary conversion to Christianity and alignment with the interests of the Spanish Empire (Worth 2013:138). However, in spite of Spanish intentions to create a subordinated, Hispanicized native populace, Guale elites were also able to use European materials and Spanish military support, which they received in
exchange for their allegiance, to maintain traditional forms of power within their own society (Francis and Kole 2011:91; Thomas 2013a:259, 2013b:119).

Thus, instead of incorporating the Guale into the Spanish Empire as a subjugated people, the colonial government assumed the role of a powerful chiefdom in accordance with the existing indigenous political structure (Blair and Thomas 2014:29-30; Hall 2007, 2009; Thomas 2010a:103, 2013a:261, 2013b:119-123; Worth 2002:58). The Guale chiefdoms viewed and treated the Spanish as they would a powerful indigenous polity. They competed for their favor by providing gifts of food, labor, and precious materials and when these efforts failed the Guale attempted to weaken Spanish influence in the region through political intrigue and violence (Thomas 2013b:119; Francis and Kole 2011). Although contact with the Spanish inevitably altered many aspects of Guale culture, a number of indigenous customs were able to survive the effects of missionization due accommodations made during Franciscan proselytization, the mutual compatibility of Spanish and Guale sociopolitical structures, and the continued dominance of elites who benefitted from preserving traditional ideologies (Blair and Thomas 2014:28-30; Francis and Kole 2011:10-11, 91; Hall 2007, 2009; Thomas 2010a:102-103, 2013a:258, 2013b:119, 2014:28; Worth 2002:58, 2013:138).
CHAPTER 3:
COMPOSITIONAL ANALYSIS OF SIMPLE, Drawn,
MANGANESE BLACK GLass TRADE BEADS

Introduction

Archaeological and historical research has established the value of European beads as high-resolution temporal markers for colonial North America (e.g., Bradley 1983; Fitzgerald 1983, 1990; Kent 1983, 1984; Kenyon and Fitzgerald 1986; Little 2008, 2010; Marcoux 2012a, 2012b; Rumrill 1991; Sempowski and Saunders 2001; Smith 1983, 1987). The historic glass recipes first developed in Venetian glasshouses (see Anonymous 1835; Milanesi 1864; Moretti et al. 2004; Moretti and Toninato 2001; Neri 1980[1612]; Zecchin 1986, 1987) and subsequently imitated throughout Europe (Francis 1988:44-45, 2009b:73; Janssens et al. 2013:537-540; Verità 2014:54) are thought to have been remarkably stable, producing relatively homogenous glasses during the periods of time in which they saw use. Marco Verità (2014:53) has attributed this to the fact that, “glass represents a combination of properties: thermal (viscosity, workability), optical (colour, transparency), chemical (resistance to environmental attack, ...), etc., which cannot be modified separately and vary by changing the composition of glass (type and ratios of the components).” As a result, changes to existing recipes were often precipitated by pragmatism and necessity. For example, changes are known to have occurred as glassmaking technology spread in order to accommodate available resources (Verità 2014:55-56). Geographically and temporally restricted communities of practice came to produce distinctive glass varieties born
from their unique combination of available resources and technological tradition (Blair 2015a:85-86, 2016). By identifying the physical correlates of these communities of practice, it is possible to accurately determine the provenance of glass artifacts and refine archaeological analyses of patterning in artifact production and consumption.

This chapter presents the results of a fine-grained compositional analysis of American Museum of Natural History (AMNH) type 17 (Kidd and Kidd IIa6, IIa7, and IIa8) simple, drawn, manganese black glass trade beads recovered from Mission Santa Catalina de Guale (St. Catherines Island, Georgia) and explores the implications for current understandings of seventeenth century European glass trade bead production as it relates to colonial interactions between the Spanish and indigenous Guale of coastal Georgia. I open this chapter by outlining anthropogenic glass composition and provide a brief history of the methods used to produce European glasses and glass beads, with special attention given to those developed by the dominant Venetian glasshouses. I provide an overview of the most influential bead taxonomies in order to outline the academic genealogy that contributed to the development of the AMNH bead classification system, which has served as the basis for academic inquiry into the assemblage recovered from Mission Santa Catalina de Guale (see Blair 2015a, 2015b, 2016, 2017; Blair et al. 2009). Afterwards, I give an overview of the defining characteristics of AMNH type 17 black glass trade beads serving as the focus of this study. I then provide an outline of the sampling strategy, methods, and statistical analyses employed during data collection and interpretation. Having established the requisite technological, historical, and academic contexts, I present the results of the exploratory data analyses used to identify sample-wide compositional variation and their implications for current understandings of seventeenth century European glass production. Lastly, I apply the results of the compositional analysis to refine the current site
chronology for Mission Santa Catalina de Guale by comparing temporally diagnostic opacifiers with historically and archaeologically documented trends in seventeenth century glass composition supplemented by additional evidence recovered during excavations of the mission compound.

A History of Glass Bead Production and Classification

Glass Chemistry and Characteristics

The term “glass” is used colloquially to describe amorphous silicate solids often exhibiting some degree of translucency (Fernández-Navarro and Villegas 2013:3). Historic soda-lime glasses produced in southern Europe are composed of five primary ingredients: vitrifiers, fluxes, stabilizers, opacifiers, and colorants (Moretti and Hreglich 2013). Silicates, such as sand and powdered quartz pebbles, were the most common vitrifiers and provided historic glasses with their basic structure (Henderson 2013:56-57; Moretti and Hreglich 2013:28-29). However, pure silica glass has an exceptionally high melting point (ca. 1,700°C) that was difficult to achieve with historic furnaces (Henderson 2013:2). As a result, fluxes containing elevated levels of sodium bicarbonate (Na₂CO₃) or potassium carbonate (K₂CO₃), such as natron, plant ash, and tartar, were added to glasses in order to lower their melting points to between 1,100°C and 1,400°C (Henderson 2013:68; Moretti and Hreglich 2013:29-30). Fluxes also provided the added benefit of increasing the amount of time before the molten glass solidified and became unworkable (Moretti and Hreglich 2013:29-30; see also Henderson 2013:22-55 for a more detailed examination plant ash fluxes). Pure silicate glasses are naturally water-soluble and require stabilizers to prevent them from dissolving. Alumina (Al₂O₃), alkaline-earth oxides (e.g.,
CaO and MgO), and metal oxides (e.g., PbO, Pb$_3$O$_4$, and ZnO) have all been used as stabilizers at various points in time throughout history (Fernández-Navarro and Villegas 2013:9; Henderson 2013:25; Moretti and Hreglich 2013:30). Unlike fluxes and stabilizers, opacifiers and colorants were added for purely aesthetic reasons. Calcium antimonate (Ca$_2$Sb$_2$O$_7$) is the earliest known glass opacifier (ca. BC 1500) and saw continued use for nearly a thousand years (Henderson 2013:77; Moretti and Hreglich 2013:31). Although, it had largely been replaced with tin oxide (SnO) in European glasses by the twelfth century A.D., calcium antimonate would once again become the opacifier of choice in the mid-seventeenth century (Sempowski et al. 2000:264; Tite et al. 2008:67). A number of elements applied in varying concentrations have been used to produce glasses in a wide range of colors. Common historic colorants include cobalt (blue), iron (green), copper oxide (turquoise blue and red), silver halides (orange, red, and yellow), manganese (decolorized and violet), and gold (red) (Pendleton and Francis 2009:55; Henderson 2013:65-76; Moretti and Hreglich 2013:31).

The historic glasses with which this study is concerned largely conform to Venetian standards and were most likely produced using quartzite silicates, coastal plant ash based fluxing agents, as well as a variety of opacifiers and colorants. Beginning in the fourteenth century, Venetian glassmakers had begun to replace traditional sand-based silica sources (*sablunum ad facendum Vitrum*) from the Levant, Sicily, and the Veneto with quartz pebbles (*cogoli*) from the Ticino and Adige rivers in northeastern Italy. These pebbles were prized for their purity. They were very nearly pure silica and lacked many of the impurities associated with earlier sources (e.g., iron and chromium) (Blair 2015a:85; McCray 1996:Table 8.1, 1999:197; Moretti and Hreglich 2013:29; Verità 2014:55). Venetian glassmakers preferred to use a Levantine fluxing agent produced by burning halophytic plants, such as glasswort, saltwort, and barilla plant
The silica and flux would then be fused or partially fused in a low temperature furnace to produce a crystalline mixture (frit), which could be stored for later use (Blair 2015a:85; Verità 2014:56). Frit production also served to eliminate carbon introduced by the flux, oxidize sodium and calcium carbonates so that they can react with the silica, and remove carbon dioxide (Verità 2014:56). A *conciatore* would later mix the frit with cullet (broken scraps of glass) and any opacifiers or colorants required by the recipe in a high temperature pot furnace in order to produce the finished glass (Blair 2015a:85; Verità 2014:56).

**Venetian Glassmaking Traditions**

In order to protect the Venetian monopoly on glass production and reduce the potential for uncontrolled fires stemming from the placement of furnaces in the Rialto, the government resettled glassmaking operations to the island of Murano in the tenth century (Pendleton and Francis 2009a:56; Janssens et al. 2013:538). Following their relocation, Venetian glassmakers began to form specialized guilds reflecting their unique products and techniques. Two such guilds, the *Arte di Margariteri* and the *Paternostri*, specialized in the production of drawn glass beads (Pendleton and Francis 2009:56).

The State Inquisition founded the *Margariteri* or Beadmaker’s Guild in 1308 as the first glass beadmaking guild in Venice (Pendleton and Francis 2009:56). The *Margariteri* specialized in the production of seed beads, a term used to refer to any bead less than 5.0 mm in diameter (Francis 2009a:61). Production began by drawing molten glass until they formed a long tube of the appropriate thickness. Afterwards, these tubes would be cut into smaller, meter length sections, which would then be cut to the desired length using a combination of handheld and fixed blades. The cut segments were typically finished using the *a ferraza* method. The segments
were first coated in either ash or a lime-charcoal mixture to prevent collapse and adhesion and then stirred in a copper pan set over a fire until any sharp edges had been melted smooth. The rounded beads were then sorted by size using increasingly small screens and polished by being shaken first in bags of sand and then in bags of bran before being strung together for sale (Blair 2015a:86-88; Pendleton and Francis 2009:59; Kidd and Kidd 2012[1970]:40-41).

The Paternostri was founded in 1486 and differentiated itself from the Margariteri primarily by producing larger beads finished using the a speo method. A speo finished beads were mounted on a specialized tool consisting of a wooden handle and approximately six tines arranged evenly around a metal base. The segments were then rotated in a fire by hand until they achieved a spherical shape. However, it was not uncommon for glass segments to drip and form tails or fuse together during the finishing process (Francis 2009a:65; Karklins 1993).

Beginning in the fifteenth century, Venetian glassmakers had perfected a colorless, translucent glass suitable for luxury goods known as cristallo. Cristallo was often compared to rock crystal and saw extensive trade throughout Europe (Janssens et al. 2013:539; Verità 2014:57). As a result of the economic success it brought, many European countries attempted to lure Muranese master glassmakers away from Venice hoping that they too might profit. During the sixteenth century, many glassmakers fled and established glasshouses throughout northern Europe. This led to the proliferation of imitation Venetian glass, known as “verre à-la-façon-de-Venise,” which was used to produce a wide array of goods including glass beads (Janssens et al. 2013:538).
Systems of Bead Classification

The beads produced by European glassmakers seem to possess a nearly infinite amount of variation, which has historically made the classification of those recovered from archaeological contexts both cumbersome and tedious. To quote Kenneth and Martha Kidd (2012[1970]:39), “Describing these [glass] beads has proven to be frustrating for most archaeologists, involving the making of fine distinctions as to colour, size, shape, and other characteristics between many similar specimens.” To date, numerous attempts have been made to develop a functional classification system, but few have proven wholly satisfactory (see Beck 1928; Karklins 2012[1982]; Kidd and Kidd 2012[1970]; Sprague 1994; van der Sleen 1973).

Kenneth and Martha Kidd sought to remedy the dearth of functional classification systems by publishing their own in 1970. Rather than create divisions based upon aesthetic variation, Kidd and Kidd (2012[1970]:39) developed their system according to historically attested processes of manufacture and physical characteristics, such as shape, size, diaphaneity, opacity, and color. However, it has received criticism for its lack of precision, particularly where color and shape are concerned, and its failure to address wound-on-drawn, mold-pressed, blown, and Prosser-molded beads (Pendleton et al. 2009:35; Karklins 2012[1982]:62). Karlis Karklins (2012[1982]) has attempted to remedy this weakness by providing corrected and expanded typologies as well as equivalent color codes employing the widely used Munsell color notation system.

The Beads of St. Catherines Island

Almost 70,000 beads were recovered during the excavation of Mission Santa Catalina de Guale requiring the development of a simple, direct, and universally understood classification
system capable of accounting for the assemblage’s uniquely large variation. As a result, Blair, Pendleton, and Francis Jr. (2009) drew on the past work of Beck (1928), Kidd and Kidd (2012[1970]), and Karklins (2012[1982]) to form the basis for their own categorizations. Beads were first separated according to material (i.e., glass, metal, jet, amber, carnelian, crystal, shell, pearl, bone, wood, antler, and stone) before being divided according to production technique (e.g., drawn, wound, molded, blown). Drawn beads were then subdivided according to their construction, which was characterized as either simple (composed of a single layer of glass), compound (composed of two or more layers of glass), complex (simple with added decoration), or composite (compound with added decoration), and finishing technique (i.e., a ferraza or a speo). Wound beads, on the other hand, were subdivided into WI (monochromatic, simply shaped beads), WII (monochromatic, irregularly shaped, modified beads), and WIII (beads with added decoration) groupings according to the example set by Kidd and Kidd (2012[1970]) (Pendleton et al. 2009:35).

Morphological and chemical analyses of temporally diagnostic beads types (Kidd and Kidd IIa14, IIa40, IIa13, IVa, IVa5, IIb71, IIbb24, IIg, IIg4, IIh1) allowed Blair (2009a:157-159, 2009b:174-175, n.d.) to relatively date a portion of the burial pits in the mission cemetery. Blair (2009b:177) concluded that the beads served multiple functions in the lives of the mission’s inhabitants. The quantity and variety of beads recovered from the mission are thought to reflect the considerable economic contributions of the Guale to the Spanish colonial government as well as an indicator of participation in missionization efforts. Diachronic variation in bead consumption may reveal ongoing economic, political, and cultural negotiations between the Guale and Spanish.
Since the completion of Blair et al. (2009), additional studies have sought to elucidate the role of glass trade beads at Mission Santa Catalina. As part of a larger analysis of social aggregation at the mission, Blair (2015b:156) examined 783 white glass trade beads (Kidd and Kidd IIa14, IIa13, IVa11, and IVa13) using a multi-tiered compositional analysis. First, the beads were examined using X-ray fluorescence spectrometry (XRF) and the resulting semi-quantitative data was analyzed using a spectral deconvolution algorithm. A smaller sample drawn from across each of the four types of beads was then examined using Laser ablation-Inductively coupled plasma-Mass spectrometry (LA-ICP-MS), which provided a means of empirically calibrating the XRF data. Blair (2015b:165) found that the white beads clustered into at least six compositional groups differentiable by opacifier (i.e., lead-tin vs. calcium antimonate) and raw material source (i.e., silica and soda). The observed compositional variability was ultimately attributed to the practices of three to six distinct glassmaking communities of practice operating throughout the seventeenth century (Blair 2015a, 2015b:165).

AMNH Type 17 Glass Trade Beads

Approximately ten percent (n=6,697; N=67,184) of the beads in the assemblage from Mission Santa Catalina de Guale correspond to AMNH type 17 (Figure 3.1), a composite category composed of Kidd and Kidd (2012[1970]) types IIa6, IIa7, and IIa8. All type 17 beads are simple, drawn, and opaque to translucent, manganese black beads. Although most of these beads are tauri (ring shaped), spherical, barrel, oval, and olive shaped examples are also contained within the type 17 typology. Initial examinations by Peter Francis Jr. suggested that type 17 beads were finished using the \textit{a speo} method; this was supported by the presence of bilobed or fused segments. However, type 17 beads range in diameter from less than 2.60 mm to
8.40 mm and in length from less than 2.51 mm to 14.6 mm. As such, many fall within the prescribed size range for seed beads and, thus, were possibly *a ferrazza* finished (Pendleton et al. 2009:38).

Figure 3.1: AMNH Type 17 Simple, Drawn, Manganese Black Glass Trade Bead (after Blair et al. 2009: 289, Plate 1).

**Compositional Analysis of Type 17 Black Glass Trade Beads**

**Sample and Methods**

As previously discussed in the introduction to this chapter, a number of geographically and temporally distinct communities of practice were responsible for producing the glass artifacts that have made their way into the archaeological record of the New World. The unique combinations of raw materials and glassmaking technologies employed by these communities produced patterned physical traces, which may in turn be used to identify the time and place of manufacture. Past studies have shown that chemical analyses of historic glasses have the potential to reveal both inter- and intra-regional variation given adequate contextual information.

In the past few decades, XRF in particular has seen an appreciable increase in popularity among archaeologists due to its effectiveness, portability, ease-of-use, and relatively low cost (Shugar 2013:174). However, some (e.g., Conrey et al. 2014; Nazeroff and Shackley 2009; Shackley 2002, 2010a, 2010b; Shugar 2013; Shugar and Mass 2012; Speakman and Shackley 2013) have criticized widespread use of the technique without proper understanding of its limitations. Like many analytical techniques, XRF is unable to detect all naturally occurring elements with equal precision and accuracy. Additionally, the data produced is often semi-quantitative unless it is transformed using material-specific empirical calibrations, which may not exist for complex, heterogeneous archaeological materials. Nevertheless, even untransformed XRF data possesses exceptional utility as a measure of internal chemical variation within an assemblage of similarly composed artifacts so long as the criteria by which they are measured remain “internally consistent” (Blair 2015b; Frahm 2013a, 2013b; Frahm and Doonan 2013).
Several studies (Blair 2015b; Dalton-Carriger and Blair 2013, 2015) have shown that statistical analyses of deconvoluted elemental spectra (i.e., calculating the net area of each elemental peak using a Bayesian deconvolution algorithm) can be used to assess internal variation in archaeological glasses without compromising the integrity of the results (Blair 2015b:155).

I echo Blair’s (2015b) sentiment in arguing that XRF may be the most appropriate tool for chemical analyses of large quantities of sensitive glass artifacts. Unlike many other techniques used to conduct compositional analyses, XRF does not require that archaeological materials be physically or chemically altered prior to examination. This not only reduces the amount of time and training required to conduct the analysis, but also allows one to include samples or collections deemed too valuable for analyses using destructive techniques in studies. Additionally, the rapidity and relatively low-costs with which XRF analyses can be conducted allows much larger sample to be analyzed than would be possible given similar time and funding constraints using other techniques (Blair 2015b:155-156). As such, XRF is particularly well suited for intra-site comparisons of glass artifacts, such as the type 17 beads recovered from the Mission Santa Catalina de Guale cemetery.

In order to determine the provenance of the type 17 bead assemblage recovered from Mission Santa Catalina de Guale, 940 beads (N=6,697) were selected from the following 22 contexts: Burial B (n=31 beads); Burial E (n=1); Individual 86 (n=4); Individual 90 (n=1); Individual 139/140 (n=2); Individual 151 (n=106); Individual 200 (n=18); Individual 207 (n=1); Individual 208 (n=169); Individual 212/218 (n=1); Individual 215 (n=1); Individual 217 (n=1); Individual 248 (n=34); Individual 282 (n=1); Individual 307 (n=410); Individual 394 (n=14); The Fallen Tree residential neighborhood (n=5); the mission church (Structure 1, n=88); the kitchen (Structure 2, n=17); the late mission well (Structure 2/4, n=5); the friary (Structure 4,
n=6); and a native residential structure (Structure 5, n=20). Whenever possible, all beads from a given context were included in the analysis. Contexts with larger assemblages precluding complete analysis were randomly subsampled from available lots.

Compositional data was collected using a Bruker Tracer III-SD portable X-ray fluorescence spectrometer (pXRF) capable of accurately identifying diagnostic elements found in historic glasses. Many of the diagnostic elements associated with seventeenth century black glasses, such as the colorant manganese (Pendleton et al. 2009:38), its trace element barium (Gratuze 2013:342), and the opacifiers tin and antimony (Blair 2015b; Dalton-Carriger and Blair 2013, 2015; Hancock et al. 1997; Sempowski et al. 2000), are high Z elements. High Z elements possess heavy, proton-laden nuclei, which exert a strong attractive force on the surrounding electrons. In order to excite the electrons and cause the elements to fluoresce, each bead in the sample was analyzed for 180 seconds using high energy X-rays (45KeV and 30 µA). Additionally, a custom-made secondary target filter composed of 100 µm niobium, 150 µm copper, 25 µm titanium, and 200 µm aluminum was used to reduce signal interference and improve the clarity of X-rays produced. Once collected, net peak area for each element was calculated for each spectrum using a Bayesian deconvolution algorithm in Artax 7.4. This resulted in net photon counts for the following elemental peaks: arsenic K12 (AsK12), barium K12 (BaK12), calcium K12 (CaK12), cesium K12 (CsK12), copper K12 (CuK12), iron K12 (FeK12), mercury L1 (HgL1), potassium K12 (KK12), manganese K12 (MnK12), sodium K12 (NaK12), niobium K12 (NbK12), lead L1 (PbL1), antimony K12 (SbK12), tin K12 (SnK12), strontium K12 (SrK12), titanium K12 (TiK12), and zinc K12 (ZnK12). Exploratory data analysis techniques (see Drennan 2009; Tukey 1977) were used to compare the net photon counts from
each spectrum and identify distinct compositional groups in JMP 13. In the following sections, I explore some of the significant elemental patterning that emerged from these analyses.

**Colorants and Associated Impurities: Manganese and Barium**

Manganese has long been used as the primary colorant in black glasses. In pure soda-lime-silicate glasses, concentrations of manganese oxide (Mn$_2$O$_3$) in excess of 2.5 percent are sufficient to produce a violet color that is visibly indistinguishable from opaque black in reflected light. However, the presence of additional elements necessitates the addition of increasingly large quantities of colorant due to the introduction of competing pigments (Turner 1956a:179). Given the relative impurity of historic glasses, it comes as little surprise that there exists a wide range of variation in manganese concentration within the assemblage.

Pyrolusite (MnO$_2$) acquired from Piemonte, Germany, and France is believed to have been used to produce seventeenth century manganese black glasses (Henderson 1985:283; Verità 2014:56). Pyrolusite is commonly found in association with the barium-manganese ores hollandite (Ba$_2$Mn$_8$O$_{16}$) and romanèchite (Ba$_2$Mn$_5$O$_{10}$) (Anthony et al. 2001), which may explain why concentrations of manganese and barium are often correlated in historic glasses (Gratuze 2013:343). In order to identify compositional variation that might be indicative of sourcing, manganese was plotted against barium (Figure 3.2), which would occur together in different concentrations depending upon the geochemistry of the ore and region from which it was sourced. Close examination of Figure 3.1 reveals that the plotted points lie along two distinct axes, which intersect to create a bifurcated or “v-shaped” distribution. The more steeply inclined axis (relationship 1) exhibits a much higher ratio of manganese to barium than does the second more shallowly inclined axis (relationship 2). The differences in the two strongly suggest that
two distinct manganese sources were being exploited in order to produce this sample of seventeenth century black glass trade beads.

Figure 3.2: Biplot of Manganese (MnK12) vs. Barium (BaK12)

Relative ages for 13 of the burial contexts included in this compositional analysis had previously been determined using temporally diagnostic artifact typologies, temporally diagnostic glass recipes, and stratigraphic relationships of the burial pits (Blair n.d.). Correlation of the identified relationships with the relative ages of the beads within each context suggests that these sources were used at different points in time. Early (pre- ca. 1630-1650) burial contexts are well represented along both axes; however, late (post- ca. 1630-1650) burial contexts are only associated with relationship 1. This most likely indicates that the glasshouses responsible for producing the assemblage from Mission Santa Catalina de Guale were exploiting
multiple mineral sources at the beginning of the seventeenth century. However, as time passed, they came to exclusively use the purer source represented by relationship 1.

**Opacifiers: Tin and Antimony**

As previously mentioned, tin and antimony were among the most popular opacifiers used in the production of historic European glasses. Numerous studies have established that European glasshouses ceased producing tin-opacified beads and began producing antimony-opacified beads during the mid-to-late seventeenth century (ca. 1630-1650) (Blair 2015a, 2015b; Hancock et al. 1997; Sempowski et al. 2000). Using 198 drawn white glass trade beads from two parallel series Seneca Iroquois sites in western New York, Sempowski et al. (2000) determined that drawn white soda-glass beads in the region were opacified solely with tin during the sixteenth and early seventeenth centuries. However, by the mid seventeenth century (ca. 1655-1670), tin had been completely replaced by antimony as the opacifier of choice (Sempowski et al. 2000:564). Blair (2015b) extended archaeological analyses of glass opacification during the seventeenth century by conducting compositional analyses of AMNH types 15 (Kidd and Kidd Ila14), 23 (Kidd and Kidd Ila13), 38a (Kidd and Kidd IVa13), and 38b (Kidd and Kidd IVa11) opaque white glass beads recovered from the cemetery at Mission Santa Catalina de Guale using a combination of X-ray fluorescence spectrometry (XRF) and laser-ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS). Blair (2015b:165) found that three of the six identified compositional groups were opacified using a lead-tin mixture, while those remaining were opacified using calcium-antimonate.

The identification of a temporally confined, continent-wide transition from tin to antimony, allows relative concentrations of the two elements to be used as high-resolution
indices of the timeframe in which historic southern European glasses were produced. As such, tin and antimony were plotted against one another in order to identify diachronic patterns in bead consumption. The two interrelated chemical components form a bifurcated, “v-shaped” plot (Figure 3.3) indicative of two competing use patterns. Relationship 1 corresponds to those beads primarily opacified using antimony, while relationship 2 corresponds to those primarily opacified using tin.

Consistent with previous findings, black beads recovered from early contexts contain significantly more tin than antimony, whereas black beads recovered from late contexts contain significantly more antimony than tin. These findings, in combination with those from analyses of white glass beads, suggest that the replacement of tin by antimony in glass recipes occurred with
little regard for bead type. Additionally, the transition from tin to antimony across multiple bead
types of different colors and manufacture would seem to support interpretations suggesting that
fiscal pressures led glasshouses across Europe to reject traditional lead-tin opacification in favor
of more cost-effective calcium antimonate (Blair 2015b; Dalton-Carriger and Blair 2013, 2015;
Zecchin 1986). However, unlike the white glass beads recovered from Mission Santa Catalina
(see Blair 2015b), many of the black glass beads were produced using a combination of tin and
antimony. This may indicate that early, tin-opacified black glass was being recycled following
the transition to antimony-opacified glasses and that the two types of glass were combined to
produce a portion of the beads in the assemblage (DeGryse 2013; Gratuze 2013; Henderson

Silica Impurities: Titanium

Titanium is not normally regarded as a diagnostic element in glass production. It occurs
most commonly as an impurity in quartzite sources of silica, such as sand and stone (Biron and
Chopinet 2013:59; Velde 2013:68,70). However, visual inspection of the biplots produced using
titanium and the other elements for which data was available revealed the presence of two
distinct compositional groups defined according to the amount of titanium contained within the
bead. In order to confirm the observations, a histogram of titanium was produced, which
possesses a distinct, bimodal distribution (Figure 3.4). Using the peaks and valleys visible in the
histogram, the assemblage was divided into a low titanium group (0-169 net photons) and a high
titanium group (170-325 net photons). Because silica sources of varying purity were used
throughout the history of European glassmaking, the variability in titanium may reflect the use of
two distinct silica sources and/or inconsistent purification standards during production of the type 17 assemblage from Mission Santa Catalina de Guale.

Figure 3.4: Histogram of Titanium (TiK12)

In order to test this hypothesis, titanium was compared with the temporally diagnostic opacifiers tin and antimony using a principle components analysis (Figure 3.5a and 3.5b). The results of the principle components analysis revealed four distinct compositional groups defined by unique combinations of the three elements. The leftmost cluster (low titanium, high antimony) is composed primarily of beads from the mission structures and nearby residential areas, while the rightmost cluster (low titanium, high tin) consists largely of beads associated with early burial contexts. However, the two clusters located between them contain a mixture of beads from early burials, late burials, mission structures, and residential neighborhoods. This distribution of contexts suggests that the transition from low titanium to high titanium silica sources coincided with the transition from tin-opacified to antimony-opacified glass production.
Figure 3.5a: Principle Components Analysis of Titanium (TiK12) and Opacifiers (SnK12 and SbK12)

Figure 3.5b: Principle Components Analysis of Titanium (TiK12) and Opacifiers (SnK12 and SbK12)
The substitution of a purer silica source for an inferior and, presumably, cheaper alternative provides further evidence indicating that variation in raw materials during the seventeenth century was economically motivated. The adoption of new and cheaper raw materials and/or the use of less rigorous purification processes during the mid seventeenth century would have necessitated changes to traditional recipes, which, given the volatility of glass, would have involved an extended period of trial and error as the recipes were rebalanced to accommodate changing resources. Thus, the transition to a titanium rich silica source may conceivably represent an attempt to reduce costs by using inferior materials, an attempt to counteract the unforeseen effects of new materials on finished glasses, or both.

Impurities of Indeterminate Origin: Strontium

Strontium and barium form a bifurcated, “v-shaped” biplot (Figure 3.6) reminiscent of those produced by the manganese-barium (Figure 3.2) and tin-antimony (Figure 3.3) pairings. Unlike tin and antimony, there is little evidence to suggest that barium and strontium concentrations are related due to their roles in historic glass production. As such, it seems much more likely that the two were introduced as byproducts of one or more ingredients used in the manufacturing process, reminiscent of that which has been suggested for manganese and barium.

One potential explanation for the apparent relationship between the two may lie in the silica sources used to produce the beads. Henderson (2013:239) suggests that barium and strontium are naturally occurring impurities in the Levantine feldspar sands favored by southern European glasshouses. The sodium-rich and alkali feldspars sourced from the Levant often contain higher concentrations of barium and calcium than those found in Europe, a fact which
has been supported by compositional analyses of Levantine glasses (e.g., De Francesco et al. 2010; Freestone et al. 2000; Silvestri et al. 2006; Thirion-Merle 2005).

Thus, it is possible that the two relationships pictured in Figure 3.6 may indicate that two chemically distinct silica sources were used to produce the collection of black beads recovered from the mission.

Alternatively, elevated concentrations of barium and strontium have been associated with many of the organic compounds used during glass production (Besborodov 1975; Henderson 1996, 2013; Sanderson and Hunter 1981; Stern and Gerber 2009; Turner 1956b). Dolomitic limestone, plant ash, bone ash, and shell were regularly included in glass recipes for their calcium content. When sufficiently heated, the calcium carbonate (CaCO₃) contained within
these materials is converted into calcium oxide (CaO), which improves the durability of the finished glass (Henderson 2013:64-65). However, living organisms are known to incorporate environmental strontium and use it in place of calcium in a number of compounds, including calcium carbonate, due to the similar valence structures of the two elements. As a result, the inclusion of organic calcium sources would have inadvertently introduced strontium and barium as well.

Unfortunately, neither of these potential explanations seems especially satisfying. As noted by Blair (personal communication 2017), barium has never been found in any appreciable quantities in European manufactured sixteenth and seventeenth century glass beads except in those colored using manganese. Due to the fact that barium has not been shown to be associated with other colors of beads (e.g., white, blue, etc.), it was most likely introduced as an impurity in the manganese source rather than through the Levantine silicates or organic compounds, which served as base ingredients for the majority of glasses regardless of color.

However, because strontium has not been shown to co-occur with either manganese or barium in the various ores used to color historic European glasses (e.g., hollandite and romanèchite), the variability observed in the relationship between the two elements may reflect the incorporation of recycled barium-rich glasses imported from Asia. Elevated concentrations of barium are commonly associated with East Asian glasses produced in China, Japan, and Korea (In-Sook 1993:164-166). Lead-barium glasses have been made in China since the early fifth century B.C. and were imported into Europe beginning in the tenth century A.D. (Beck and Seligman 1934:982; Franics 2009:81; Gan 2009:Tables 1.4 and 1.6; Gan et al. 1978:99; Henderson 2013:123; Meiguang et al. 1987; Seligman et al. 1936). Lead-barium glasses may contain anywhere from 6.6 percent to 21.5 percent barium by volume (Gan 2005:Table 14.7).
Had European glassmakers been recycling imported East Asian glasses, beads containing recycled glass could be expected to possess a unique compositional signature reflecting the influence of multiple regionally distinct glassmaking traditions, their recipes, and preferred sources of raw materials.

**Reconstructing the History and Chronology of Mission Santa Catalina de Guale**

**Previous Age Estimates for Burial Contexts**

The information gleaned through statistical analysis of the compositional data was used to guide a reconstruction of use patterns at Mission Santa Catalina de Guale. As previously discussed, compositional evidence suggests that the transition from tin to antimony was not limited to blue and white beads, but affected black beads as well. Concentrations of the temporally diagnostic opacifiers tin and antimony for each context were compared with previous relative age estimates produced by Blair (n.d.). Drawing on previous compositional studies of blue and white glass trade beads (e.g., Blair 2015b; Dalton-Carriger and Blair 2013, 2015), Blair (n.d.) divided the mission burials into early (pre- ca. 1630-1650) and late (post- ca. 1630-1650) contexts by interweaving three lines of evidence: 1) the presence of temporally diagnostic artifacts (e.g., beads and majolica); 2) relative dates derived from temporally diagnostic shifts in bead chemistry (i.e., the primary opacifier used in production of the assemblage); and 3) the stratigraphic relationships between burial pits. Using these criteria, he provided age estimates for 74 burial contexts (Blair n.d.). Age estimates for burial contexts included in this study can be found in Table 3.1.
<table>
<thead>
<tr>
<th>Burial</th>
<th>Relative Age</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Early</td>
<td>Bead Style, Recipe, Stratigraphy</td>
</tr>
<tr>
<td>E</td>
<td>Early</td>
<td>Bead Style, Recipe</td>
</tr>
<tr>
<td>86</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>90</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>139/140</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>151</td>
<td>Early</td>
<td>Bead Style</td>
</tr>
<tr>
<td>200</td>
<td>Early</td>
<td>Bead Style</td>
</tr>
<tr>
<td>207</td>
<td>Early</td>
<td>Bead Style, Stratigraphy</td>
</tr>
<tr>
<td>208</td>
<td>Early</td>
<td>Bead and Artifact Style, Bead Chemistry</td>
</tr>
<tr>
<td>212/218</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>215</td>
<td>Unknown</td>
<td>N/A</td>
</tr>
<tr>
<td>217</td>
<td>Unknown</td>
<td>N/A</td>
</tr>
<tr>
<td>248</td>
<td>Unknown</td>
<td>N/A</td>
</tr>
<tr>
<td>282</td>
<td>Early</td>
<td>Bead and Artifact Style, Bead Chemistry</td>
</tr>
<tr>
<td>307</td>
<td>Early</td>
<td>Bead and Artifact Style, Bead Chemistry, Stratigraphy</td>
</tr>
<tr>
<td>394</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
</tbody>
</table>

Net photon counts for tin (SnK12) and antimony (SbK12) were then used to create a single variable indicative of the primary opacifier used in the construction of each bead. The percentage of antimony in each bead was calculated using the formula \( y = \frac{SbK_{12}}{SbK_{12} + SnK_{12}} \cdot 100 \). The relative ages in Table 3.1 were then used to separate the burial data into “early,” “late,” and “unknown” contexts, while the data from the mission complex and surrounding neighborhoods were categorized as “structure” contexts. The distinction between burial and structural contexts is necessitated by the different use patterns associated with each. Christian burials, such as those found in the mission cemetery, are only accessible for a limited time, while the required funerary rites are performed. Thus, any artifacts associated with burials most likely...
represent intentional deposition; however, beads recovered from continually occupied residences and structures were most likely deposited through accidental loss.

The Implications of Compositional Data from Type 17 Beads

A boxplot (Figure 3.7) was constructed to visually represent the distribution of the two opacifiers across each of the three categorized contexts. As expected, early contexts were primarily opacified using tin (75-100% Sn; 0-25% Sb), while late contexts were primarily opacified using antimony (15-50% Sn; 50-85% Sb). Lastly, the beads associated with mission structures displayed the greatest variability of all four categories (4-100% Sn; 0-96% Sb), likely reflecting the continuous use of the mission complex.

Figure 3.7: Distribution of Antimony (Opacifier Percentage) by Relative Age
In order to determine whether the trends indicated in Figure 3.7 were applicable to individual contexts within each of the four categories, antimony percentage was plotted against provenience and then color-coded by relative age. Using Figure 3.8, the accuracy of the established relative age of each context was assessed and new ages have been assigned according to the strength of available compositional evidence. However, it must be noted that the compositional evidence is attenuated based upon the available sample size and likelihood that intrusive deposits have contaminated the bead assemblage of each individual context.

First, three burial contexts stand out as potentially mislabeled: 1) Individual 139/140; 2) Individual 200; and 3) Individual 207. Despite containing antimony-rich beads, Individuals 139/140 (n=2) and 207 (n=1) suffer from a small sample size. Additionally, both are associated
with multiple individuals that were interred closely together, increasing the likelihood that artifacts may have been introduced at a later date or incorrectly attributed by excavators (Blair 2009a:Figure 15.10). It is felt that there is currently not enough information to warrant re-categorizing either. Individual 200, however, has a relatively large sample size (n=18) and demonstrates considerable overlap with definitively late contexts, such as Individuals 86, 90, and 394 (Blair n.d.). The presence of large quantities of antimony (44-72% Sb) indicates that Individual 200 was interred more recently than is suggested by the style of beads in association.

Until now, Individuals 215, 217, and 248 have been unable to be dated using associated artifacts. In light of the lack of relevant information, the small sample sizes available for Individuals 215 (n=1) and 217 (n=1) have been ignored and tentative ages have been assigned. The lone black glass trade bead associated with Individual 215 is composed of 37 percent antimony, which suggests that this burial is either early or, quite possibly, the burial coincided with the transition between opacifiers, given its lack of overlap with any clearly defined clusters of definite age. The bead associated with Individual 217, on the other hand, is composed of 93 percent tin, clearly identifying it as an early burial. Lastly, Individual 248 (n=34) shows considerable overlap with well-dated early burials, such as Burial B and Individual 307, which suggests that it is an early burial as well (Blair 2009b:174). Although one might be tempted to argue that it is a transitional burial based upon the cluster of outliers (n=7) between 37 and 49 percent antimony, this is unlikely. Individual 248 was interred next to Individual 243; a known late burial dated using compositional evidence from associated white glass trade beads (Blair 2009b:174-175, n.d.). This raises the distinct possibility that the minority of antimony-rich beads was introduced to Individual 248 from Individual 243 during interment. As such, Individual 248 is categorized as early given the predominance of tin-rich beads.
The seventeenth century mission complex was thought to have been continuously occupied from the time it was resettled in 1605 following the Guale Uprising until its abandonment in 1680 (Thomas 1988, 1993). However, attempts to date individual structures have been complicated by long use-lives, which have contributed to chronologically heterogeneous artifact assemblages. Three of the structural and residential contexts examined in this study (i.e., Fallen Tree (n=5), the late well [Structure 2/4, n=5], and the friary [Structure 4, n=6]) exhibit wide ranges in opacifier concentrations, which may indicate continual use throughout the seventeenth century. However, small sample sizes problematize attempts to date the contexts with any confidence. The mission church (Structure 1, n=88), the kitchen (Structure 2, n=17), and Structure 5, a native residential structure (n=20), by comparison, have relatively large sample sizes, which impart greater confidence in assessments of relative age. The church shows the widest range of opacifier composition (20-100% Sn; 0-80% Sb) suggesting continual use throughout the history of the mission. This interpretation is supported by documentary evidence indicating that it was the first structure established following the Guale Revolt of 1597 and logically would have seen continuous use given that the cemetery containing all known burials is located beneath its floor (Thomas 1993:13, 2009:26). Like the church, beads from the kitchen and Structure 5 have opacifier concentrations (15-100% Sn; 0-85% Sb) cross-cutting both early and late groups. However, 88 percent of beads from the kitchen and 96 percent of beads from Structure 5 were primarily opacified with antimony (31-86% Sb), which suggests that the two buildings were primarily utilized during the mid- to late-seventeenth centuries. Due to their portability, glass trade beads have a tendency to circulate throughout the communities in which they are found, whether through gifting or barter (Blair 2015a, 2015b). The minority tin-opacified beads likely arrived on the island during the nascence of the mission complex and
would have been traded among the mission’s inhabitants before finally being deposited in the two structures.

**Conclusion**

Compositional analysis of 940 simple manganese black glass trade beads recovered from Mission Santa Catalina de Guale (St. Catharines Island, GA) has provided new insight into glassmaking during the seventeenth century. Evidence suggests that glassmakers exploited a number of different materials and recipes during this time. Comparisons of manganese and its associated trace element barium indicate that manganese-containing ores used to color the black glass beads at the mission were likely being collected from two different geologic sources of varying purity. Although both sources were employed at the beginning of the century, this practice was phased out and only the purer source (i.e., high manganese, low barium) was used in the production of black glass trade beads. A similar shift in material choice was observed for the opacifiers tin and antimony. Analyses revealed that tin was gradually being replaced by antimony as the opacifier of choice during this time. The transition between the tin and antimony was marked by a period of experimentation in which various concentrations of the two were included in glass recipes. Although a similar transition has been observed in white glass trade beads from Mission Santa Catalina de Guale and other parts of *La Florida* ca. 1630-1650 (Blair 2015b) and shortly thereafter in blue beads (Dalton-Carriger and Blair 2013, 2015), it remains to be seen whether the change observed in the type 17 beads is contemporaneous. Additionally, it was found that different silica sources were likely employed throughout the seventeenth century based upon variation in the impurity titanium. Values for titanium demonstrated a distinct
bimodal distribution indicating the existence of two separate populations. By comparing titanium with the two temporally diagnostic opacifiers, it was surmised that glassmakers had replaced their original low-titanium silica source with a less pure, high-titanium source at approximately the same time that they were replacing tin with antimony. However, this change was temporary and purer sources were being employed by the end of the century. Together, these sourcing patterns suggest that the glasshouses were experiencing economic pressures during the mid-seventeenth century that encouraged them to seek out more cost-effective alternatives to existing sources. The process involved the use of purer resources requiring less refinement (e.g., manganese) and the use of less pure resources (e.g., silicates) when the impact to quality was minimal. As the economic environment improved, the glassmakers began to employ more rigorous purity standards.

Compositional data pertaining to the temporally diagnostic shift from tin to antimony allowed the previous site chronology for Mission Santa Catalina de Guale to be refined (Table 3.2). Antimony percentages were calculated for each type 17 bead as a proxy for relative age and compared with the ages postulated by Blair (n.d.) according to the stratigraphic relationships between contexts and the chemical composition and morphology of associated grave goods. Although many of the assigned ages were confirmed, the new compositional data indicates that Individual 200 was a later addition to the cemetery than suggested by the style of associated glass trade beads. Additionally, Individuals 215, 217, and 248 were assigned an early relative age, which had hitherto been impossible to assign due to a lack of available information on associated artifacts. Lastly, relative ages were provided for non-burial contexts, including the Fallen Tree neighborhood and Structures 1, 2, 2/4, 4, and 5. The presence of tin-rich and antimony-rich beads in Fallen Tree and Structures 1, 2/4, and 4 is most likely indicative of
continual use throughout the life of the mission. Structures 2 and 5, however, have produced predominantly antimony-opacified beads, which implies that they represent later episodes of occupation at the mission complex.
Table 3.2: Revised Relative Age Estimates for All Contexts

<table>
<thead>
<tr>
<th>Burial</th>
<th>New Relative Age</th>
<th>Original Relative Age</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe, Stratigraphy</td>
</tr>
<tr>
<td>E</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe</td>
</tr>
<tr>
<td>86</td>
<td>Late</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>90</td>
<td>Late</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>139/140</td>
<td>Late</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>151</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe</td>
</tr>
<tr>
<td>200</td>
<td>Late</td>
<td>Early</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>207</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe, Stratigraphy</td>
</tr>
<tr>
<td>208</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe, Artifact Style</td>
</tr>
<tr>
<td>212/218</td>
<td>Late</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>215</td>
<td>Early/Transitional*</td>
<td>Unknown</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>217</td>
<td>Early*</td>
<td>Unknown</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>248</td>
<td>Early</td>
<td>Unknown</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>282</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe, Artifact Style</td>
</tr>
<tr>
<td>307</td>
<td>Early</td>
<td>Early</td>
<td>Bead Style and Recipe, Artifact Style, Stratigraphy</td>
</tr>
<tr>
<td>394</td>
<td>Late</td>
<td>Late</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>Fallen Tree</td>
<td>Continual*</td>
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<td>Bead Recipe</td>
</tr>
<tr>
<td>Str. 1</td>
<td>Continual</td>
<td>N/A</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>Str. 2</td>
<td>Late</td>
<td>N/A</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>Str. 2/4</td>
<td>Continual*</td>
<td>N/A</td>
<td>Bead Recipe</td>
</tr>
<tr>
<td>Str. 4</td>
<td>Continual*</td>
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<td>Bead Recipe</td>
</tr>
<tr>
<td>Str. 5</td>
<td>Late</td>
<td>N/A</td>
<td>Bead Recipe</td>
</tr>
</tbody>
</table>

*- Small Sample Size
CHAPTER 4:
COLOR PREFERENCE AT MISSION SANTA CATALINA DE GUALE

Introduction

In the previous chapter, I discussed the value of AMNH type 17 (Kidd and Kidd IIa6, IIa7, and IIa8) simple drawn manganese black glass trade beads as high-resolution temporal markers. Historic glass recipe books and compositional analyses of archaeological glasses dating to the seventeenth century had previously established the substitution of calcium antimonate (Ca$_3$O$_8$Sb$_2$) for tin oxide (SnO$_2$) in white glass trade beads ca. 1630-1650 (Blair 2015b; Sempowski et al. 2000; Moretti 2005:28-29; Verità 2002:267-268). By comparing the relative amounts of tin and antimony across early (pre- ca. 1630-1650) and late (post- ca. 1630-1650) contexts, which had been previously dated using multiple lines of evidence including stratigraphy, artifact typologies, and white bead chemistry, I demonstrated that these opacifying agents may be treated as temporally diagnostic in black glass beads as well. The utility of this finding is seen in the refinement of the previous chronology for Mission Santa Catalina de Guale (Blair n.d.). By associating tin-rich beads with early contexts and antimony-rich beads with late contexts, it became possible to strengthen existing arguments for dates associated with Burials B and E and Individuals 86, 90, 139/140, 151, 207, 208, 212/218, 282, 307, and 394. Additionally, new, more accurate dates were provided for Individuals 200, 215, 217, and 248. However, the implications for current understandings of Guale practices and beliefs associated with grave good assemblages are not as immediately accessible.
In this chapter I attempt to remedy this by providing ideological context for the bead assemblages recovered from the cemetery (campo santo) at Mission Santa Catalina de Guale. I suggest that Native American cosmologies and religious beliefs operated according to similar shamanic fundamentals. Shamanic belief systems often attribute supernatural or divine qualities to light and “otherness”. Such associations are well attested in the folklore, mythology, ethnohistoric accounts, and material culture of widely dispersed native peoples throughout the Americas, such as the Iroquois (NE United States), Timucua (SE United States), Taíno (Caribbean), Aztec (Central Mexico), Maya (Yucatan), Inca (Peru), and Mapuche (Chile) (Hamell 1983, 1987, 1992; Saunders 1998, 1999). Given the wide distribution of such beliefs temporally, geographically, and cross-culturally, I propose that the Guale likely would have held similar attitudes regarding the value of light and reflective materials. Furthermore, I suggest that beads may act as useful material correlates of such beliefs in light of Native American values prizing spiritual wellbeing and its ability to be concentrated through the accumulation of divinely charged objects. This is particularly relevant in light of both ethnohistoric and archaeological evidence suggesting that the Guale employed large quantities of colorful glass beads as bodily ornaments, which are known to act as referents of salient sociocultural values (Blair et al. 2009; Larson 1978; Loren 1999, 2000, 2009, 2010, 2013). The symbolic value of a given artifact likely would have been tied to one of the culturally salient primary colors used to partition the cognitive color space of the Guale. This symbolic value has been extrapolated through the use of Berlin and Kay’s (1969) color term evolution schema in conjunction with similarities between the surviving Guale lexicon and those of linguistically related peoples.

Using this method five primary colors are identified: black, white, red, yellow-green, and blue. Available Munsell bead color identifiers (Blair et al. 2009: 235-252) allow all available
bead types to be sorted into their corresponding color category. The distribution of colors in each assemblage is cross-referenced with known demographic variables, which include date of interment, age, and sex. Comparisons are then made using correspondence analysis and chi-square test for independence statistics ($\rho < 0.05$). Finally, the anthropological significance of observed patterning and statistically significant relationships is discussed.

**Background**

**The Importance of Light and Color in the Americas**

Humans as a species have demonstrated an intrinsic fascination with the colors found in nature. The white shine of the first winter’s snow, the red petals of the summer rose, and the fading yellows and oranges of autumn foliage all serve as important indices of the state of nature, its available resources, and its many dangers (Taussig 2006:43-44). To paraphrase Diderot (quoted in Delamare and Guineau 2000:129; cited in Taussig 2006:36), it is color that brings creatures to life and imbues them with animacy and it is color that provokes the mind and excites its faculties. Color, like taste or sound, has the ability to transport individuals through time and space by rousing the mind through association. Color vision is less a sensation of sight than it is a total bodily experience in which the observer can become lost in the numinous (Otto 1958[1923]) reality represented by the image and its ideological connotations. As noted by Taussig (2006:31), “To advocate such a sense of color is not to say color is really this or really that. Instead it is to speculate on some of the…wonder [that] lies obscured within.” The term color is itself derived from the Latin word *celare* meaning to conceal (Taussig 2006:32-33) and carries with it connotations of an esoteric world hidden from humans’ ability to experience the
mundane through sense alone. It is a “magical polymorphous substance” (Taussig 2006), which oscillates between truth and deception, its protean nature captivating the human imagination and leaving one in awe and wonderment of its inexplicable transformations as he edges ever closer towards *mysterium tremendum et fascinans* (Otto 1958[1923]). Color sense encourages the participant to engage with the world in such a way that he abandons the transcendent position of metaphysical observer and becomes inextricably linked to his version of reality (Taussig 2006:31). As such, it comes as little surprise that humans have venerated culturally salient colors throughout history, particularly in colonial contexts in which exposure to new and exotic colors became increasingly commonplace.

The human fascination with light and color is especially visible among the peoples of the Americas. Cross-cultural comparisons of historic Native American belief systems reveal the presence of analogous, and potentially homologous, shamanic cosmologies, which associated divine power with exoticism, light, and color (Hamell 1983, 1987, 1992; Miller and Hamell 1986; Saunders 1988, 1998, 1999; Turgeon 2004). According to these shamanic worldviews, “telluric geography is inextricably entwined with sacred places and physical distance often equated with spiritual geography and the power of ‘otherness’” (Saunders 1998:226). Potent supernatural powers are believed to have been concentrated in “strangers” who possessed shiny objects retrieved from a distant mirror-image realm inhabited by a variety of bright spirit beings, incorporeal souls, were-beings, and immanent supernatural forces. This shininess, alternatively defined as surface glitter or brilliance, was believed to correspond to spiritual essence, equated here with Taussig’s (2006) “polymorphous magical substance” or Mauss and Hubert’s *mana* (Mauss 1975[1903]:117). Although derived from a supernatural realm normally inaccessible to humans, divine power could be observed in a number of mundane contexts (e.g., celestial bodies,

Early historic accounts by Europeans suggest that the peoples of the Southeast valued light and brilliance in much the same way. For example, great significance was attributed to the luster of pearls and native caciques kept them in great quantities. This fact is well attested by Hernando de Soto who was gifted with a string of pearls when he entered Cofitachequi in 1540 and subsequently given permission to plunder the pearl-laden burial mounds near Augusta, Georgia (Saunders 1999:248-249). Additionally, the widespread valuation of brilliant, glittering objects is also reflected in the reports of early explorers to present-day Virginia. Their accounts state that funerary rights for elite individuals involved filling the deceased’s body with pearls, polished copper, and white sand and surrounding it with baskets full of gleaming pearls (Saunders 1999:248).

The arrival of European “others” in possession of vast quantities of shiny metal and glass goods complimented pre-contact American mythologies influenced by shamanic valuations of the exotic. For example, the following characterization was made by a group of New England Indians in the early seventeenth century and later recorded by William Wood (1634:77),

[The Indians] tooke the first Ship they saw for a walklng Iland, the Mast to be a Tree, the Saile white Clouds, and the discharging of Ordinance for Lightning and Thunder, which did much trouble them, but this thunder being over, and this moving Iland stedied with an Anchor, they manned out their cannowes and goe and picke strawberries there...

The Montagnais and Micmac Algonquians reported similar first impressions of Europeans and their technologies (Hamell 1987:87). The Micmac told Silas Tertius Rand in 1869 that they had
believed the first European ship to be a floating island manned by bear spirits and captained by the mythical *Mahtigwess* or White Rabbit Man-Being. It was only upon closer inspection that they realized that the bears were in fact fur-clad men and that *Mahtigwess* was a priest dressed in a white stole. Nonetheless, Europeans and priests in particular came to be identified with these mythic figures for centuries to come (Miller and Hamell 1986:321).

As a result, Europeans goods enjoyed a privileged position within Native American society. Oftentimes, the “otherness” of these objects resulted in exchange/prestige values exceeding those of natively acquired materials, such as copper, exotic siliceous stone, and shell (Miller and Hamell 1986:315; Saunders 1998:2401-241; Turgeon 2004:35). Nevertheless, Native Americans consistently repurposed them in order to accommodate pre-existing material needs. This suggests that imported goods, such as copper cooking vessels and glassware, were not perceived as something new. Instead, they were classified in accordance with existing culturally significant typologies and assimilated in traditional native ideological systems (Miller and Hamell 1986:315; Saunders 1998:237).

This is supported by Wilcomb E. Washburn’s observation that, “the exchange of goods that took place bore almost no relation to the economic process with which we (Euro-Americans) are familiar” (Miller and Hamell 1986:314). This is due in part to different understandings and definitions of wealth. Unlike Europeans who appreciate materials almost exclusively for their value as commodities in an exchange-based economic system, Native Americans appreciated materials for their latent social and symbolic significance, which was intertwined with their relation to the exotic or foreign “other” and their inherent ability to reflect specific forms of light (e.g., colors, intensities, etc.). Material substances existed as manifestations of specific colors and their associated semantic connotations. As a result, the acquisition of materials with certain
Color values equated to the acquisition of the related ideational values, which translated into physical, spiritual, and social wellbeing (Hamell 1987:73-75). The intrinsic social and spiritual value of these items could then be broadcast through their display as bodily ornaments or transferred to others via gifting (Turgeon 2004:35-41).

**Color Symbolism in the Southeast**

Knowledge of Native American color symbolism at the time of European colonization has largely been drawn from the historic accounts of European traders, missionaries, and colonists residing in northeastern North America, Central America, and South America (e.g., Classen 1990; Hamell 1983, 1987, 1992; Miller and Hamell 1986; Saunders 1988, 1998, 1999; Turgeon 2004). George R. Hamell (1983, 1987, 1992) and Christopher L. Miller (Miller and Hamell 1986) have explored the “mythical reality” (see Sahlins 1981) of the Iroquois and its influence on their consumption of glass beads and other European trade goods (see also Turgeon 2004). Nicholas J. Saunders (1988, 1990, 1999; see also Classen 1990) has written extensively on the supernatural implications of brilliance and color revered by the Aztec, Olmec, and Maya of Central America, the Taíno of the Caribbean, and the Desana, Inka, Muisca, Tukano, and Tunebo of South America.

In the Southeast, color was closely associated with native cosmologies. Generally speaking, the indigenous inhabitants of the Southeast envisioned their world as a large, flat island, which was suspended between the Upper World located above the sky and the Under World located beneath the earth and waters (Hudson 1976:122). The Middle World inhabited by humans was divided into four quadrants separated by the cardinal directions, each of which was associated with a specific color and social values. The east held the greatest significance as the
point of origin of the Sun, which brought warmth light and life. It was associated with the color red, the sacred fire or "Ancient Red," blood, life, and success (Hudson 1976:126, 132). The west sat in opposition to the east and was associated with the Moon, the color black, death, and the souls of the dead. North and south also embodied oppositional values. The north was associated with the colors blue and purple, trouble, and defeat; while the south was associated with the color white, warmth, peace, and happiness (Hudson 1976:132).

Like other Amerindian groups, Southeastern peoples believed that humans were subject to the whims of powerful supernatural beings, such as the giant Long Man, the monstrous, raptorial Tlanuwa, and the horned, winged, and serpentine Utktena (Hudson 1976:128-132). Oftentimes, these beings and their familiars were identified with a specific color representing their point of origin within the cosmic geography and its effect upon their respective natures (Hudson 1976:132). For example, the Cherokee worshipped Kanati (the Red Man of the East) and his sons (the Little Red Men) who, consistent with the life-giving and success-bringing connotations of the color red, were thought to bring aid and offer protection by striking down enemies with lightning. However, Kanati preferred to be called "white" and would turn wrathful if anyone referred to him as the "Red Man" outside of ritual observances (Hudson 1976:127).

Treatment of Kanati illustrates the importance of color symbolism in the Southeast. Color terms acted as potent significata that if used properly could produce beneficial supernatural effects. However, improper use was just as likely to result in divine punishment or even death.

Auspicious colors (e.g., red, white, and perhaps sky blue) were often employed in social contexts to reinforce the connection of the individual or group to the divine and the values they represented. Southeastern elites are known to have decorated themselves in elaborate red and white garb in order to stress their virility and right to assume political office by virtue of their
superiority. For example, the Great Sun of the Natchez is known to have worn a crown decorated with a red diadem, red beads, and white feathers topped with tufts of red hair (Hudson 1976:209), while priests and warriors often decorated their bodies using red pigments and feathers (Hudson 1976:244, 332, 371). The use of red and white extended beyond personal decoration to include honorifics for social groups. The Creek anchored their most prestigious clans in the mythic past and referred to them and their leaders as Hathagâlgi (the Whites) in order to stress their role as wise and senior peacemakers within the Creek nation, while younger, more bellicose clans and their leaders were known as Tcilokogâlgi (the speakers of different languages) and were associated with the color red (Hudson 1976:194-195; Pesantubbee 2004:35).

Asocial colors, such as black, were employed less frequently than either white or red. Black appears largely confined contexts in which one might expect to come into contact with death, such as war and mortuary rituals. For example, Southeastern warriors decorated their bodies with black war paint before leaving for battle (Hudson 1976:244) and at the funeral, for the Natchez Sun Tattooed-Serpent, French observers noted that the priest leading the procession wore black feathers around his waist and carried a baton decorated with black feathers (Hudson 1976:331). However, black objects might also be used to predict death, illness, and disaster. Taking the black bead in one hand and the red or white bead in the other, a priest would compare the movements of the two. Stronger movement in the black bead foretold misfortune (Hudson 1976:356).

The inclusion of black glass trade beads in grave goods assemblages at Mission Santa Catalina de Guale most resembles the use of black garb and paraphernalia in Natchez mortuary ritual. As such, they likely reference the liminal and asocial aspects of death. However, the beads
are not distributed evenly across all contexts and may have been included as decorations on burial clothes, used in mortuary rituals, given as gifts by survivors, or some combination thereof. However, the lack of documentary evidence from the mission leaves the exact nature of their deposition uncertain and further analysis is required to discern the exact nature of their use.

The Semiotics of Beads

The 67,184 glass trade beads recovered from the mission cemetery may have acted as particularly important indicators of traditional Guale belief systems given their historically documented desirability within many Native American cultures. Beads are known to have acted as objects of personal adornment, commodities of social and economic exchange, and a means for mediating relationships across a wide variety of social boundaries (Blair et al. 2009). Larson (1978:130-131) cites Spanish documents dating to 1595 as evidence that the Guale regularly employed beads as forms of bodily ornamentation. Spatial relationships between interred individuals and associated in situ beads further support that they were worn on various parts of the body and suggest that they also may have been embroidered onto clothing. Bodily ornaments such as these can be understood as visible manifestations of preexisting aspects of an individual’s ascribed social status and advertise these aspects to peers by referencing social inclusion and differentiation (Joyce 2005:142). As such, they are likely to represent socially significant boundaries and can be expected to act as effective advertisements of adherence to certain culturally specific behaviors (e.g., ethnicity, class, religious affiliation, gender, etc.) (Wobst 1977:323-328).

With respect to the beads recovered from the cemetery at Mission Santa Catalina de Guale, ornaments that have been intentionally deposited as grave goods exist as symbols of prestige
sacrificed in order to express the status and identity of the deceased, ritual paraphernalia
discarded at the conclusion of burial rituals, or gifts indicating specific relationships between the
living and the deceased. The materials employed exist as indices of previously filled nodes in the
social structure that has been vacated by the deceased, and are in the process of being
renegotiated through the enactment of the appropriate rituals. Duties, indebtedness, authority,
and/or affiliation of the deceased can be transformed or reaffirmed depending on the present
needs of the living. As such, deposited ornaments can serve as reflections of the deceased’s role
within the existing social structure by continuing to transmit encoded messages.

The semiotic value of a given ornament can most often be characterized as emblemic,
declared by Wiessner (1983:257) as, “formal variation in material culture that has a distinct
referent and transmits a clear message to a defined target population about conscious affiliation
or identity,” albeit with one major caveat. A number of studies (e.g., Bowser 2000; Braun 1991;
Hegmon et al. 1992; Hodder 1985) suggest that the clarity and, therefore, efficiency of the
messages being conveyed may not always be of the utmost importance. In fact, objects
embracing complex, overlapping, or otherwise ambiguous messages may be socially
advantageous under the right circumstances (Hegmon 1992:520). As a result, a single object,
such as a simple, monochrome glass bead, may come to embody a number of layered meanings,
which vary according to the specific contexts in which they are being employed.

Janet D. Spector has shown that the preferences of indigenous consumers played an active
role in determining the types of beads brought to the Americas. Spector (1976) notes that a
survey of shipping manifests from trading companies doing business with Native American
groups during the seventeenth century indicates that the frequencies of specific bead types were
fluctuating on at least a yearly basis. Because these companies were often doing business with
individual groups with a limited geographic range, the observed temporal variation most likely indicates shifts in culturally appropriate or desirable bead types. As such, glass beads may act as high-resolution indicators of temporal variation in the salience of culturally significant social identifiers (e.g., religion, lineage, etc.) as reflected in the colors being preferentially consumed.

**Color Classification Schema**

It has been established that linguistic recognition and, therefore, salience of color categories varies cross-culturally (Berlin and Kay 1969; Kay 1975, 1999; Kay and Maffi 1999; Kay and McDaniel 1978). In 1969, Berlin and Kay hypothesized, “that the basic color terms of all languages encode some subset of a set of eleven fixed perceptual foci and that there is a partially fixed temporal order in which these foci are encoded” (Kay 1975:258). All languages were believed to have first developed two terms in order to differentiate between the achromatic sensations: black and white. These two terms would have then been followed by a term for red, after which a green/yellow hybrid term would have developed. This event would be succeeded by the appearance of a term for blue and afterwards a term for brown. The process concluded with the development of terms for purple, pink, orange, and gray, in no particular order (Kay 1999:33; Kay and Maffi 1999:733-734).

Since its inception, several refinements have been made to Berlin and Kay’s original model. In response to methodological challenges by anthropologists, Kay and McDaniel (1978) reduced the number of basic color terms from the original eleven to the six found in the Hering opponent process model. The Hering opponent process model supposes that humans perceive six basic colors that are paired together. Black and white, red and green, and blue and yellow operate along different channels in the nervous system such that the perception of one member of the
pair prevents perception of the other. This is why humans do not perceive reddish-green or bluish-yellow hues. However, humans are able to perceive mixtures of non-oppositional color pairings, which produce sensations associated with non-primary colors (Hubel n.d.). The five colors that had been removed were reclassified as “fuzzy” colors corresponding to these mixtures (Kay 1999:33-34; Kay and Maffi 1999:744). More recently, Kay and Maffi (1999) have used the results of the World Color Survey (WCS) and Mesoamerican Color Survey (MCS) to explore the implications of the Emergence Hypothesis, which rejects the notion that all languages necessarily have a small number of words whose individual significatum relate to a single color concept and collectively partition perceptions of color (Kay 1999:34; Kay and Maffi 1999:744). Upon review of 110 basic color terminology systems, Kay and Maffi (1999:745) concluded that, “In notional domains of universal or quasi-universal cultural salience (kin relations, living things, colors, etc.), languages tend to assign significata to lexical items in such a way as to partition the denotata of the doma.” In other words, the formation of color terms is causally linked to a culture’s need to distinguish objects by color, which occurs more frequently as a culture becomes more technologically complex and the color of its artifacts become more prone to intentional manipulation (Kay and Maffi 1999:745).

Although the Guale language is long extinct, using the color theory developed by Berlin, Kay, McDaniel, and Maffi, it is possible to draw some conclusions regarding a plausible color lexicon through the judicious use of available ethnohistoric data and cross-cultural comparison. Linguistic remains, in the form of town names, political titles, and terms recorded in Spanish documents, suggest that the Guale most likely spoke a variant of the Muskogean dialect subsumed under the Macro-Algonquin linguistic phylum (Broadwell 1991, cf. Sturtevant 1994; Waldman 2014:276; Worth 2004:238). In the past, it was reported by M. Haas that both of the
Muskogean dialects spoken by the Creek and Natchez possessed basic color terms for black, white, red, yellow-green, and blue, which Kay subsequently identified with Stage IV of the evolutionary schema (Kay 1975:260-261). More recently, the World Color Survey identified the distantly related Cree dialect as a Stage IV language possessing terms for black, white, red, yellow-green, and blue (Kay and Maffi 1999:753). The apparent continuity in the three geographically disparate Macro-Algonquian languages suggests that the Muskogean Guale also would have spoken a Stage IV language partitioned into white, black, red, yellow-green, and blue terms.

**Methods**

In order to identify evidence of diachronic color patterning at Mission Santa Catalina de Guale that may correlate with patterns in ideological, biological, and/or sociopolitical identities, counts for 133 different types of beads were tabulated for 79 burial contexts associated with the mission cemetery (Blair et al. 2009:215-234). Bead types were then condensed into black, white, red, yellow-green, and blue categories according to previously assigned Munsell colors (Blair et al. 2009:235-252). Bead types without assigned Munsell colors (i.e., amber, crystal, gilded, jet, incised bone, pearl, shell, and wooden beads) were assigned values based on the closest matching color category. For example, amber and gilded beads were categorized as yellow-green, jet beads were categorized as black, and incised bone, pearl, and shell beads were categorized as white. Once all beads had been recoded, a correspondence analysis, calculated in PAST (Paleontological Statistics) (Hammer et al. 2001), was used to assess the interrelatedness of each of the five color categories across the entire sample. The resulting eigenvalues were then
imported into JMP 13 (a statistics and experimental design software package developed by Statistical Analysis Software) in order to compare evidence of color preference across demographics, including relative date of interment, sex, and age of the individual interred. The relative date of interment was categorized as either early (pre-ca. 1630 to 1650) or late (post-ca. 1630 to 1650) according to the stratigraphic, typological, and chemical criteria outlined in Chapter 3 (Blair n.d.), while the sex and ages of those interred were drawn from the observations of Clark Spencer Larsen (1990), who led the bioarchaeological investigations of the mission cemetery. Larsen’s age estimates were then recoded into the age categories based upon those suggested by Buikstra and Ubelaker (1994:9). Individuals were categorized as infants (birth-2 years); children (3-12 years); subadult (13-17 years); young adults (18-34 years); middle adults (35-49 years); and old adults (≥ 50 years). Individuals with missing values and multiple burials for which reasonable conclusions cannot be drawn were excluded from consideration. Evidence of patterning across each of the three demographic categories was then reanalyzed using chi-square tests for independence.

**Statistical Analyses: Correspondence Analysis and Chi-Square**

Correspondence analysis (CA) of the five culturally salient bead colors resulted in the identification of four relational dimensions (Table 4.1). The first dimension (axis 1) possesses an eigenvalue of 0.293, which explains 44.9 percent of the observed variance, while the second dimension (axis 2) possesses an eigenvalue of 0.206, which explains 31.6 percent of the observed variance. Combined, these two axes explain 76.5 percent of the total variance present
in the sample, far exceeding the explanatory potential of other possible combinations of relational dimensions (e.g., axis 1 and axis 3 (58%)).

Due to their superior explanatory potential, burial contexts were plotted against Axis 1 and Axis 2 in order to produce the graph found in Figure 4.1. Figure 4.1 suggests that blue was the most prevalent color of bead included among analyzed Guale burials contexts (N=79). Monochromatic blue assemblages (n=20, 25.3%) account for the majority of all analyzed contexts, while blue beads in general comprise between 33.3 percent and 98.3 percent of all beads in multi-chromatic assemblages. Monochromatic white (n=3, 3.8%) and monochromatic yellow-green (n=4, 5.1%) assemblages have also been identified.

Using monochromatic blue assemblages as a baseline for comparison, the color ratios of multi-chromatic assemblages appear to form several distinct patterns. As the frequency of blue beads in each individual’s assemblage of grave goods decreases, the presence of other colors appears to increase according to one of three broadly outlined linear relationships. The two most common patterns involve the inclusion of white and/or black beads to create blue/white assemblages (n=10, 12.7%), blue/black/white assemblages (n=7, 8.9%), and less frequently blue/black assemblages (n=3, 3.8%). The third, less common pattern involves the addition of red and/or yellow-green beads resulting in blue/yellow-green (n=4, 5.1%), blue/black/red (n=1, 1.3%), blue/white/red (n=2, 2.5%), blue/white/yellow-green (n=5, 6.3%), blue/red/yellow-green (n=1, 1.3%), blue/black/white/yellow-green (n=8, 10.1%), and blue/black/white/red/yellow-green (n=6, 7.6%) assemblages.
Table 4.1: Correspondence Analysis Eigenvalues

<table>
<thead>
<tr>
<th>Axis</th>
<th>Eigenvalue</th>
<th>Percent of Total</th>
<th>Cumulative Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.293</td>
<td>44.9</td>
<td>44.9</td>
</tr>
<tr>
<td>2</td>
<td>0.206</td>
<td>31.6</td>
<td>76.5</td>
</tr>
<tr>
<td>3</td>
<td>0.086</td>
<td>13.1</td>
<td>89.7</td>
</tr>
<tr>
<td>4</td>
<td>0.067</td>
<td>10.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 4.1: Correspondence Analysis of Bead Color

Although the three identified patterns apply to the majority of cases (n=69, 95.8%) two individuals possess uniquely colored assemblages that set them apart. Individual 42 was buried with a blue/red/yellow-green assemblage (n=1, 1.3%), while Individual 88 was buried with a white/green assemblage (n=1, 1.3%). It is proposed that these two individuals may represent separate color patterns sharing some relation to the monochromatic white, monochromatic yellow-green, and/or blue/yellow-green assemblages.
Information regarding date of interment is available for 47 individuals (59.5% of total sample). Twenty-two of the 47 individuals (46.8% of dated subsample) are categorized as early, while the remaining 25 (53.2% of dated subsample) are categorized as late. These 47 individuals were plotted against CA Axes 1 and 2 in order to visually identify evidence of diachronic patterning in color preference. Based upon the results shown in Figure 4.2, late individuals appear to demonstrate greater variability in dominant assemblage color, which can be seen in the more constrained distribution of early individuals relative to that of the late individuals. Roughly one half of the late individuals are located within the blue dominated cluster centered at approximately (0.75, 0.00) in Figure 4.2, while the remaining half are much more closely
associated with the coordinates for black (-1.35, 1.77), red (-0.76, -1.62), yellow-green (-1.02, 0.09), and white (0.87, 0.14) beads. This suggests that as of yet unidentified cultural changes took place during the seventeenth century, which led to the creation of more varied bead assemblages without entirely eliminating traditional color preferences. The veracity and statistical significance of these observations were confirmed (Table 4.2). Thus, it is concluded that the observed diachronic variation in the bead assemblages is a reflection of human action guided by preference for certain colors and not chance.

Table 4.2: Results of Chi-Square Test for Independence of Date

<table>
<thead>
<tr>
<th></th>
<th>Black</th>
<th>White</th>
<th>Red</th>
<th>Yellow-Green</th>
<th>Blue</th>
<th>Total Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>7176</td>
<td>7246</td>
<td>628</td>
<td>5153</td>
<td>20565</td>
<td>40768</td>
</tr>
<tr>
<td>Expected</td>
<td>6543</td>
<td>7368</td>
<td>550</td>
<td>4085</td>
<td>22222</td>
<td></td>
</tr>
<tr>
<td><strong>Late</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>1223</td>
<td>2213</td>
<td>78</td>
<td>91</td>
<td>7962</td>
<td>11567</td>
</tr>
<tr>
<td>Expected</td>
<td>1856</td>
<td>2091</td>
<td>156</td>
<td>1159</td>
<td>6305</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>8399</td>
<td>9459</td>
<td>706</td>
<td>5244</td>
<td>28527</td>
<td>52335</td>
</tr>
</tbody>
</table>

*p<0.01

Sex of the Interred

Information regarding the sex of individuals buried in the cemetery is available for 17 individuals (21.5% of total sample). Five of the 17 individuals (29.4% of sexed subsample) are categorized as male, while the remaining 12 (70.6% of sexed subsample) are categorized as female. These 17 individuals were plotted against CA Axes 1 and 2 in order to identify evidence of color preferences attributable to sex. Unfortunately, it is difficult to visually identify meaningful patterns from the correspondence analysis alone due to the small sample size and
wide range of observed values. As such, the data were analyzed statistically. The results of the analysis (Table 4.3) suggest that there are significant differences in the manner in which beads corresponding to the five culturally salient color categories are distributed between male and female burials.

Table 4.3: Results of Chi-Square Test for Independence of Sex

<table>
<thead>
<tr>
<th></th>
<th>Black</th>
<th>White</th>
<th>Red</th>
<th>Yellow-Green</th>
<th>Blue</th>
<th>Total Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>11</td>
<td>296</td>
<td>0</td>
<td>9</td>
<td>1801</td>
<td>2117</td>
</tr>
<tr>
<td>Expected</td>
<td>539</td>
<td>443</td>
<td>19</td>
<td>20</td>
<td>1098</td>
<td></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>1004</td>
<td>538</td>
<td>35</td>
<td>28</td>
<td>268</td>
<td>1873</td>
</tr>
<tr>
<td>Expected</td>
<td>475</td>
<td>392</td>
<td>16</td>
<td>17</td>
<td>971</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1015</strong></td>
<td><strong>834</strong></td>
<td><strong>35</strong></td>
<td><strong>37</strong></td>
<td><strong>2069</strong></td>
<td><strong>3990</strong></td>
</tr>
</tbody>
</table>

$p<0.01$
Age of the Interred

Information regarding the age of individuals interred in the cemetery was available for 58 individuals (73.4% of total sample), including one infant (1.7% of aged subsample), seven children (12.1% of aged subsample), four subadults (6.9% of aged subsample), 31 young adults (53.4% of aged subsample), and 15 middle adults (25.9% of aged subsample). These 58 individuals were plotted against CA Axes 1 and 2 in order to visually identify evidence of color preferences associated with each of the five age groups (Figure 4.4). According to Figure 4.4, it appears as though most middle adults display a preference for blue and white colored beads. Infants (-1.34 ≤ x ≥ -1.34, -0.67 ≤ y ≥ -0.67), children (-1.34 ≤ x ≥ 0.87, -0.67 ≤ y ≥ 1.35), subadults (-0.08 ≤ x ≥ 0.47, -0.33 ≤ y ≥ 0.84), and young adults (-1.34 ≤ x ≥ 0.87, -1.62 ≤ y ≥ 1.51) suffer from small sample sizes and/or wide variation in assemblage composition, which prevent further meaningful conclusions. However, statistical analysis of the data (Table 4.4) suggests that the differences in
color patterns are considered extremely statistically significant despite not being able to draw well-defined conclusions about four of the five age groups.

Table 4.4: Results of Chi-Square Test for Independence of Age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Observed</th>
<th>Expected</th>
<th>Total Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Observed</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Expected</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Child</td>
<td>29</td>
<td>1007</td>
<td>5246</td>
</tr>
<tr>
<td>Observed</td>
<td>239</td>
<td>56</td>
<td>2249</td>
</tr>
<tr>
<td>Expected</td>
<td>837</td>
<td>558</td>
<td></td>
</tr>
<tr>
<td>Subadult</td>
<td>21</td>
<td>432</td>
<td>2249</td>
</tr>
<tr>
<td>Observed</td>
<td>589</td>
<td>24</td>
<td>1637</td>
</tr>
<tr>
<td>Expected</td>
<td>359</td>
<td>239</td>
<td></td>
</tr>
<tr>
<td>Young Adult</td>
<td>7290</td>
<td>500</td>
<td>33830</td>
</tr>
<tr>
<td>Observed</td>
<td>7629</td>
<td>361</td>
<td></td>
</tr>
<tr>
<td>Expected</td>
<td>5398</td>
<td>3598</td>
<td></td>
</tr>
<tr>
<td>Middle Adult</td>
<td>187</td>
<td>63</td>
<td>5850</td>
</tr>
<tr>
<td>Observed</td>
<td>599</td>
<td>622</td>
<td></td>
</tr>
<tr>
<td>Expected</td>
<td>5398</td>
<td>3109</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7527</td>
<td>15017</td>
<td>47176</td>
</tr>
<tr>
<td>Observed</td>
<td>9056</td>
<td>25072</td>
<td></td>
</tr>
<tr>
<td>Expected</td>
<td>504</td>
<td>3017</td>
<td></td>
</tr>
</tbody>
</table>

$p<0.01$

Conclusion

Statistical comparisons of the interrelatedness of the five primary colors proposed for the Guale at Mission Santa Catalina (i.e, black, white, red, yellow-green, and blue) suggest that the distribution of beads between burial contexts is non-random and reflects choices made by those
consuming/depositing them. This is perhaps most evident in the clear preference for blue beads demonstrated by the correspondence analysis shown in Figure 4.1. However, this comes as little surprise given the well attested preference for blue beads throughout the Southeast and, thus, offers little in the way of new evidence differentiating the Guale from other Southeastern Indians (Smith 1983:151).

Far more interesting is the variable distribution of early and late burials between the five color categories. As previously mentioned, late burials demonstrate greater variability as a whole and are more likely to eschew traditional blue dominant assemblages in favor of increasingly large quantities of black, white, red, and yellow-green beads. A subsequent analysis of variance (ANOVA) confirms that the early and late burials differ significantly along Axis 1 (F=6.85, p=0.01), but not along Axis 2 (F=2.03, p=0.16). This suggests that the two subsamples are primarily differentiable by the mean percentage of blue beads within their respective assemblages.

The observed increase in bead variety (post- ca. 1630-1650) is noteworthy given historical evidence of population aggregation at Mission Santa Catalina. In 1659, a group of exiled Westo Indians came to settle in the falls region of the Savannah River (Blair 2015b:3; Bowne 2000, 2005; Gallay 2003; Oatis 2004; Smith 1987:132-134, 2002). Following their arrival, the coastal Spanish missions began to be victimized by raiding parties composed of Westo and British slavers. The effects of these raids included the destruction of the northern Guale town of Huyache in 1662, which forced the inhabitants of Mission San Diego de Satuache to relocate to St. Catherines Island sometime between 1663 and 1666. Individuals from Satuache and Santa Catalina formed an aggregated community on the island until additional Westo attacks forced them to abandon the mission in 1680 (Blair 2015b:3; Bowne 2005:78; Worth 1995:197-
198, 2007:19). However, as noted by Blair (2015b:181) these communities likely retained distinct social identities due to their history of intense factional conflict prior to aggregation, as exemplified by the Guale Uprising of 1597 (see Blair and Thomas 2014; Francis and Kole 2011).

The Mahalanobis distance between the x-coordinates of the early and late assemblages may reflect disparities in competing value systems introduced into the sociocultural landscape of Mission Santa Catalina by the displaced inhabitants of Satuache. If color does indeed bear some direct connection to pre-contact religious systems, then one may postulate that variability in the early and late assemblages exists as a reflection of both temporal and geographic variation in beliefs. However, it is difficult to say for certain whether this is indeed the case. Alternatively, previous studies of the post-contact Apalachee (McLamb 2000) and Natchez (Wiegand 2013) suggest that bead color preference may have been associated with either Catholic liturgical colors and/or indigenous clan affiliation (McLamb 2000:84; Wiegand 2013:132). Although the association between bead color and those of the liturgical calendar (i.e., white, red, green, violet, and rose [Broderick 1976:123-124]) has largely been rejected due to their infrequent appearance in the archaeological record of the Southeast (McLamb 2000:86), potential associations between sociopolitical identity and bead color is compelling, particularly in light of the fact that there is precedence for Southeastern Native American clans to be associated with specific colors (Hudson 1976:194-195; Pesantubbee 2004:35) and evidence suggesting that Guale concepts of communal identity were tied to social bonds rather than places of residence (Thomas 2008a:23). It stands to reason that refugees from Satuache would have strived to maintain and broadcast their natal identities in a pluralistic, aggregated setting such as Mission Santa Catalina de Guale. Still, this does not explain the statistically significant distribution between the two sexes or the
five age groups. Ultimately, additional lines of evidence are required in order to disentangle the myriad factors, which influenced the creation of these 79 different bead assemblages.
CHAPTER 5:
DISCUSSION AND CONCLUSIONS

Introduction

In the previous chapters, I presented an analysis of seventeenth century European glass trade beads recovered from Mission Santa Catalina de Guale (St. Catherines Island, Georgia) designed to identify diachronic patterns in bead consumption. As discussed in chapter 2, European goods and glass trade beads in particular played an integral role in mediating cultural interactions between the Spanish and the native peoples of the Southeast. The Spanish, finding themselves ill-equipped to eke out an existence in their new home, were reliant upon maintaining positive relationships with the region’s indigenous inhabitants in order to provide for their most basic of needs (Francis and Kole 2011:18; Rodning et al. 2013:235-240; Thomas 2013a:252-253). This was largely accomplished through the efforts of Franciscan missionaries who offered material incentives (e.g., rings, medallions, beads, etc.) in exchange for conversion to Christianity (Thomas 1988:119). However, rather than establishing Spanish cultural hegemony in the Southeast, missionization preserved indigenous culture and sociopolitical hierarchies by providing elites with exotic materials that could be used in traditional displays of wealth and authority (Blair and Thomas 2014:29-30; Hall 2007, 2009; Thomas 2010a:103, 2013b:119; Worth 2002:58). In light of the perseverance of traditional cultural practices and plentiful evidence suggesting that color played an important role in Southeastern cosmologies (e.g., Classen 1990; Hamell 1983, 1987, 1992; Miller and Hamell 1986; Saunders 1988, 1998, 1999;
I hypothesized that differences in color patterning between burial contexts at Mission Santa Catalina de Guale may reflect conscious choices intended to express salient aspects of individual identities and social relationships. In order to better assess diachronic variability, I conducted a compositional analysis of simple manganese black glass trade beads in order to identify temporally diagnostic opacifiers (see Blair 2015b; Dalton-Carriger and Blair 2013, 2015; Hancock et al. 1997; Sempowski et al. 2000) and refine the current site chronology for the mission.

**Compositional Analysis of Type 17 Black Glass Trade**

In chapter 3, I discussed the results of the compositional analysis of 940 of American Museum of Natural History type 17 (Kidd and Kidd IIa6, IIa7, IIa8) simple drawn manganese black glass trade beads, which revealed evidence of distinct patterning in a number of diagnostic elements, including manganese, barium, titanium, strontium, tin, and antimony. These findings have significant implications for current understandings of European glass bead production and consumption during the seventeenth century. The data suggest that two manganese sources, differentiable by their relative concentrations of the trace element barium, were being used to produce the black glass trade beads recovered from the mission complex. Barium also demonstrated evidence of patterning with strontium. However, until additional compositional data is collected, it is not possible to differentiate between potential sources of barium and strontium, including the use of impure manganese ores (Anthony et al. 2001:252), impure Levantine silicates (De Francesco et al. 2010; Freestone et al. 2000; Henderson 2013:239; Silvestri et al. 2006; Thirion-Merle 2005), organic fluxes and stabilizers (Gratuze 2013:342;
Henderson 2013; Velde 2013:67), and/or recycled high barium glasses imported from East Asia (Beck and Seligman 1934:982; Francis 2009b:81; Gan 2009:Tables 1.4 and 1.6; Gan et al. 1978:99; Henderson 2013:123; In-Sook 1993:164-166; Meiguang et al. 1987; Seligman et al. 1936). Additionally, it was observed that titanium concentrations within the assemblage exhibit a bimodal distribution. Given the known association between titanium and silicates, it is suggested that the distribution of titanium is representative of two different silica sources of varying purity or the adoption of less rigorous purification processes. Lastly and perhaps most significant of all, the data confirms that black glass beads were subject to the same transition from tin-based opacifiers (e.g., tin oxide) to antimony-based opacifiers (e.g., calcium antimonate) previously identified among white glass trade beads (see Blair 2015b; Hancock et al. 1997; Sempowski et al. 2000) allowing them to be separated into early (pre-ca. 1630-1650) and late (post-ca. 1630-1650) contexts after Blair (n.d.).

Reassessing Site Chronology at Mission Santa Catalina de Guale

In light of the new compositional evidence, it was possible to reexamine the estimated dates for these contexts using additional lines of evidence. Elliot Blair (n.d.) had previously separated 74 burial contexts into early and late contexts based upon artifact typology, stratigraphic relationship with contexts of known age, and the principle opacifier used to produce associated white glass trade beads. Unlike the white glass trade beads from Mission Santa Catalina de Guale for which compositional data is available (Blair 2015a, 2015b), which are opacified with either antimony or tin, the black beads analyzed in this study show evidence of mixed opacifier use suggesting a period of experimentation or recycling made possible by a
greater margin of error for black glass. It is certainly plausible that the dark color of black glass would naturally reduce diaphaneity allowing for greater flexibility in the concentrations of incorporated elements. In spite of the overlap, it is possible to confidently date contexts containing black beads by calculating the relative concentration of each opacifier expressed in terms of the antimony net photon count divided by the total number of photons recorded for both tin and antimony \( \left( y = \frac{SbK_{12}}{SbK_{12} + SnK_{12}} \cdot 100 \right) \). The range of antimony for each context has been compared with the estimated dates in order to ascertain the viability of using it as an index of date of interment. Beads with high percentages of antimony corresponded strongly with late contexts, while those with low percentages of antimony, and by extension high concentrations of tin, corresponded strongly with early contexts. As a result, the dates proposed for Burials B and E, Individuals 86, 90, 139/140, 151, 207, 208, 212/218, 282, 307, and 394 have been supported using additional data. Additionally, new dates are suggested for Individuals 215, 217, and 248 and Structures 2 (kitchen) and Structure 5 (potential elite residence). It was originally assumed based on the supposed operation of the mission that Structure 1 (church), Structure 2 (kitchen), Structure 2/4 (well), Structure 4 (friary), Structure 5 (potential indigenous residence) and Fallen Tree saw continual use throughout the seventeenth century. However, beads recovered from Structures 2 and 5 were primarily opacified using antimony, which may indicate a later date of construction and use. Although it has been suggested by David Hurst Thomas (1988, 1993) that Structure 2 was built during the initial phase of reconstruction (ca. 1605-1610), the new compositional evidence seems to indicate that both Structure 2 and Structure 5 were likely built at least two decades later than previously thought (post- ca. 1630), if not later still.
Analysis of Guale Color Preference

In chapter 4, I presented an overview of Native American religious beliefs and their relationship to light and color. The importance of color in Native American religious beliefs has been studied in greater depth than I will attempt to cover in this brief conclusion (e.g., Classen 1990; Hamell 1983, 1987, 1992; McLamb 2000; Miller and Hamell 1986; Saunders 1988, 1998, 1999; Turgeon 2004; Wiegand 2013). Hamell (1983, 1987, 1992), Miller and Hamell (1986), and Saunders (1999, 1998, 1988) have attributed the importance of color in the New World to the presence of a ubiquitous shamanic cosmology that valued light as a manifestation of divine power, which could be collected in objects in order to promote wellbeing. Given the persistence of many aspects of traditional Guale culture throughout the missionization process, it was hypothesized that evidence of color patterning among the beads recovered from the cemetery at Mission Santa Catalina de Guale reflects the communication of traditional values associated with culturally salient colors.

Hudson (1976) suggests that the peoples of the Southeast shared associations between specific colors and social values. Bright or warm colors, such as red, white, and perhaps sky blue, possessed positive connotations. Red was linked with blood, life, and success, while white was linked with warmth, peace, and happiness. Darker colors, such as blue, purple, and black, represented asocial or negative traits. Blue and purple signified trouble or defeat, while black was associated with death, liminality, and the souls of the departed (Hudson 1976:132). If the hypothesis is correct, one may speculate that the inclusion of red and white beads in Guale grave goods assemblages represented elevated social status while alive and/or attempts by survivors to
extend the colors’ positive qualities into the afterlife, whereas the inclusion of black beads may have served as recognition of the deceased’s biological and social death(s).

The beads assemblages from 79 burial contexts were recoded according to five linguistically attested Muskogean color groups (i.e., black, white, red, yellow-green, and blue) (Kay 1975:260-261) and statistically analyzed using correspondence analysis. The most informative axes produced by the correspondence analysis explain 76.5 percent of the observed variance between the five colors categories, which are separated by relatively large Mahalonobis distance supporting not only their cultural salience but also evidencing preference between them. The data points produced by the correspondence analysis have been coded by date of interment, sex, and age of the deceased in order to identify potential relationships between known determinants of social identity and color. Graphically, only date of interment demonstrated any potential for patterning. However, chi-square tests for independence produced p-values less than 0.01 for each of the three demographics indicating that non-random patterning is present although not easily interpretable.

Potential Explanations of Observed Color Patterns

I propose that diachronic change in bead color preference may have resulted from social aggregation at Mission Santa Catalina in the late seventeenth century following increased incidences of violence along the Guale Coast (Blair 2015b:3; Bowne 2005:78; Worth 1995:197-198, 2007:19). Although color preference may represent regional variation in religious symbolism as originally hypothesized, the variation might also be attributable to persistent ethnic or community identities associated with individual towns. As originally suggested by McLamb
(2000) and Wiegand (2013), bead colors may have acted as referents to individual polities and been used to visually communicate sociopolitical affiliation.

Ultimately, such a conclusion remains purely conjectural at this point in time. In order to better assess the validity of the newly hypothesized political symbolism, additional data is required. Future research would benefit by incorporating measures of social and biological relatedness. Previous research by Blair (2015b) has identified a number of distinct bead-consuming communities present at Mission Santa Catalina de Guale during the seventeenth century. Recoding the existing color relationships in terms of these communities may provide additional insight into social values associated with black, white, red, yellow-green, and blue. Additionally, comparison with the results of Guale biodistance analyses (e.g., Stojanowski 2006; see also Stojanowski 2001, 2003, 2005a, 2005b; Stojanowski et al. 2007) would likely prove useful in determining whether or not these color categories bear any relation to Guale matrilineages or other kin affiliations.
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