BIOARCHAEOLOGICAL ANALYSIS OF A HISTORIC NORTH CAROLINA FAMILY CEMETERY

by

Madison Long

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Director of Thesis: Dr. Megan Perry

Major Department: Anthropology

The Gause Cemetery at Seaside, located in Sunset Beach, North Carolina, purportedly contains members of a wealthy and influential planter family, the Gauses, who died during the late 18th and early 19th centuries. In 2017, a Gause descendant requested excavation of the cemetery by East Carolina University as part of an extensive genealogical project that will culminate in the reburial of the human skeletal remains. During the first season of excavation, three adult individuals were recovered from the cemetery, and excavation in 2018 uncovered five additional graves containing seven individuals. Six out of the seven individuals recovered in 2018 are subadults, one 6-8 years of age, one 7-8 years of age, another 1.5 years old, and three term infants. All individuals at the site display skeletal evidence of childhood non-specific stress indicators, such as linear enamel hypoplasias in the adults and children, and/or periostitis or porotic hyperostosis in the children. This evidence, along with the simultaneous burial of two of the newborns and the 6-8 year old child in the same grave possibly due to a disease epidemic based on historical evidence, suggests that even “elite” 18th and 19th century landowning families experienced childhood frailty in North Carolina.

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By

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APPROVED BY:

DIRECTOR OF THESIS: ______________________________
(Dr. Megan Perry)

COMMITTEE MEMBER: ______________________________
(Dr. Charles Ewen)

COMMITTEE MEMBER: ______________________________
(Dr. James Loudon)

CHAIR OF THE DEPARTMENT OF ANTHROPOLOGY: ______________________________
(Dr. Randy Daniel)

DEAN OF THE GRADUATE SCHOOL: ______________________________
(Dr. Paul Gemperline)

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CHAPTER ONE:

INTRODUCTION

Overview

The Gause family is remembered as a wealthy and influential component of the planter elite of Brunswick County during the late 18th and early 19th centuries. Multiple Brunswick County sites are connected with this historic family, including Gause Landing and Gause Manor (Carson 1999). Furthermore, there are two known burial sites in the region associated with the family during the 18th and 19th centuries. The first is the Gause Tomb, which is located near Ocean Isle Beach, NC and is thought to date to the 1830s. The second burial site is the Gause Cemetery at Seaside, located in Sunset Beach, NC and can be dated to between the late 18th and early 19th centuries. It is the latter of these two burial sites on which the current research is focused.

The Gause Cemetery at Seaside has become a recent site of interest for Gause family descendant J.R. Robinson. At the request of Mr. Robinson, an initial field season of archaeological work was conducted in 2017, during which three graves were excavated for study (Quintana 2019). Although there is no record of who was buried in the Gause Cemetery, historical documents (i.e. census and land records) and a formal osteological study of the human remains may provide insight into this matter. The current project builds upon the initial field season in 2017 with the excavation and bioarchaeological analysis of five additional burials in 2018, along with supplementary research on 18th and 19th century plantation lifeways and the Gause family itself. The analysis includes the archaeological context of the cemetery in addition to the osteological study of the skeletal remains in an effort to understand more about the identity and lived experiences of those buried in the cemetery, and to contribute more broadly to the knowledge of late 18th and early 19th century landowners on the coast of North Carolina. The purpose of this study is to explore the individual and group identities of those interred at the Gause Cemetery through the construction of osteobiographies via archaeological and osteological analysis of the cemetery, human remains, and relevant historical documentation.

Intellectual merit

Currently, there are few bioarchaeological studies that have focused on elite plantation-owning families in the southeastern United States (Seeman 2011; Quintana 2019; Rathbun & Scurry 1992; Little et al. 1992). Although the sample size gathered through this particular research project is small, much information has been gained on 18th and 19th century health among planter families of the rural southeastern U.S. and adds to the dearth of studies focused on this demographic. The osteological study of the human remains coupled with archival work places these remains in their broader context and allows for the inclusion of this small sample within a growing, overarching sample that consists of the individuals from multiple bioarchaeological studies of human remains associated with 19th century American plantations.

The participation of the landowner and Gause family descendant, J.R. Robinson, throughout the research process underscores myriad advantages to be gained from collaborative research, along with unique angles from which to interpret and analyze the archaeological material. First, the active role taken by Mr. Robinson in the project provides a positive example of collaborative bioarchaeological research between academic bioarchaeologists and an interested, supportive descendant community. Additionally, the involvement of Mr. Robinson in the project allows for the exhumed remains to be analyzed with the inclusion of the point-of-view held by a familial descendant who possesses information of family history and lore.

Broader impacts

This research has the immediate impact of helping J.R. Robinson learn more about his ancestors from the Gause family. In its capacity as a potential genealogical research tool, the bioarchaeological research undertaken during this project stands as an example of the individual-level information that can be gained through the study of archaeological and osteological remains. Furthermore, the combined use of traditional genealogical research with osteological analysis demonstrates the unique data that can be garnered for a family, or even an individual, through the construction of osteobiographies. Osteobiography, or the contextualized interpretation of skeletal remains in order to better understand an individual's life history, is a particularly effective method for understanding bioarchaeological data from small sample sizes (Boutin 2012). Information of this variety for the Gause family is of much interest to Mr. Robinson, and his continued involvement and interest in the project illustrates the benefits to both the research and the descendant community when a collaborative model is adopted from the outset of a bioarchaeological project. The research will also become a useful tool for those people who are interested in the history, archaeology, and osteology of Brunswick County, NC, allowing it to become a resource for further research into the area's history.

CHAPTER TWO:

BACKGROUND

Historical background

Historical documents and family lore both indicate that the Gause family lived in Horry County, South Carolina before some members of the family moved north to Brunswick County, North Carolina prior to the onset of the Revolutionary War (Carson 1999; Berry 1988). According to Berry (1988), a 1751 deed details the exchange of 400 acres of land between Nathan Frink and William Gause, Sr. in Horry County, SC. This deed describes the aforementioned William Gause, Sr. as an Inn Keeper (Berry 1988). This exchange was promptly followed by the movement of Frink and "several of William Gause's sons" to what is present day Brunswick County, North Carolina (Berry 1988).

The presence of the Gause family in Brunswick County, NC is well documented in historical records. For example, land grant number 383, which was issued in December 1798, details the acquisition of 150 acres of land "beginning at a post white oak Bull Pond and Cherry Tree Branch" by a Charles Gause. Similarly, a land grant dating to October 1811 describes 250 acres of land being granted to a Bryant Gause that was located "on the S side of Caucau beginning at a pine." One final example is a land grant for John Gause, Sr. that was entered in June of 1788. This granted John Sr. 50 acres of land on the Shallot River. In addition to land grant records, the federal censuses of 1790 through at least 1830 demonstrate the presence of the Gause family in Brunswick County, North Carolina. In 1790, seven Gause heads of household are listed in Brunswick County. This includes Benjamin, Charles, Susanna, Bryant, John, Needham, and William, Jr. It is thought that these seven individuals are the children of the Inn

Keeper William Gause, Sr., who lived in Horry County, SC (Berry 1982). Including these heads of household, a total of 38 Gause family members are recorded as living in Brunswick County at this time. A total of 105 enslaved peoples were owned between these seven households, with William Gause, Jr. owning the highest number of slaves at 37.

After members of the family moved to North Carolina, many served in the Revolutionary War. Family lore and local histories suggest that at least four Gause sons served as Patriots in the Revolution, including John, Needham, Charles, and William, Jr. (Berry 1996; Berry 1982). Additionally, historical records indicate that Benjamin Gause served as a private in Willett's New York regiment, and that Charles Gause was a captain in the militia by 1780. Although records of his enlistment were not found, William Gause, Jr. is discussed in family lore and local histories having been a well-respected Revolutionary War veteran who lost one of his legs in the conflict (Robinson, pers. comm. 2018; Berry 1982). Regardless, the status of the Gause family immediately after the Revolutionary War is attested through direct historical documentation. President George Washington chronicled a visit to William Gause, Jr. on Tuesday, April 26, 1791 during which he breakfasted at the Gause residence (Berry 1996). Multiple male members of the Gause family also served in the War of 1812, as indicated by historical records of soldiers serving under Captain John Gause in the North Carolina militia, and of soldiers serving under a Captain Benjamin Gause in the South Carolina militia.

In addition to many Gause family member's service in the Revolutionary War and the War of 1812, the status of the Gause family in North Carolina is attested to via historical records as well. Records of court minutes from 1778 indicate that Needham Gause and William Gause (no suffix given, but probably William, Jr.) served as a freeholder and Justice of the Peace, respectively, in the Brunswick County Court of Magistrates and Freeholders (North Carolina

Magistrates and Freeholders Court, 375-376). Furthermore, Needham and William Gause (no suffix given) are both documented as Brunswick County representatives in the North Carolina Provincial Congress' "Ordinances of Convention, 1776" (North Carolina Provincial Congress, 985-1000). The fact that members of the Gause family held these positions is suggestive of their presence and high-status in local society. Additional information from wills can demonstrate the material wealth held by the Gause family during the 19th century. For example, the will of John J. Gause, dating to May 3rd, 1836, indicates his son John P. Gause was willed his father's gold watch, chain, and seal, while a second son, whose name has been lost to stains on the documentation, was willed a set of silver table spoons. John J.'s daughters were each willed a bed and furniture, while one was willed a set of table spoons along with the instructions that the spoons be engraved with her initials. Finally, further evidence comes from the will of Charles Gause, which dates to August 27th, 1806. In his will, Charles bequeathed a total of eight hundred acres of land, split between one of his daughters, a step-daughter, two granddaughters, and one grandson.

Two known burial sites are associated with the Gause family during their time in Brunswick County – the Gause Tomb and the Gause Cemetery at Seaside. The Gause Tomb is located in Ocean Isle Beach, Brunswick County, North Carolina and is likely the same tomb that was willed by John Julius Gause, son of John Gause, in May 1836. In his will, John Julius instructs that, "a sum sufficient to build a family vault for the interment of my remains and that of my family" be extracted from his net worth at death, and he requests that his body be placed with those of his two wives until the new vault could be built "at the old family ground on the plantation late the residence of Samuel Gause, deceased" (Berry 1982). This sum of money was to be taken from John J.'s wealth at the time of his death. John Julius also requests that the remains of his children that were either buried in an earlier family vault, either in the Seaside cemetery or elsewhere, also be reinterred within the new vault once it was constructed.

The second burial site associated with the Gause family is the Gause Cemetery at Seaside (GCAS), located in Sunset Beach, Brunswick County, North Carolina (Figure 2.1). The GCAS does not have similar historical documents linking its use specifically to the Gause family; however, family lore and local historians all associate the cemetery with the Gause family, and the site is even labeled as "Gause Cemetery" on Google Maps (Google Maps 2019). While it is possible that this small cemetery is the old burying grounds to which John Julius refers in his will, it is not conclusive. The GCAS is the site on which the current project is focused.

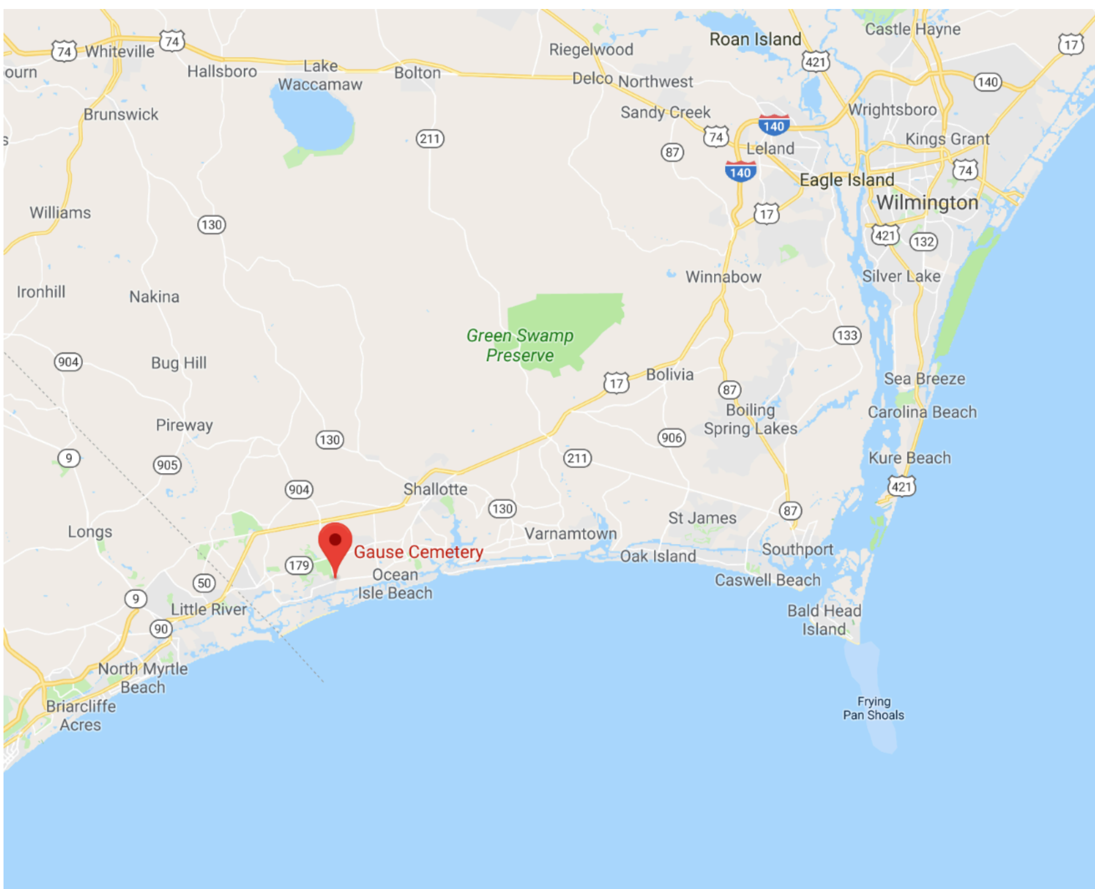

Figure 2.1: Google Maps location of the GCAS

The Gause Cemetery at Seaside was surveyed by Dan Pezzoni and the North Carolina State Historic Preservation Office in 2009. The survey report indicates that six rectangular brick tombs were visible above the ground surface, and that one of these tombs had a mortar inscription block associated with it that included a “barely legible 1830s date” (North Carolina State Historic Preservation Office 2010). A date range of ca. 1800-1900 was given for the cemetery site in the report.

The first full archaeological field season at the Gause Cemetery took place in 2017 at the request of J.R. Robinson, and was conducted by faculty and students from East Carolina University (ECU). The 2017 project formed the basis for ECU student Jorge Quintana’s MA thesis. Four burials were excavated during this fieldwork (graves 1, 2, 6, 8), three of which contained human remains (graves 2, 6, 8). It was determined early on that grave 1 had been misidentified, and this was confirmed based on further excavation of grave 1 during the 2018 field season. The initial fieldwork determined that the cemetery layout consisted of three rows running from north to south, with the burials oriented from east to west according to traditional Christian burial custom.

Osteological analysis indicates that one adult female and two adult males were exhumed (Table 2.1). Artifacts recovered in association with the skeletal remains include coffin wood, nails, metal clothing fasteners, and buttons. The coffin wood was poorly preserved and therefore original coffin shape could not be determined, but enough remnants were recovered to allow for analysis of the wood type. Coffin wood fragments excavated during the 2017 field season at the GCAS were sent to Dr. Peszlen and the Department of Forest Biomaterials at North Carolina State University for identification. Samples from Grave 2, Grave 6, and Grave 8 were all found to belong to southern yellow pines based on microscopic images (Peszlen, pers. comm.). Pine was commonly used for coffin construction during the early 19th century due to its easy ability to work (Rodman et al. 2000). The nails were also poorly preserved and highly corroded; however, identification of the nails as machine-cut was possible. This type of nail was used starting in the late 18th century through the mid-to-late 19th century, thus indicating a date range for the three burials from which they came (Hume 1974). A total of 12 buttons were recovered, 11 of which were made of bone, and one made of shell. Using South's (1964) button typology, Quintana determined that buttons of type 22, type 19, and type 15 had been found. However, two of the buttons did not match any of South's (1964) types (Quintana, pers. comm. 2019).

Table 2.1: Biological information of individuals analyzed during 2017 GCAS project (Quintana, 2019)

Grave	Skeletal Age	Estimated Sex	Estimated Ancestry	Estimated Stature	Observed Pathologies
2	30-39 years	Male	European	66.9"-71.7"	Antemortem tooth loss (AMTL), dental abscesses, dental enamel hypoplasias (DEH), osteophytic lipping of vertebrae, Schmorl's nodes, mastoiditis
6	25-34 years	Female	European	61.6"-66.7"	AMTL, dental abscesses, DEH, occipitalization of 1st cervical vertebra (congenital condition)
8	20-25 years	Male	European	70.3"-75.2"	AMTL, dental caries, DEH, *os calcaneus secundarius* (congenital condition)

Further bioarchaeological investigation of the Gause Cemetery at Seaside was deemed necessary for many reasons. First, Gause family descendant and landowner J.R. Robinson wanted more of the graves in the cemetery to be excavated and any remains recovered from within to be analyzed. This would not only increase the overall sample size of individuals from the cemetery, but would also provide the opportunity to further address some of the key research foci of interest to both Mr. Robinson and the archaeological team at ECU. One of these major areas of focus for the 2018 field season was to narrow down the estimated date of use for the cemetery, likely through the recovery of dateable artifacts due to the complete lack of headstones at the cemetery. In addition to dating, the excavation of more graves would allow for more exploration into whether or not any evidence remained to be found that could more concretely link the cemetery to the Gause family. Finally, a larger sample of human skeletal remains would allow a clearer picture of the health and quality of life of the family.

Current date estimates for the cemetery come from family lore, local histories, and from the archaeological work done during the 2017 field season at the GCAS. The North Carolina Office of State Archaeology survey recorded a mortar capstone with a barely readable date on it beginning with "18." The number following this "18" is thought to have been a "3" but the surveyor notes that it could also have been a "5" (Pezzoni 2010). Either scenario would give the cemetery a date of at least the early-to-mid 19th century; however, the presence of a single incomplete date does not provide a date range. In general, the Gause Cemetery at Seaside is thought to date back to the 18th century, although no concrete evidence has yet been found.

The lack of a more concise date range is mostly due to the dearth of headstones or diagnostic artifacts in the cemetery (with the exception of a single incomplete capstone recorded in 2009) (Pezzoni 2010). When a cemetery is completely void of headstones, (bio)archaeologists use myriad other techniques to establish dates. Aspects of non-skeletal material culture that can be used for dating purposes are coffin shape, coffin hardware, an overall assessment of burial elaboration or décor, and the presence of historical artifacts. For example, analyses of burials from a small family cemetery in Maryland that date from 1736 to 1884 have allowed for Riordan and Mitchell (2011) to assess a pattern between time period and coffin shape. According to their study in a family cemetery in Maryland, rectangular coffins had the earliest dates, while hexagonal coffins were most common between 1820 and 1860 (Riordan & Mitchell 2011, 95). In addition, Rodman and colleagues (2000) suggest that rectangular coffins were meant to provide ambiguity regarding the coffin's contents and did not become widely used until the mid-19th century. Furthermore, they argue that rectangular coffins post-date hexagonal coffins at the 19th century Grafton cemetery in Illinois (Rodman et al. 2000). While temporal patterns of coffin shape can clearly be identified within sites, not all of these patterns match across sites in different geographic regions of the U.S., as seen between the different conclusions drawn by Riordan and Mitchell (2011) and Rodman and colleagues (2000). Therefore, coffin shape should be used in conjunction with other material culture in establishing a date for a cemetery.

Other methods of dating unmarked graves include analysis of coffin hardware, including handles, escutcheons, nails and coffin tacks. Coffin handles are seen as early as the beginning of the 18th century in North America; however, mass produced coffin handles are not documented until the mid-19th century (Springate 2015). Escutcheons are small decorative pieces that begin to appear during the mid-to-late 19th century (Springate 2015). Nails can often be dated based on their method of manufacture; for example, machine cut nails did not come into use until the 1830s (Rodman et al. 2000). Coffin tacks are also a decorative, rather than functional, coffin hardware that were used commonly before the mid-18th century to spell out information about the individual inside the coffin, including their initials and date of death (Springate 2015).

Additionally, ideological changes about death in North America, namely the Beautification of Death, manifested in burial practices can often be used in the dating of unmarked graves. The Beautification of Death took place during the 19th century and is characterized by a general upscaling of burials and an increase in decorative elements, including more elaborate burial clothing and grave markers (Little et al. 1992; Buikstra 2000). The Beautification of Death reached its height during the mid-to-late 19th century. Prior to this shift, burials were only lightly adorned, if at all, and were usually simple in nature. Analysis of the mid-19th century to early 20th century Weir Family Cemetery in Virginia provides an example of these material changes (Little et al. 1992). Here, the pre-Beautification of Death lack of elaboration characterizes the burials dating before 1843. Beginning in the burials dating to the 1850s, Little and colleagues (1992) note an increase in coffin décor including white metal coffin screws, caplifters, handles, decorative metal, escutcheons, and glass viewing plates. This increase in burial elaboration is seen continually in the Weir family graves through the end of the cemetery's use during the first decade of the 20th century (Little et al. 1992). A similar overall increase in coffin hardware is seen by Woodley (1992) in burials from the Stirrup Court cemetery in Ontario. Although this cemetery is not located near the GCAS, its demonstrated pattern of coffin hardware suggests that the changes to burial practices associated with the Beautification of Death took place across North America. Because the graves in the GCAS are unmarked, many of these dating methods are likely to be used. However, the cemetery's location in the South may render many of the patterns of burial changes less precise due to the persistence of family burial grounds, rather than community burial grounds, in the rural South (French 1974).

Bioarchaeological background

While the mortuary landscape and historical artifacts can provide information about the dates of use for the cemetery, bioarchaeological methods will provide information regarding the lived experiences of the individuals disinterred through the creation of biological profiles, or osteobiographies.

Biological profiles are composed of demographic information including age, sex, ancestry, stature, and observed skeletal pathologies established using standard bioarchaeological methods from Buikstra and Ubelaker's *Standards For Data Collection From Human Skeletal Remains* (1994). For complete adult skeletal remains, age is primarily estimated using the pubic symphysis and the auricular surface of the os coxa. Morphological changes on both the pubic symphysis and auricular surface have been standardized (Brooks & Suchey 1990; Todd 1921) in order to allow for accurate age estimations to be made using increasing stages of wear (Buikstra & Ubelaker 1994). If the os coxae are not present, the observed degree of cranial suture closure can also be used to estimate age-at-death (Buikstra & Ubelaker 1994). Age-at-death estimates for subadult remains can be more specific than for adult remains due to the ongoing state of development during the subadult years. Age estimates for subadults are primarily established by examining the stages of dental development, including crown and root formation and eruption (Buikstra & Ubelaker 1994; Scheuer and Black 2004). Another method of obtaining age estimates for subadults uses the observed stages of epiphyseal union in an individual (Buikstra & Ubelaker 1994; Scheuer and Black 2004). Accurately estimating age-at-death for skeletal individuals allows for important demographic information to be obtained for an archaeological population so that evidence of mortality rates across the life-course can be explored both within the population and comparatively between populations from other sites.

Estimating sex for adult skeletal remains is done primarily through analysis of several sexually dimorphic features of both the os coxae and the cranium (Buzon et al. 2005). Features analyzed in the os coxae include the ischiopubic ramus ridge, the ventral arc, and subpubic concavity. Each of these features are scored on a scale from one to three, with one being more female and three being more male. A fourth feature of each os coxa, the greater sciatic notch, is scored on a scale from one to five, with one being the widest and most female, and five being the narrowest and most male (Buikstra and Ubelaker 1994). Sexually dimorphic features of the cranium are analyzed on a scale from one to five, with one being less robust and more female, and five being more robust and more male (Buikstra & Ubelaker 1994; Buzon et al. 2005). Sex is generally not estimated for subadults because these bones have not yet developed enough to discern sexually dimorphic variation. Although some scholars have tried to apply methods such as analyzing differences in the auricular surface of os coxae (Mittler & Sheridan 1992), there is no accepted or standardized methodology for sex estimation in subadults (Buzon et al. 2005). Despite the lack of sex assessment in subadults, sex estimations for adult remains provide valuable demographic information for the population, as well as a basis for applying methods of estimating and interpreting ancestry and stature. Ancestry and stature in recent historic and modern individuals can both be estimated using measurements of skeletal remains, especially long bones, and FORDISC software (Ousley & Jantz 2005). Estimations of stature in particular allow for bioarchaeologists to better understand rates of growth for comparative purposes within and between contemporary populations.

Skeletal pathologies are also recorded using the standards set forth by Buikstra and Ubelaker (1994). Within the dentition, pathologies such as caries, dental enamel hypoplasias, and antemortem tooth loss can be observed and analyzed. Dental caries, a disease caused by demineralization of dental tissue, can inform on the diet of an individual, as different types of foods, such as those high in sugar, can lead to higher rates of carious lesions (Šneberger & Pankowská 2014; Hillson 1979). Additionally, studies of living populations have shown that rates of carious lesions change according to age (Hillson 2001). Dental enamel hypoplasias (DEHs), or stress-induced deficiencies in enamel formation, provide insight into periods of stress experienced during childhood (Goodman & Rose 1990). Antemortem tooth loss (AMTL), the loss of a tooth prior to death, is indicated by bone regrowth in the alveolar socket. AMTL can be caused by myriad pathologies, including periodontal disease and the prior presence of dental wear or carious lesions. Therefore, AMTL can offer information regarding an individual's diet and overall dental health (Lukacs 2007).

Outside of the dentition, skeletal pathologies consist of abnormal bone formation, abnormal bone growth, and/or abnormal morphological changes to bone. The assessment of pathologies on bone can provide evidence for stress and/or disease experienced by a single individual, as well as shed light on patterns of disease and stress within entire archaeological populations (Buikstra & Ubelaker 1994). Beyond providing health related information for the study population, rates of disease and stress as indicated by skeletal pathologies are useful for comparative purposes across archaeological sites and allow for broader trends to be viewed across larger regions and throughout time. Many skeletal pathologies – including porotic hyperostosis (abnormal porosity due to diploic expansion occurring on the cranium) and cribra orbitalia (porotic hyperostosis occurring specifically within the orbits of the frontal bone), or periostitis or osteitis – have many potential causes, such as nutritional deficiency and infectious diseases, and anemia in the cases of porotic hyperostosis and cribra orbitalia (Buikstra & Ubelaker 1994). Therefore, it is often difficult to determine specific etiologies for observed skeletal lesions. However, certain types of pathologies can be better linked to specific diseases through the process of differential diagnosis. An example of this is seen with specific groupings of morphological changes in the ribs, including flaring of the sternal end and lateral straightening of the body, which are together often linked to rickets (Ortner & Mays 1998). Similarly, lesions specifically indicative of arthritis are common among archaeological skeletal populations, and include abnormal bone formation in the form of lipping, abnormal porosity, and eburnation (a polishing of the bone caused by degenerated cartilage between bones) (Buikstra & Ubelaker 1994). In order to better contextualize skeletal pathologies, it is important to understand what diseases and potential causes of stress were prominent in the region and time period under study; for the GCAS this is the southern United States during the 18th and 19th centuries.

In general the United States South was host to many diseases during the 19th century. Some of the most prominent diseases in the region during this time period include tuberculosis, typhoid, scarlet fever, malaria, and yellow fever (Lambert 2006). For example, a yellow fever epidemic is recorded for Wilmington, North Carolina in 1821 (Patterson 1992). It has been noted by both current scholars and contemporary historical physicians that malaria and yellow fever in particular were known to have more drastically affected European Americans as opposed to individuals of African descent (Lambert 2006). Warren (1997: 30) further highlights this discrepancy by noting that death rates during the mid-nineteenth century in Savannah, Georgia for white individuals were significantly higher than for black individuals during the late summer, and thus, during the peak season for malaria and yellow fever. This is an important distinction when interpreting the potential causes of death, or diseases experienced, of the European American individuals from the Gause Cemetery at Seaside, especially when making comparisons to bioarchaeological analyses of historical African American cemeteries. Therefore, skeletal remains from the GCAS will be analyzed with specific awareness of pathological indicators of such diseases common in the South during the 18th and 19th centuries.

Although the presence of pathology on the bones indicates that an individual experienced stress in life, from either disease or nutritional deficiency, it is difficult to make interpretations regarding the overall health of skeletal individuals or populations because of the osteological paradox. Several issues with the study of skeletal remains regarding health identified by Wood and colleagues (1992) are collectively termed the "osteological paradox." The first of these issues is the concept of demographic nonstationarity, which refers to assessing age-related mortality patterns in populations that are not static in terms of migration and growth rate. In nonstationary populations, distributions of age-at-death are more reflective of a population's rates of fertility rather than its rates of mortality. The second conceptual issue included in the osteological paradox is the idea of selective mortality. This refers to the biased samples of each age group found within a bioarchaeological population due to the fact that the only individuals of each age group available for study are those who died at that given age. In other words, selective mortality begs the question of whether the presence of skeletal pathology indicates an unhealthy individual who acquired a disease, or a relatively healthy individual who did not immediately succumb to death by the disease (Wood et al. 1992). Finally, the last concept subsumed within the osteological paradox is the notion of hidden heterogeneity in risks. This concept states that bioarchaeological populations are derived from "an unknown mixture of individuals who varied in their underlying frailty or susceptibility to disease and death" (Wood et al. 1992, 345). Therefore, interpretations of skeletal remains, especially regarding observed pathologies, should be done with consideration of all of the issues of the osteological paradox.

One method of interpreting for archaeological skeletal remains is osteobiography. This method has been widely applied throughout the field of bioarchaeology since Saul (1972) first defined it over four decades ago. A more recent definition of osteobiography was proposed by

Boutin (2012), who describes osteobiographical methods as a way of pursuing, “the meaningful interpretation of skeletal material in its archaeological contexts with the aim of reconstructing life histories as recorded in bone” (Boutin 2012: 112). The prime component of an osteobiography is detailed information about a single individual that is gained through osteological and archaeological methods via the skeleton and place of interment, respectively (Stodder & Palkovich 2012). The data gained from unique osteobiographies can be applied to studies of larger communities and populations as is often the focus of research in biological anthropology (Milhanovic et al. 2017; Buikstra et al. 2012); however, the focus on the individual situates osteobiography as a suitable method for exploring the identities of past peoples at the individual level (Boutin 2012). Osteobiographies are generally comprised of basic biological profile information that can be inferred from the skeleton, including age-at-death, sex, stature, ancestry, and any evidence of pathological conditions (Milhanovic et al. 2017). However, of key importance in osteobiography is the interpretation of this biological information in the appropriate context, which can be better understood through the both the archaeological and historical background of the skeletal individual (Boutin 2008). This importance of contextual interpretations of skeletal remains is further espoused by Buikstra, Baadsgaard, and Boutin, who argue that, “understanding the culture and society of interest is indispensable when considering human remains and mortuary contexts” (Buikstra et al. 2012).

There are many examples of using osteobiography as a method for interpreting human skeletal remains. One example comes from Mihanović and colleagues (2017) in their osteobiographical interpretation of the skeletal remains purported to belong to Saint Paul the Confessor. This particular case study highlights the benefits of osteobiographical interpretations of biological information obtained from the skeleton in situations where invasive analytical techniques, such as DNA or isotopic analysis, is not allowed. Noninvasive bioarchaeological methodology allowed for the creation of a biological profile including sex, age, ancestry, occupation, and social status which were then contextualized using historical data and led the authors to challenge previous assertions and conclude that the skeletal remains likely, though not definitively, belonged to St. Paul (Mihanović et al. 2017). Another example of the osteobiographical method of interpretation comes from Castro and colleague's (2017) analysis of the skeletal remains of a 15-19 year old female who was buried in the Chontal region of Oaxaca, Mexico between the 14^{th} and 16^{th} centuries CE. These remains represent the only excavated human skeleton from this region to date, thus providing a unique opportunity to learn about diet, disease, and activity through contextualized analysis of biological data from the bones. For example, stable isotope analysis and observed dental caries suggested to the authors that this individual's diet was high in maize. Additionally, pathologies on the individual's vertebrae indicated to the authors that she experienced infectious disease in life, possibly tuberculosis based on the sedentary lifestyle and increase in population that was occurring in Oaxaca during the relevant time period (Castro et al. 2017). This case study underscores the benefits of using osteobiography to explore the lived experiences of a single individual through the archaeological contextualization of their skeletal remains. While several examples of osteobiography exist, there is a noticeable lack of applications of this method to human remains excavated in the United States, especially from the historic period. Therefore, the use of osteobiographical interpretation in the analysis of those disinterred from the Gause Cemetery at Seaside will demonstrate the usefulness of this method to better understand smaller archaeological skeletal populations from the 18^{th} to 19^{th} centuries in the colonial and early federal periods of the U.S.

CHAPTER THREE:

METHODS

Excavation

The Gause Cemetery at Seaside is located in Sunset Beach, North Carolina on a small plot of land that is owned by Gause family descendent J.R. Robinson. The site sits within a suburban neighborhood and is bordered by paved roads on all sides. The cemetery in its current state is surrounded by a small modern wooden fence; however, it is thought that its size once exceeded that which remains today.

Archaeological excavation took place between May 29th, 2018 and June 8th, 2018. A secondary datum point established and marked during the 2017 field season was used continuously throughout the 2018 field season to take all elevations. This datum was on the corner of a bench ("bench datum") within the fenced in portion of the cemetery and was chosen for convenience in recording elevations for the graves without encountering any trees or foliage (Figure 3.1). Mapping of newly identified and numbered graves (graves 9, 11, 12, and 13) used a Sokkia 10 Total Station with the USGS marker for "Seaside 1934" as the datum (33° 53' 36" N, 78° 29' 8" W). The USGS marker was given an arbitrary designation of 500N/500E, and all of the grave coordinates are recorded relative to this point (Table 3.2). Additionally, the bench datum was located at 496.71N/378.41E. Adding these points to those taken during the 2017 field season has culminated in an up-to-date map of the site that includes the location of all identified graves relative to the USGS marker (Figure 3.2). All elevations were taken from the bench datum point, but are recorded in relation to a "below surface" reference point. This "below surface" point was established as the point on each grave's brick surface with an elevation closest to the elevation of the bench datum. After the below surface point was established for each separate grave, all successive elevations were converted into, and recorded as, feet below this point.

Figure 3.1: Image of GCAS with location of "bench datum" marked

Table 3.1: Total Station coordinates for Graves 9, 11, 12, and 13

Grave	SW corner	NW corner	NE corner	SE corner
9	508.78N/388.48E	510.72N/388.76E	510.11N/393.37E	508.27N/393.18E
11	484.19N/399.64E	486.00N/399.85E	485.47N/403.35E	483.74N/403.28E
12	481.67N/399.00E	483.23N/399.24E	482.80N/402.87E	481.27N/402.78E
13	N/A	480.52N/399.09E	480.12N/402.56E	478.46N/402.53E

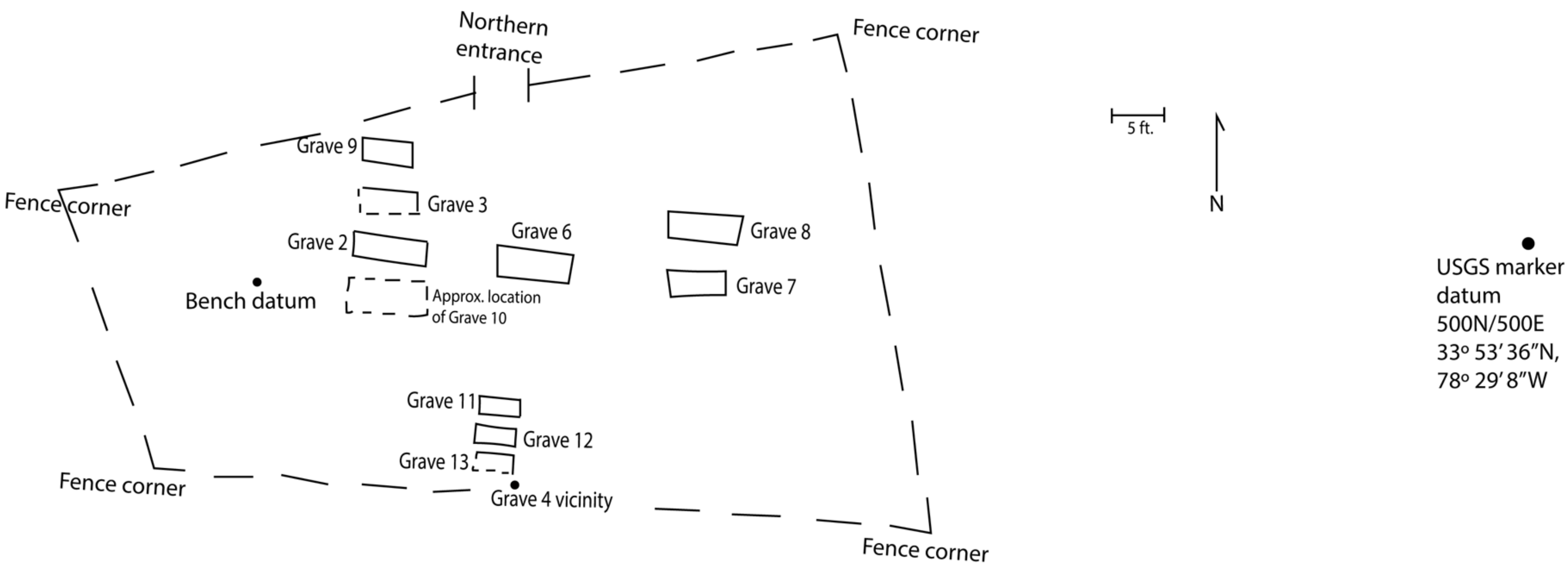

Figure 3.2: Site map for GCAS including location of identified graves

Graves were identified by the existence of a brick superstructure visible on or just below the ground surface (Figure 3.3). Graves were selected for excavation based on whether or not they had already been identified or excavated during the 2017 field season, and based on the presence of a visible brick superstructure. Excavation generally was feature-based, focusing on the immediate exterior and the interior of each brick rectilinear structure. The grave first was denuded of any plant material and any loose and/or displaced bricks removed, if necessary. Trowels were used to further expose the outer edges of this brick structure, and soil within the interior was removed down to the bottom of the bricks. In the previous season, it became clear that the actual grave shaft exceeded the dimensions of the brick rectilinear structure (Quintana 2019), and thus this season we proceeded to remove the brick feature and identify the grave cut before continuing vertically. Once the grave cut was delineated, shovels and trowels were used to remove soil at arbitrary levels (usually ca. 10-15 cm) until either bone or coffin wood emerged. Upon reaching the top of the coffin and surrounding grave fill, all soil was sifted. Each grave was next divided into roughly the western and eastern halves, which were then excavated one at a time. After documenting each half through photography and plan drawings, the artifacts, coffin wood, and bones were removed. Artifacts were placed within labeled plastic bags and both wood and bone were stored in mesh bags, with labels included inside, so as to allow for the materials to dry out. Soil samples were taken below the abdominal/pelvic region of the body for Grave 3 and Grave 10 – Burial 1. After the excavation of each grave was completed, the burials were backfilled with both the removed soil and the bricks from original structures.


Figure 3.3: Visible brick superstructure used for grave identification, Grave 3

Osteological methods

All materials recovered during the 2018 field season were brought to the East Carolina University Bioarchaeology Lab for analysis. Buikstra and Ubelaker's *Standards for Data Collection from Human Skeletal Remains* (1994) was used for inventorying the remains, and for recording skeletal pathologies, measurements, epiphyseal closure, dental pathology, dental measurements, age, and sex estimations (when each was possible and/or appropriate).

Prior to inventory and analysis, all of the skeletal remains were cleaned using dry brushes and wooden picks. The skeletal remains of each individual were recorded separately, with the exception of the single case of commingled remains from Grave 10 – Burial 2. The remains from Grave 10 – Burial 2 were recorded using Buikstra and Ubelaker's inventory form for recording commingled remains (1994). The overall preservation levels for the skeletal material was consistent across the sample. The bones were moist upon recovery, and were therefore initially stored in aerated bags to allow them to dry out. Many of the bones adhered to pieces of coffin wood that were removed with brushes and picks during the cleaning process. Significant taphonomic processes had affected the skeletal remains, often making pathological assessment particularly challenging. These include penetration and damage by roots, surface exfoliation, and warped bones (likely due to a combination of moisture and pressure).

Measurements were taken of long bones from the left side when available; if the paired bone from the right side was in a more complete state of preservation then it was substituted for the left side. Cranial measurements were taken using sliding calipers and post-cranial measurements were taken using both calipers and an osteometric board. Age estimates for subadult individuals were made using dental development, and Moorrees et al. (1963) was used for assigning a range for the age-at-death. The age estimate for the adult individual was established through analysis of the auricular surfaces on the ilia of both the left and right os coxae combined with the degree of epiphyseal fusion on the sacrum and left clavicle. Stature of the single adult individual was estimated using FORDISC 3.0 and maximum length measurements of the left femur and left tibia, and stature was not estimated for any subadult individuals. Pathology was assessed using both the naked eye and a magnifying lens. The estimated ages of occurrence for the most prominent pathology – dental enamel hypoplasia – were arrived at using Goodman and Rose (1990).

Artifact inventory & conservation

Artifacts recovered from the site were also brought back to the East Carolina University Bioarchaeology Lab for cleaning and cataloging. Cleaning was done using dry brushes due to the material composition of the artifacts. The artifacts were catalogued using an adapted version of the artifact classification system of Stanley South (South 1977). The context (i.e. grave number), count, material, type, decoration, weight, dimensions, and any remarks were recorded when applicable (see representative portion of artifact catalog in *Figure X*). Additionally, the location of an artifact (i.e. west or east end) was noted during in-field bagging when possible. The larger pieces of coffin wood recovered were measured and weighed, along with the complete buttons and metal pins. The complete buttons and metal pins were also photographed, as was a representative sample of coffin wood, all of the decorated coffin lid, and a representative sample of nails.

One artifact, the large intact coffin lid from Grave 11, required conservation efforts. The lid consists of remnants of the coffin wood with copper-alloy tacks set into it that form a decoration consisting of the individual's initials and age-at-death. To conserve the pieces, a 1:10 solution of polyvinyl acetate (3.0g) to acetone (30ml) was brushed over the exposed wooden surfaces of the coffin lid and left to dry. The tacks were not treated with the solution. The process was completed a total of three times before the lid pieces were removed from atop the burial so that excavation of the remains could be completed. After conservation was complete, each coppery-alloy figure or letter in the decoration was measured for its maximum height and width, and each separate piece of the lid which had broken into eight pieces was weighed.

CHAPTER FOUR:

RESULTS

Excavation results

Grave 1

An area designated Grave 1, associated with a rectilinear brick surface feature covered by brick tumble, was partially excavated during the 2017 field season at the Gause Cemetery at Seaside, but it was determined to have been misidentified as a burial. However, further excavation in other burials during the 2017 field season led the team to recommend that Grave 1 be further excavated during the 2018 field season (Quintana, pers. comm.). Excavation of Grave 1 in 2018 involved horizontal clearing to determine a possible grave outline, which identified the outline of the backfilled area denoted as "Grave 1" from the 2017 excavation. A ca. 4ft. by 2ft. probe was excavated to a depth of 5ft. but did not identify any further evidence that this was a grave. Sterile soil was encountered once excavation reached a depth below the original 2017 probe.

Grave 3

The first grave excavated during the 2018 field season was Grave 3. As with the graves excavated in 2017, the brick surface structure did not extend all of the way down the shaft to the burial, but stopped at 0.9ft below the uppermost point of the brick surface (Figure 4.1). This preserved height was only four courses of brick (approximately 0.8ft from top to bottom), but it is possible that it was originally taller. Additionally, the brick structure was two courses wide on all four sides, although many displaced bricks lay around the two more intact courses. The outer extent of the feature measured 2.6ft N-S and 6.1ft E-W, while the space within the brick structure measured 4.6ft N-S and 1ft. E-W. The depth of the bottom of the coffin was 6.35ft below the uppermost point of the brick superstructure. The head of the individual within Grave 3 was facing west, with the body positioned supine with the arms and hands across the lower vertebrae/upper portion of the pelvis (Figure 4.2). A visible outline of coffin staining indicates that the original shape of the coffin was hexagonal. Additionally, much of the eastern half of the burial, from the pelvis down to the feet, was surrounded by coffin wood (Figure 4.2). The majority of the skeleton was present and recovered, with the main exception of the sternum and four of the carpals, one metacarpal, five tarsals, and many of both the manual and pedal phalanges. Artifacts recovered with the skeletal remains from Grave 3 include charcoal fragments (GCAS18-1), mortar fragments (GCAS18-9) (Figure 4.3), one sherd of prehistoric pottery (GCAS18-10), 59 nails (GCAS18-4, 5, 6, 7, 8) (Figure 4.4), and two bone buttons (GCAS18-2 and GCAS18-3). All of the nails are in a poor state of preservation with high levels of corrosion. The bone buttons are plain, with three holes each. The buttons are similar in size to each other, with one weighing 0.2g and measuring 12.2mm across (GCAS18-2) (Figure 4.5), and the other weighing 0.3g and measuring 12.16mm across (GCAS18-3) (Figure 4.6).

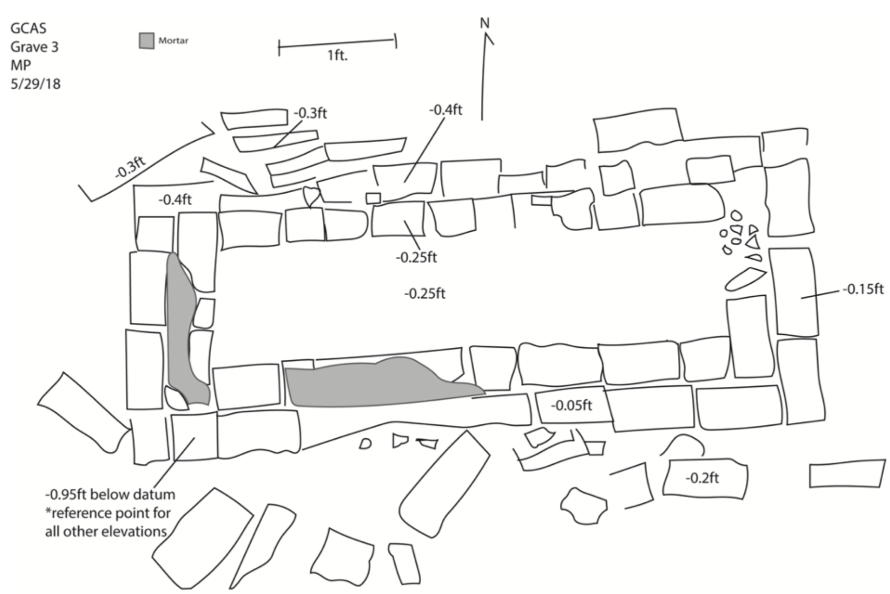

Figure 4.1: Brick structure associated with Grave 3, including elevations taken from the "bench" datum

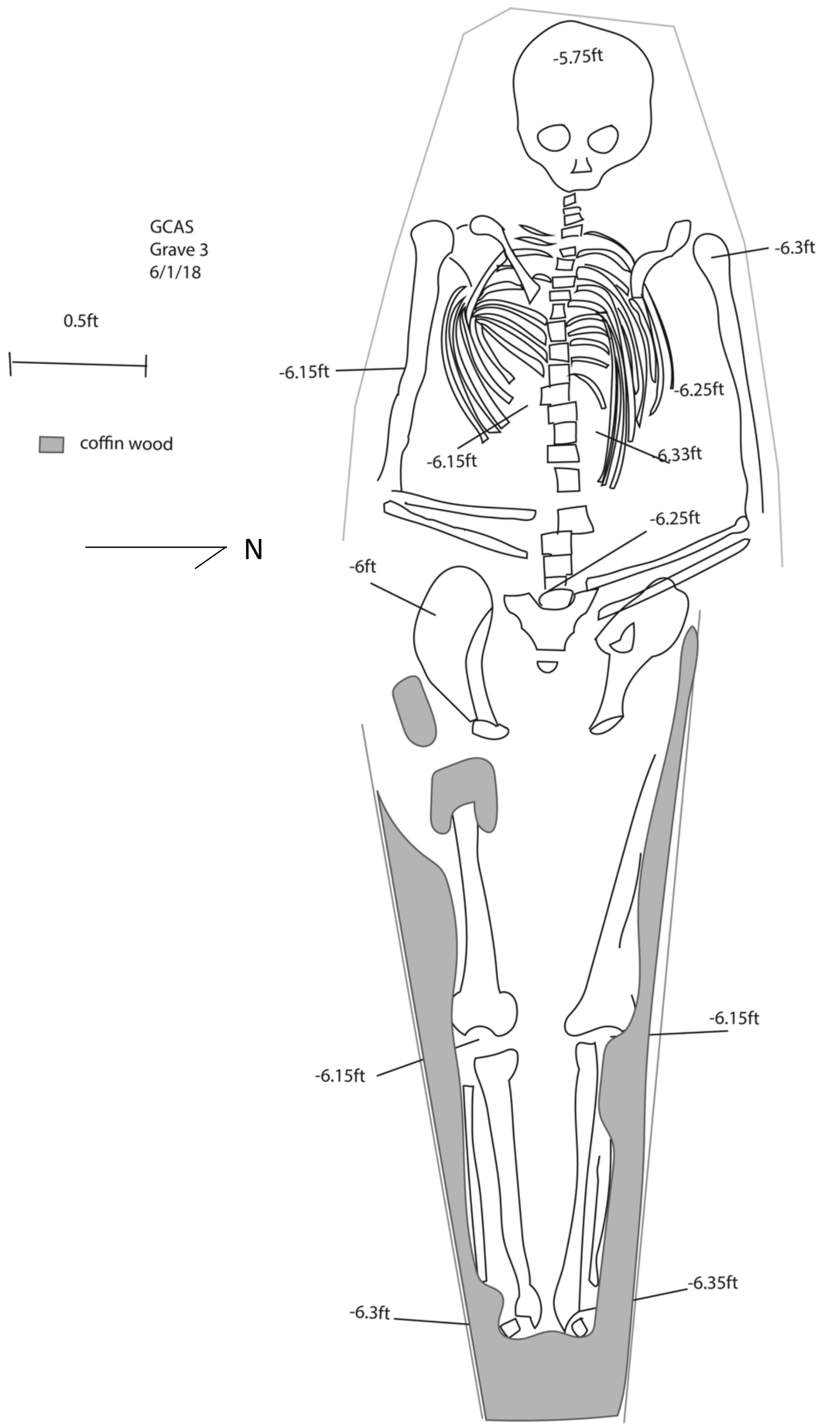

Figure 4.2: In situ skeletal remains of Grave 3, all elevations taken from top of extant brick structure

Figure 4.3: Mortar fragments recovered from Grave 3 (GCAS18-9)

Figure 4.4: Representative sample of nails from GCAS 2018, excavated from Grave 3

Figure 4.5: Three hole button excavated from Grave 3 (GCAS18-2)

Figure 4.6: Three hole button excavated from Grave 3 (GCAS18-3)

<u>Grave 9</u>

The brick structure for Grave 9 was three brick courses from top to bottom (approximately 0.5ft), and therefore the brick did not extend all the way down the burial shaft. The structure was two brick courses wide and mostly intact except for the northeastern corner. The outer course of the brick structure measured 4.25ft N-S and 2.15ft E-W, while the internal space within the brick structure measured 0.5ft wide and 3.4ft long. Some mortar remained on the top of the uppermost brick course on the southern side (Figure 4.7). The bottom of the burial was reached at 5.85ft below the uppermost point on the brick surface structure. The head of the individual from Grave 9 was facing west, with the body in a supine position and hands folded across the pelvic region (Figure 4.8). The majority of the skeleton was present and recovered, with the exception of the sternum and most of the epiphyseal ends of the long bones of both the arms and legs. No coffin wood or coffin wood staining was observed to indicate the shape of the original coffin, which may be due to preservation issues rather than the lack of a coffin. Artifacts recovered with this individual include one shell (GCAS18-12) and four sherds of prehistoric pottery (GCAS18-11) in the fill, 46 nails (GCAS18-16, 17, 18, 19, 20), and four bone buttons. All of the recovered nails are in a state of poor preservation with high levels of corrosion. Of the four bone buttons, two are broken and two are complete. The two broken bone buttons (GCAS18-13) were recovered from within the ribs of the individual, and each had five holes (Figure 4.9). The two whole bone buttons were recovered from the sift, and also had five holes each. The two complete buttons weighed 0.2g each, and have similar dimensions – one measures 12.24mm across (GCAS18-14) (Figure 4.10) and the other 12.56mm across (GCAS18-15) (Figure 4.11).

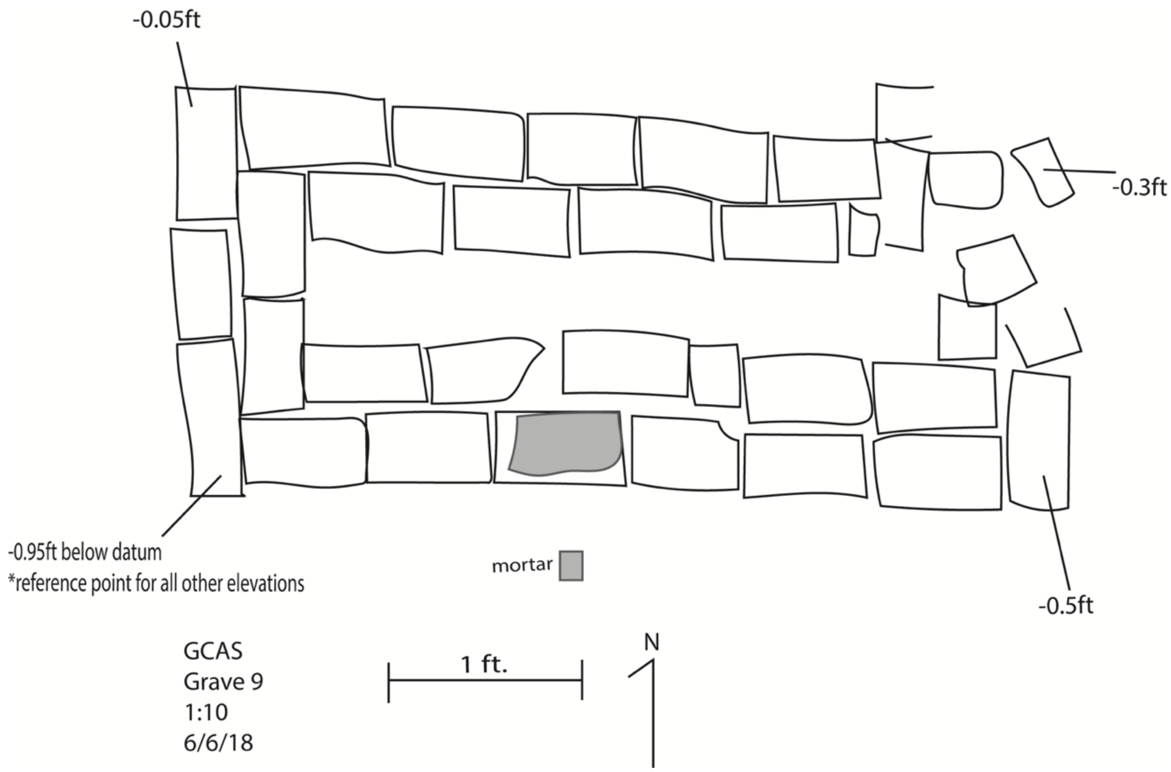

Figure 4.7: Brick structure associated with Grave 9, including elevations taken from the bench datum

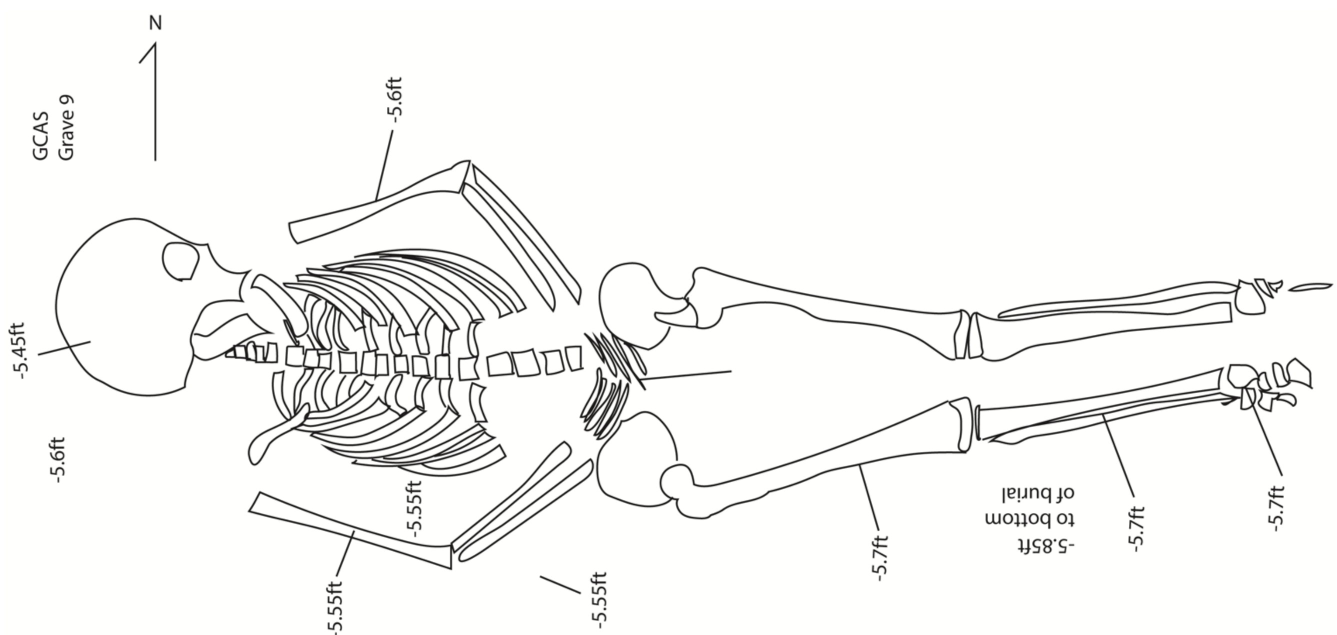

Figure 4.8 In situ skeletal remains from Grave 9, all elevations taken from top of extant brick structure

Figure 4.9: Broken five hole buttons excavated from Grave 9 (GCAS18-13)

Figure 4.10: Five hole button excavated from Grave 9 (GCAS18-14)

Figure 4.11: Five hole button excavated from Grave 9 (GCAS18-15)

Grave 10

The brick structure associated with Grave 10 was two brick courses wide on all four sides. The outermost brick course of the brick structure was 2.6ft N-S and ca. 5.8ft E-W. Additionally, a total of four brick courses (approximately 0.8ft in height) extended into the ground, ceasing before the onset of the burial shaft (figure 4.12). The space within the brick structure measured 1.1ft N-S and 4.1ft E-W. A total of three individuals were recovered from within this burial; the bottommost burial contained a single individual (Grave 10 – Burial 1), and the uppermost burial contained two individuals (Grave 10 – Burial 2). Coffin wood fragments were found between the two burials indicating a likelihood that the coffin containing the two uppermost individuals was stacked on top of the coffin with the single individual. Additional coffin wood fragments were covering the proximal and middle portions of both the right and left femora shafts of Grave 10 – Burial 1, along with the space in between them (Figure 4.13). The majority of the skeleton from Burial 1 was present and recovered, with the exception of the left clavicle, the manubrium, left and right patellae, the left and right pubis, most of the epiphyseal ends of the long bones of the arms and legs, the carpals, tarsals, metacarpals, four metatarsals, and all but two of the phalanges (hand and foot). Far less of the skeletal remains from Burial 2 were present, and they were much more fragmented. Fragments recovered came from the crania (temporal, occipital, frontal, and parietal), the cervical and thoracic vertebrae, second ribs, ribs 3-10, three incisors, and seven molars. Artifacts recovered from Grave 10 that can be specifically associated with Burial 1 based on context include four metal nails (GCAS18-25), all of which show a high level of corrosion. Similarly, only two highly corroded nails (GCAS18-23) are specifically associated with the context of Grave 10 – Burial 2. Artifacts from a general Grave 10 context include 147 nails (GCAS18-21, 22, 27) (Figure 4.14), two sherds of prehistoric pottery (in the fill) (GCAS18-24) (Figure 4.15), and one metal pin (GCAS18-26). The nails are again very poorly preserved due to corrosion. The metal pin is also poorly preserved; while it is not as

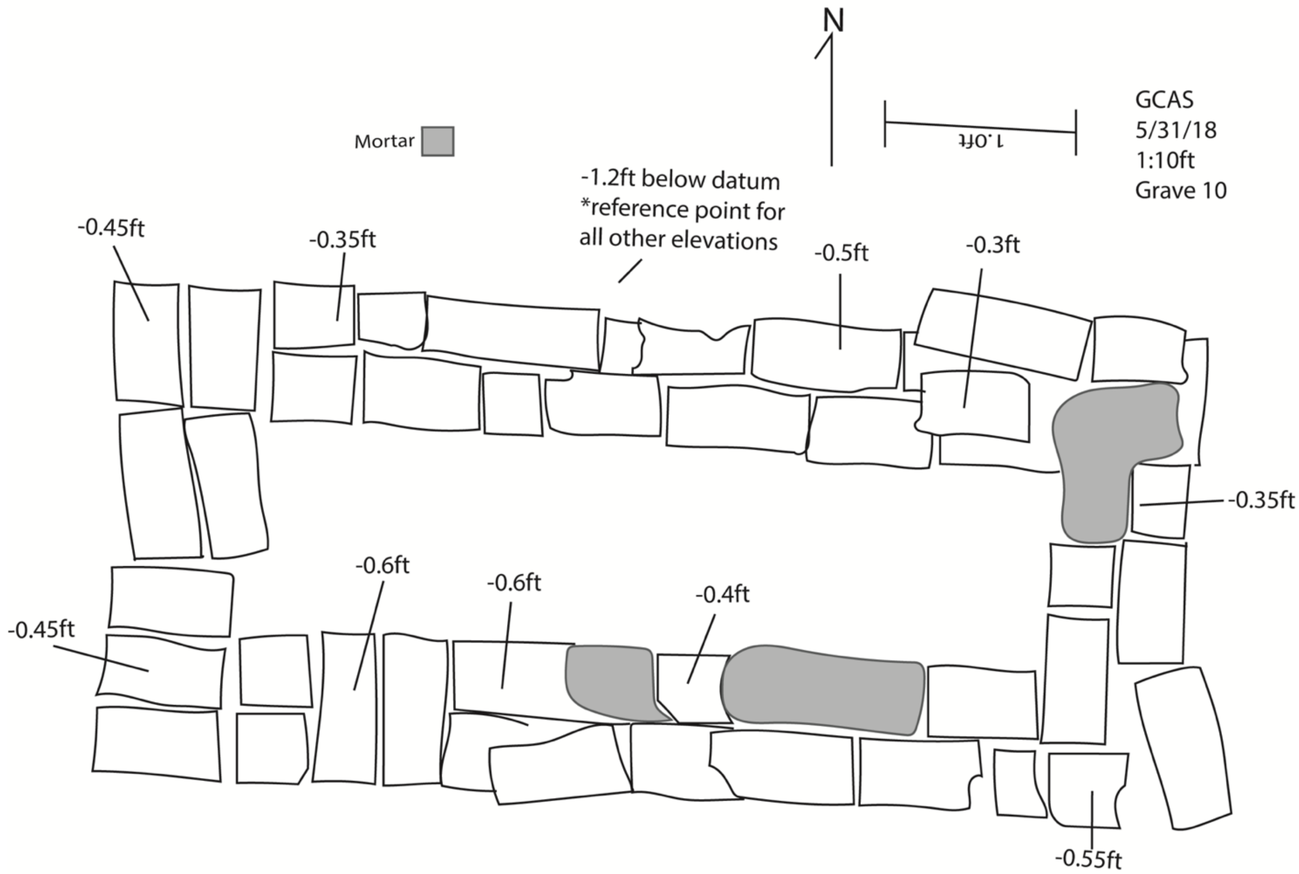

Figure 4.12: Brick structure associated with Grave 10, including elevations taken from the bench datum

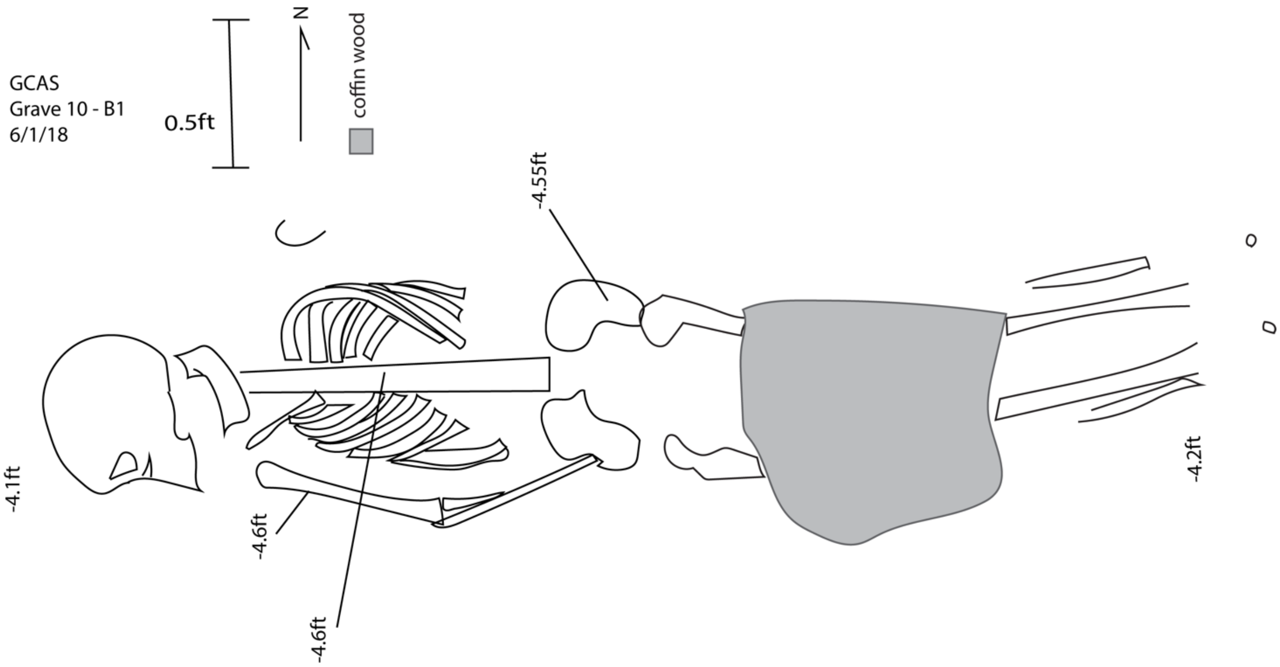

Figure 4.13: In situ skeletal remains of Grave 10 – Burial 1, including elevations taken from top of extant brick structure

Figure 4.14: Representative nail from GCAS 2018, excavated from Grave 10

Figure 4.15: Representative prehistoric potsherd from GCAS, excavated from the fill above Grave 10 (GCAS18-24)

Figure 4.16: Metal pin, broken along the shaft, excavated from Grave 10 (GCAS 18-26)

Grave 11

A width of two brick courses can be distinguished for the brick structure of Grave 11, although it is more disturbed than many of the other graves in the GCAS (Figure 4.17). The less disturbed eastern edge of the outer course of the brick structure measured ca. 1.9ft N-S, and the southern edge measured ca. 4.25ft E-W. The extent of the brick structure into the burial was not as deep as the entire burial shaft, with only three courses preserved (approximately 0.5ft from top to bottom). The individual within Grave 11 was buried in a decorated coffin, of which two intact sections from above the axial skeleton were recovered. The décor on these coffin pieces was comprised of brass tacks spelling out the decedent's initials and age-at-death ("J.A.G. Æ 1Y 5M") (GCAS18-42 through GCAS18-51). Each initial is separated by a single brass tack, while the "Y" (GCAS18-48) and "5" (GCAS18-49) are separated by a quincunx (GCAS18-51) shaped of brass tacks (figure 4.18). Additionally, large amounts of coffin wood fragments were found above and within the leg bones in the eastern half of the burial (Figure 4.18). Skeletal remains that were recovered include fragments of the cranium except for the right parietal; the left and right clavicles; the left scapula; the left ilium; fragments of cervical, thoracic, and lumbar vertebrae; the left and right first ribs, the left second rib; rib 3-10 fragments; and the shafts of the left humerus, left femur, right femur, left tibia, and right fibula. One artifact, a sherd of prehistoric pottery (GCAS18-28), was recovered from the fill of this burial. Artifacts recovered from within the burial include 71 nails (GCAS18-29, 30, 35), one complete metal pin (GCAS18-31), and 10 metal pin fragments (GCAS18-32 through GCAS18-34). All of the nails are highly corroded. Nine of the metal pin fragments were recovered from underneath the vertebrae of the individual (GCAS18-32 and GCAS18-33). The last metal pin fragment (GCAS18-34) was recovered from near the skull of the individual. The one complete metal pin has a decorative feature, with a total of two metal loops, one on each side of the pin head (Figure 4.19).

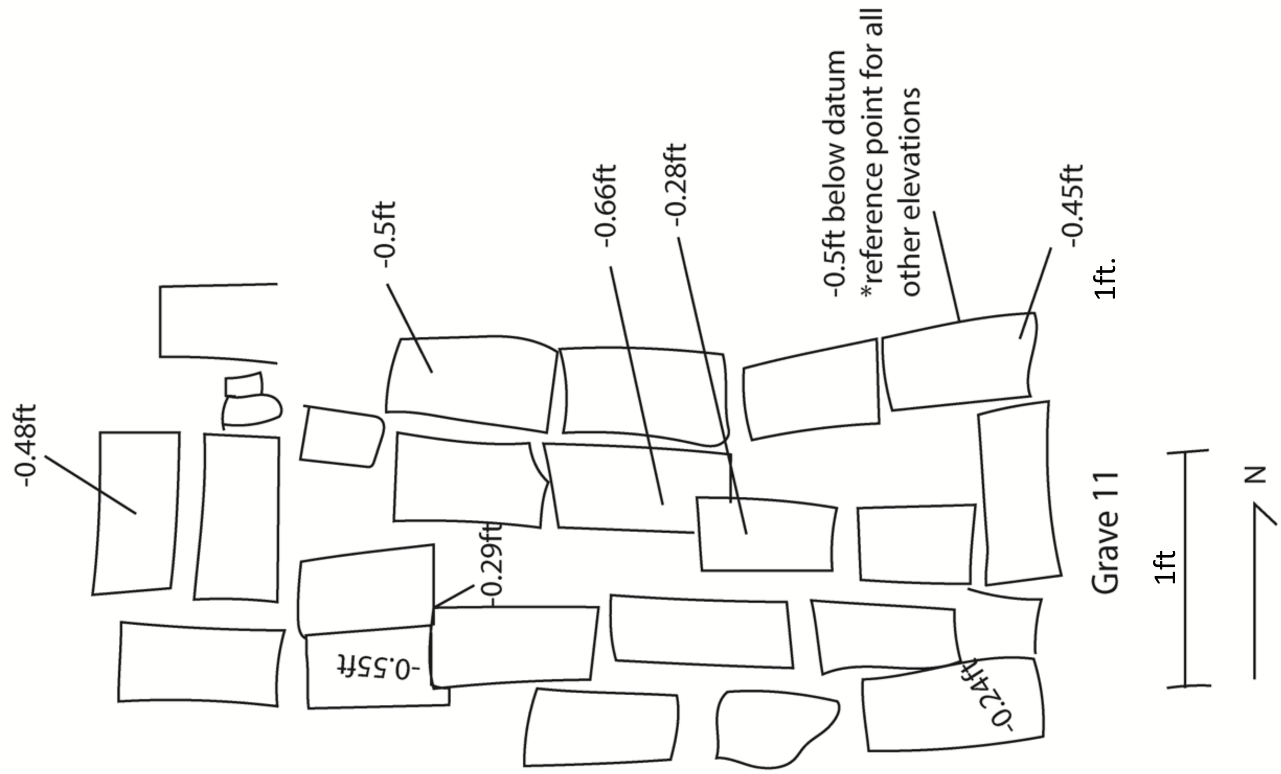

Figure 4.17: Brick structure associated with Grave 11, including elevations taken from the bench datum

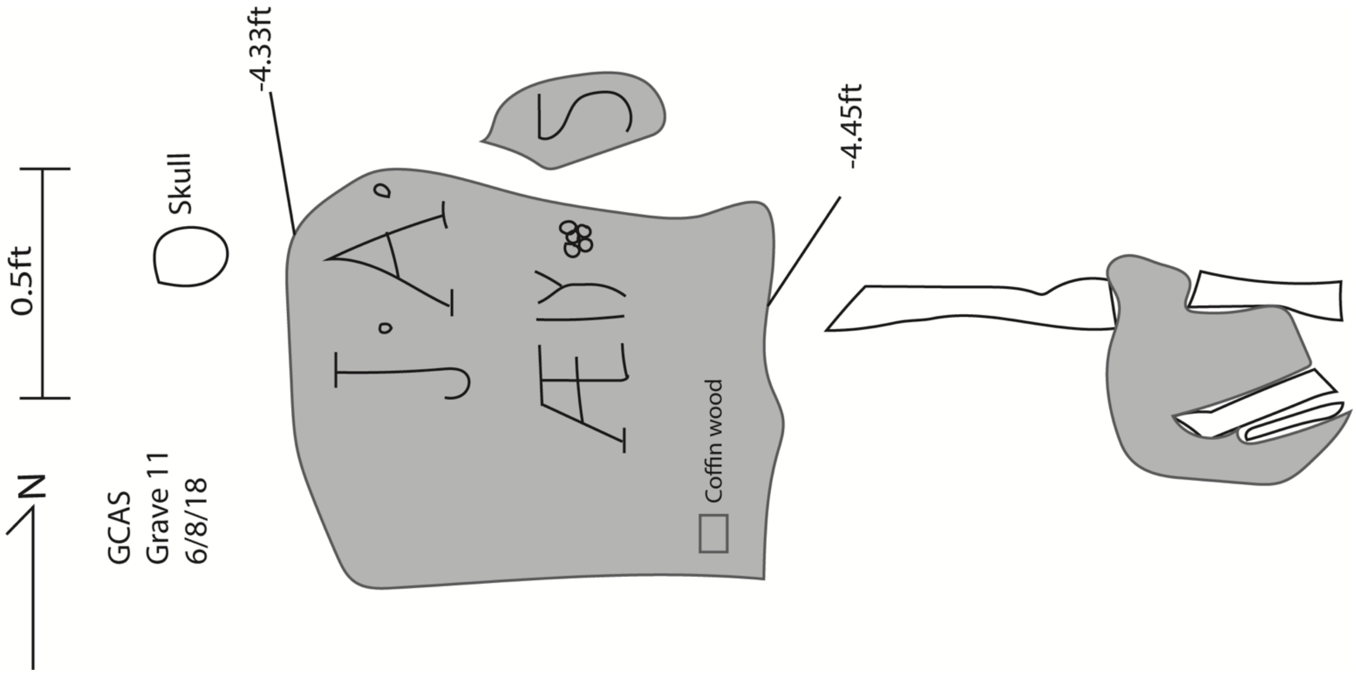

Figure 4.18: In situ coffin and skeletal remains from Grave 11, without "G"-portion of coffin lid, all elevations taken from top of extant brick structure

Figure 4.19: Complete metal pin, with decorative loops, excavated from Grave 11 (GCAS18-31)

Grave 12

The brick structure associated with Grave 12 was two brick courses wide on the western side, with only one course width present on the other three sides (Figure 4.20). The outer course of the brick structure along the western edge was 1.75ft N-S, and the southern edge was 4.4ft E-W. Displaced bricks prevent accurate measurement of the internal space between the brick structure. The feature extended four courses (approximately 0.8ft in height) of brick underground that once again did not extend all the way down into the burial shaft. The bottom of the burial was 3.08ft below the uppermost point on the brick superstructure. The individual from within Grave 12 was oriented with the head to the west and the body in a supine position (Figure 4.21). Skeletal elements that were not present include the left and right ischia, pubes, patellae, the sacrum, sternum, and epiphyseal ends of both humerii, femora, tibiae, fibulae, and the carpals, tarsals, metacarpals, metatarsals, and all but two unsided phalanges. Artifacts recovered in associated with this individual include one fragment of charcoal (GCAS18-52), 61 nails (GCAS18-54), and one metal pin (GCAS18-53). All of the nails show poor preservation with high levels of corrosion. The metal pin has no decoration, and was recovered from between the vertebrae and ribs of the individual (Figure 4.22).

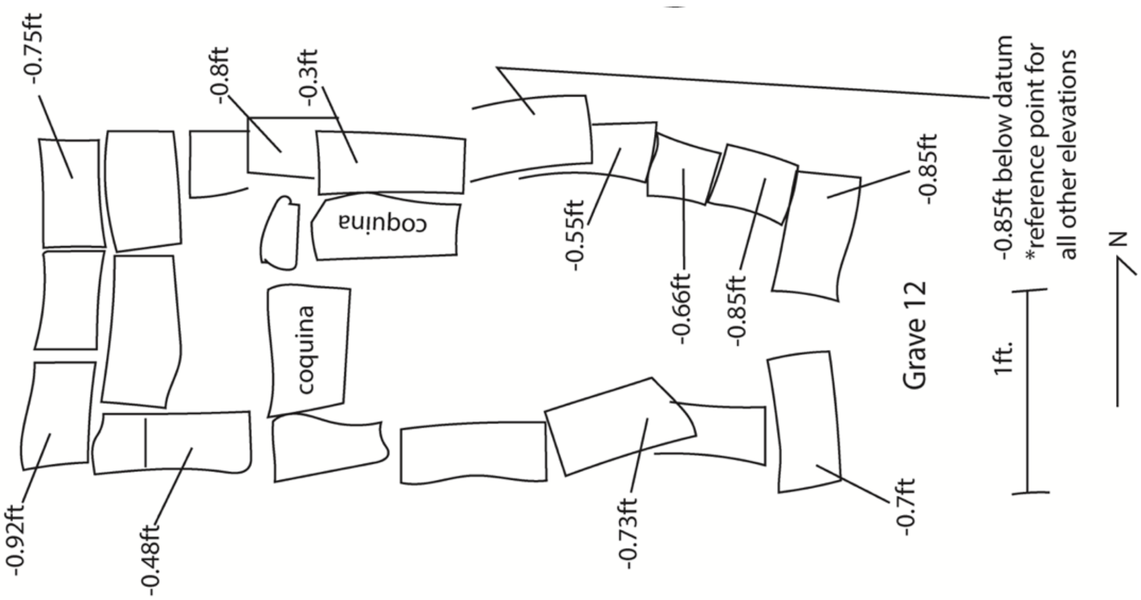

Figure 4.20: Brick structure associated with Grave 12, including elevations taken from the bench datum

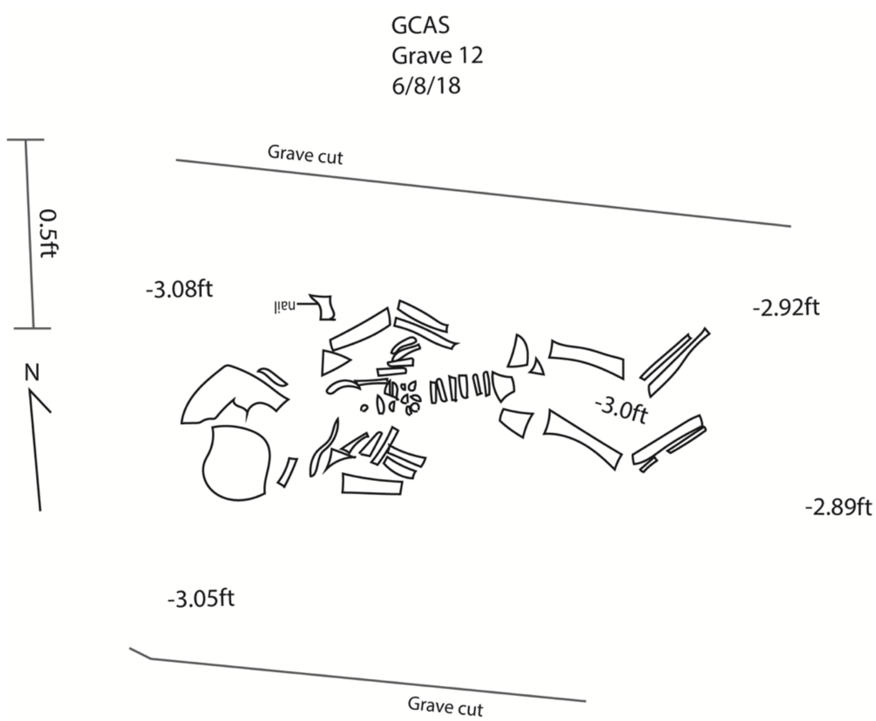

Figure 4.21: In situ skeletal remains from Grave 12, all elevations taken from top of extant brick structure

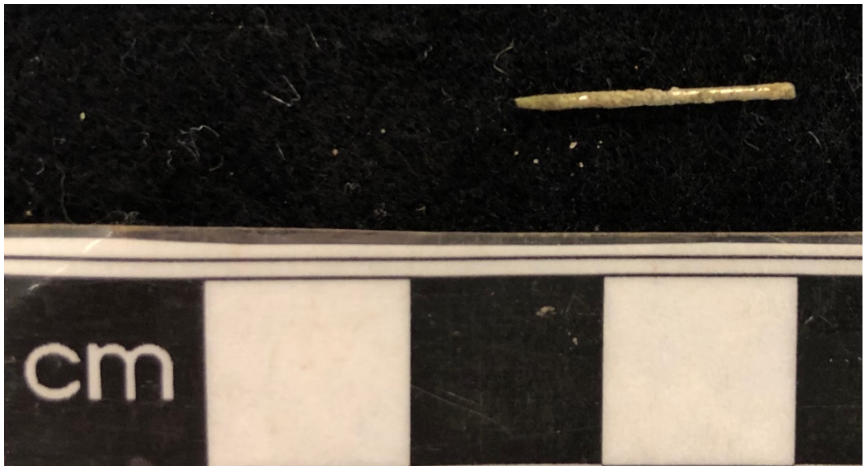

Figure 4.22: Metal pin excavated from Grave 12 (GCAS18-53)

Biological profiles

The skeletal remains were analyzed to estimate sex, age-at-death, stature, and ancestry, if possible, following the methods described in the previous chapter (Table 4.1). In addition, the remains were assessed for skeletal pathologies and other anomalies.

Table 4.1: Biological Profiles of skeletal individuals excavated from GCAS in 2018

Grave No.	Skeletal Age	Estimated Sex	# of teeth affected by DEH	Other Observed Pathologies
3	20-29 yrs.	F	6	3 caries; 12 teeth lost antemortem; calculus on all teeth present in mandible; osteoporotic bone loss with cortical thinning across entire skeleton; arthritis observed on C1, C2, & acetabulum
9	7-8 yrs.	N/A	1	Cribra orbitalia
10, B1	6-8 yrs.	N/A	9	Cribra orbitalia with evidence of healing & active lesions
10, B2 (MNI=2)	newborn	N/A	0	Cribra orbitalia with active lesions; bone loss on occipital, unsided parietal, and frontal; bone formation on frontal & parietals
11	18 mos. ± 6 mos.	N/A	0	Flaring sternal end, beading, and lateral straightening on both first ribs & several ribs 3-10
12	Birth ± 2 mos.	N/A	0	Cortical erosion across entire skeleton present

<u>Grave 3</u>

Grave 3 contained the only adult individual from the 2018 field season. The auricular surface of both the left and right ox coxae showed Lovejoy and colleague's (1985) scores of 1 to 2, corresponding to 20-29 years old. The partially but not completely fused epiphyseal rings of all of the vertebrae, which usually fuse by age 27 to 28 (Albert & Maples 1995), and incomplete fusion of the sternal end of the left clavicle, which tends to fuse between 16 and 30 years (Scheuer & Black 2004), implies this individual may have died in their early 20s. The first and second sacral vertebral bodies also were not fused, but this could be congenitally based rather than reflective of age (Barnes 2012). The sex of the individual estimated using nonmetric traits of the cranium (score of 1.5) and pelvis (score of 1) was determined to be female (Buikstra & Ubelaker 1994). Sex was also estimated using metric data using FORDISC 3.1.310 (Owsley & Jantz 2005), in addition to stature and race. Including black and white females in the FORDISC analysis and using twenty-five cranial measurements, this individual was categorized as a white female (Figure 4.23). The individual's stature was estimated to be 55.7 inches to 61.2 inches (4.64 feet to 5.12 feet) (Figure 4.24), based on maximum length of the femur, innominate height, and maximum length of the radius in 19th century white female samples.

Two Group Discriminant Function Results

Group	Classified into	Distance from	Probabilities Posterior	Typ F	Typ Chi	Typ R
WF	**WF**	85.5	1.000	0.629	0.000	0.619 (9/21)
BF		117.1	0.000	0.434	0.000	0.467 (9/15)

Figure 4.23: FORDISC results of ancestry & sex estimation based on cranial measurements of Grave 3

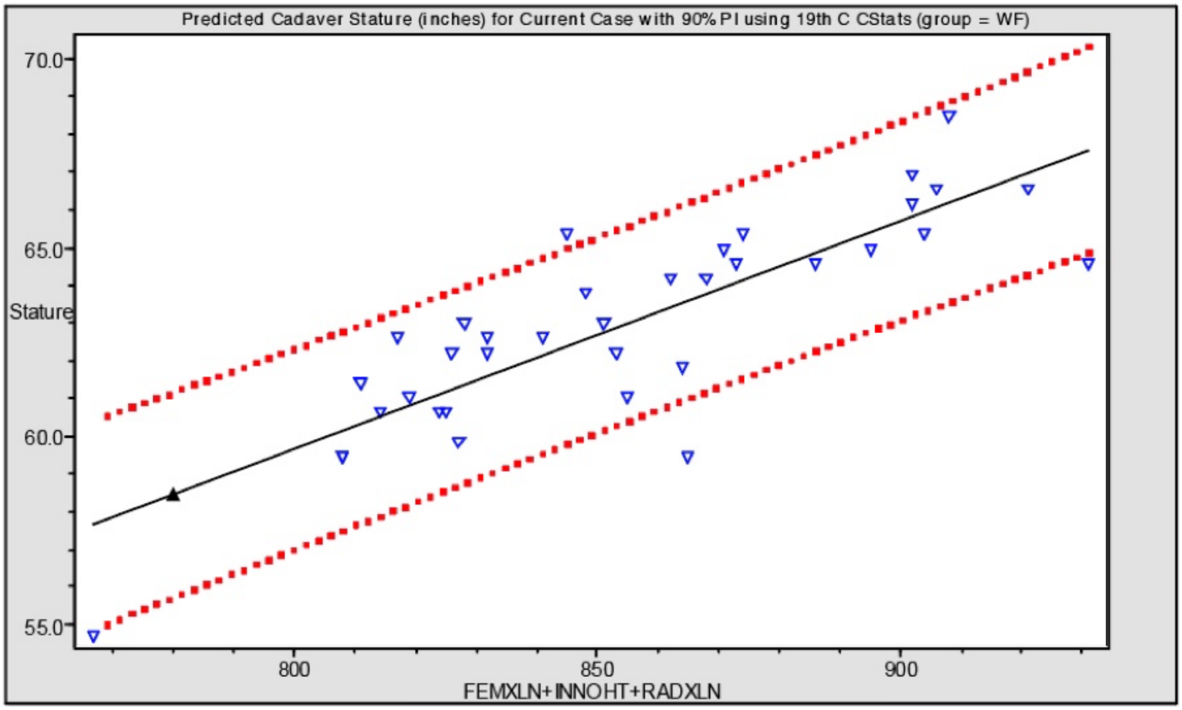

Figure 4.24: FORDISC results showing the Grave 3 individual's stature (black triangle) compared with 19th century white females

Significant dental pathology was observed in this individual, including antemortem tooth loss, caries, calculus, and dental enamel hypoplasias. Of the 15 total missing teeth, 12 were lost antemortem as indicated by alveolar resorption. The teeth lost antemortem were both right upper incisors (RI^1, RI^2), the right upper first and second molars (RM^2, RM^1), all three right lower molars (RM_1, RM_2, and RM_3), all three left lower molars (LM_1, LM_2, LM_3), as well as the upper left first incisor (LI^1) and molar (LM^1). A total of three carious lesions were observed, with one each on the right maxillary first premolar (RP^1), the left maxillary second molar (LM^2), and the right mandibular second premolar (RP^2). All of the teeth still present in the mandible had observable calculus on the lingual aspect. Finally, 13 total dental enamel hypoplasias were observed on the dentition. Six of the 17 teeth present have at least one dental enamel hypoplasia. The left maxillary first premolar (LPM^1) exhibited four defects, the left maxillary second premolar (LPM^2) exhibited one defect, the left mandibular first premolar (LPM$_1$) exhibited two defects, the left mandibular canine (LC$_1$) exhibited one defect, the right mandibular canine (RC$_1$) exhibited two defects, and the right first mandibular premolar (RPM$_1$) exhibited three defects. The earliest age of occurrence is 3.63 years on the right mandibular first premolar (RP$_1$) and the latest age of occurrence is 5.69 years on the left mandibular first premolar (LP$_1$) (Goodman & Rose 1990). Beyond the dentition, only a few pathological lesions were observed. Arthritis was seen in the superior and inferior articular facets of the first cervical vertebra and in the superior articular facets of the second cervical vertebra, as well as in the acetabulum of the ilium on both the left and the right sides. The arthritic lesions on the acetabulum were seen on both sides and on the inferior and posterior surfaces. The degree of arthritic lesions ranges from barely discernable to sharp ridges on all of the affected areas (Table 4.2). Finally, the individual buried in Grave 3 was also found to have hair remaining on approximately two-thirds of her skull (Figure 4.25).

Table 4.2: Descriptions of arthritic lesions observed on individual from Grave 3

Bone	**Side**	**Location**	**Type & degree of lesions**
C1	Right	Superior articular facet	Barely discernable lipping; >2/3 area affected
C1	Left	Inferior articular facet	Sharp ridged lipping; 1/3-2/3 area affected
C2	Right	Superior articular facet	Sharp ridged lipping; 1/3-2/3 area affected
Acetabulum	Right, Left	Inferior, posterior surfaces	Barely discernable lipping; 1/3-2/3 area affected

Figure 4.25: Skull of individual from Grave 3, with preserved hair (and root)

<u>*Grave 9*</u>

Grave 9 contained the remains of an individual estimated to have been 7 to 8 years old at the time of death based on the observed stages of dental development (Moorrees et al. 1963). Of the permanent teeth present the left mandibular second molar (LM_2) was the least developed, with a score of seven indicating that the crown had been completely developed followed only by the initial root formation (Buikstra & Ubelaker 1994). Epiphyseal union of the two halves of the neural arch was complete for the thoracic and lumbar vertebrae, and unobservable in the cervical vertebrae due to breakage. All of the neural arches fuse together by the age of five, indicating an age of above five years for this individual (Scheuer & Black 2004). While the neural arches are completely fused to the centrum in the cervical and lumbar vertebrae, this fusion is only partially complete in the thoracic vertebrae. The neural arches of the vertebrae fuse to the vertebral body between the ages of two and five (Scheuer & Black 2004), with the fusion progressing downward from the first cervical and upward from the fifth lumbar vertebrae toward the thoracic vertebrae. The complete fusion of the cervical and lumbar neural arches to the body and incomplete fusion in the thoracic vertebrae indicate an age of around 5 years of age (Scheuer and Black 2004). Therefore, it is possible that the unfused thoracic vertebrae represent either a stress-related delay in development, or normal variation within skeletal development. Since the dentition are less affected by environmental factors in growth, the age range they provide (7-8 years) is more reliable (Cunningham et al. 2017). Sex was not estimated because the individual is a subadult. Pathological lesions observed in the teeth of this individual include three dental enamel hypoplasias, all on the right permanent maxillary first incisor (RI^1). Only one tooth out of the 12 present permanent teeth has at least one dental enamel hypoplasia. The ages of occurrence range from 1.88 years to 3.95 years (Goodman & Rose 1990). Cribra orbitalia was also observed in the orbits of this individual. In addition to these pathologies, a large Carabelli's cusp was observed on both the left and right permanent maxillary first molars (LM^1 and RM^1). Using the Arizona State University dental plaque, each Carabelli's cusp was scored as a seven, the highest score on the system's scale. Like sex, stature and race were not estimated due to remains being that of a subadult.

<u>*Grave 10*</u>

Grave 10 is unique within the 2018 Gause Cemetery at Seaside sample because it contained the remains of three individuals. "Burial 1" has been used to designate the set of remains first interred within the grave. The two additional sets of remains were recovered from on top of the remains of Burial 1, and these together were designated "Burial 2". The uppermost skeletal remains (Burial 2) were intermingled *in situ* due to shifting from coffin decomposition.

Grave 10 – Burial 1

Grave 10 – Burial 1 contained the remains of a single subadult individual with an estimated age-at-death of 6 to 8 years based on dental development (Moorrees et al. 1963). Measurements of the humerus, femur, and tibia corroborate this age range based on Maresh (1970). Specifically, measurements of the humerus suggest 6.5 years ± 6 months, and measurements of both the femur and tibia suggest 6 years ± 6 months (Maresh 1970). Sex was not estimated due to the subadult age of the individual. Pathological lesions were observed in both the dentition and the cranium of the individual. In the dentition, 27 total dental enamel hypoplasias were observed, and nine out of the 18 permanent teeth present have at least one dental enamel hypoplasia. The right permanent maxillary second incisor (RI^2) exhibited three defects, the right permanent maxillary first incisor (RI^1) exhibited four defects, the left permanent maxillary first incisor (LI^1) exhibited three defects, the left permanent maxillary first premolar (LPM^1) exhibited two defects, the left permanent mandibular second premolar (LPM_2) exhibited one defect, the left permanent mandibular first premolar (LPM_1) exhibited two defects, and the left and right permanent mandibular first incisors (LI_1 and RI_1) and right permanent mandibular second incisor (RI_2) exhibited four defects each. The ages of occurrence for the DEH range from 1.87 years to 4.83 years. On the cranium, cribra orbitalia was observed on both the right and left orbits of the frontal bone, with both healing and active lesions present (Buikstra & Ubelaker 1994).

Grave 10 – Burial 2

Burial 2 contained the commingled remains of more than one subadult individual. A minimum number of individuals (MNI) of 2 was established for Burial 2 based on many skeletal elements – the left and right petrous portions of the temporal, the left and right lateral portions of the occipital, the basilar and squamosal portions of the occipital, the left portion of the frontal bone, the right neural arch of the second cervical vertebra, the dens process of the second cervical vertebra, the left deciduous maxillary first incisor (Li^1), the left and right deciduous maxillary first molars (Lm^1 and Rm^1), and the left and right deciduous mandibular second molars (Lm_2 and Rm_2). The estimated age-at-death for both of the individuals is newborn (Moorrees et al. 1963). Sex, stature, and race were not estimated because the remains belong to subadults. No dental pathologies were observed, but porotic hyperostosis and both abnormal bone loss and formation were observed in the cranium. Porotic hyperostosis (cribra orbitalia) was observed on the left side orbit of a frontal bone fragment, with evidence of active lesions at the time of death (Buikstra & Ubelaker 1994). Abnormal bone loss was observed on four parietal fragments, two frontal bone fragments, and two occipital fragments (Table 4.3). Abnormal bone formation was observed on two frontal bone fragments and two parietal fragments (Table 4.4).

Table 4.3: Location and description of abnormal bone loss in remains from Grave 10 – Burial 2 (MNI=2) (Buikstra & Ubelaker 1994)

Bone	**Side**	**Location**	**Description**
Occipital, basilar portion	Right, left	Superior, inferior surfaces; mix of periosteal or subchondral surface and cortex	>2/3 area affected; 10+ foci; bony response with boundaries well defined
Occipital, lateral portion	Right, left	Superior, inferior surfaces; mix of periosteal or subchondral surface and cortex	>2/3 area affected; 10+ foci of <10cm size; boundaries well defined
Parietal	Unsided	Superior surface (outer table); mix of periosteal or subchondral surface and cortex	<1/3 area affected; 10+ foci of <10cm size; margins not sharply defined
Parietal	Unsided	Superior surface (outer table); mix of periosteal or subchondral surface and cortex	<1/3 area affected; 10+ foci of <10 cm size; margins not sharply defined
Parietal	Left	Superior surface; mix of external table and cortex	>2/3 area affected; 10+ foci of <10 cm size; margins not sharply defined
Parietal	Right	Superior surface; mix of external table and cortex	>2/3 area affected; 10+ foci of <10 cm size; margins not sharply defined
Frontal	Left	Superior surface; mix of external table and cortex	<1/3 area affected; 10+ foci of <10 cm size; margins not sharply defined
Frontal	Midline	Superior surface; mix of external table and cortex	<1/3 area affected; 10+ foci of <10 cm size; margins not sharply defined

Table 4.4: Location and description of abnormal bone formation in remains from Grave 10 – Burial 2 (MNI=2) (Buikstra & Ubelaker 1994)

Bone	**Side**	**Location**	**Description**
Frontal	Left	Superior surface; external	>2/3 area affected; reactive woven bone
Frontal	Midline	Superior surface; external	>2/3 area affected; reactive woven bone
Parietal	Right	Superior surface; external	>2/3 area affected; reactive woven bone
Parietal	Left	Superior surface external	>2/3 area affected; reactive woven bone

Grave 11

Grave 11 contained the remains of an individual with an age-at-death of 1 year and 5 months based on the design observed on the preserved portion of the coffin lid. The stage of dental development indicates a biological age comparable to the chronological age recorded on the individual's coffin lid. Using dental development, the estimated age-at-death for this individual is 18 months ± 6 months (Moorrees et al. 1963). The subadult age of this individual hindered the estimation of sex, stature, and race. Pathology was observed in the ribs of this individual, with morphological changes present in both the left and right first ribs, and in six rib 3-10 fragments. The right first rib exhibited clearly discernable beading, or anterior-posterior thickening, and flaring of the sternal end. The left rib one also exhibited clearly discernable beading and flaring of the sternal end along with overall lateral straightening (Figure 4.26). Beading and/or flaring of the sternal end were observed on the affected rib 3-10 fragments (Table 4.5).

Figure 4.26: Pathological left first rib, lateral straightening, sternal flaring, & beading, Grave 11

Table 4.5: Location and description of rib pathologies for individual from Grave 11 (Buikstra & Ubelaker 1994)

Bone	**Side**	**Description**
Rib 3-10	Left	Clearly discernable flaring of sternal end
Rib 3-10	Left	Barely discernable flaring of sternal end and beading
Rib 3-10	Right	Clearly discernable flaring of sternal end
Rib 3-10	Right	Clearly discernable flaring of sternal end and beading
Rib 3-10	Right	Barely discernable flaring of sternal end
Rib 3-10	Right	Clearly discernable beading

Grave 12

Grave 12 contained the remains of a subadult individual with an estimated age-at-death of birth ± 2 months based on dental development (Buikstra & Ubelaker 1994). Of the six deciduous teeth present, the two most developed were the left mandibular canine (Lc_1) and left mandibular second incisor (Li_2); each had a development score of five indicating that the crown was only three quarters complete and no root formation had begun (Moorrees et al. 1963). No dental pathologies were observed in this individual, but cortical erosion was present on all of the skeletal remains present. Sex, stature, and race were not be estimated as the remains are that of a subadult.

Historical artifacts

Artifacts recovered from the site include prehistoric pottery, buttons, nails, metal pins, plain coffin wood fragments, and a decorated coffin lid piece (see Appendix A). The prehistoric pottery was excavated from within the fill of Graves 3, 9, 10 and 11 and therefore is not directly associated with the burial contexts. A total of eight prehistoric potsherds were recovered. All of the sherds have a sand temper, are brown in color, and with varying degrees of burning on the internal surface. The brown side of each sherd was cord marked. The consistency in the type of pottery recovered allowed for all of the sherds to be classified into the Cape Fear type of pottery. This phase of pottery production along the coast of North Carolina is dated to the Woodland period (960 – 1320 CE) (Herbert 2011).

A total of six buttons were recovered, two in Grave 3 and four in Grave 9. All six of the buttons are made of bone and are plain without any decoration. The two buttons found within Grave 3 both have three holes. The first of these two buttons has a diameter of 12.2mm, and the second has a diameter of 12.16mm. Two of the buttons from Grave 9 were found from within the ribs of the individual. These two buttons are both broken, and were therefore not measured. The other two buttons from Grave 9 were found during sifting of the eastern end of the grave. The first of these two buttons has a diameter of 12.24mm, and the second has a diameter of 12.56mm. All four buttons found in Grave 9 have five holes each.

The most common artifact recovered was metal. While the state of preservation is often so poor that it is difficult to distinguish the artifact's original form, the general size, shape, location, and number present suggest that most, if not all, are nails. Nails were found in varying amounts in all of the excavated graves. Fifty-nine nails were recovered from Grave 3, 152 from both burials in Grave 10 combined, 51 from Grave 11, and 63 from Grave 12. Many of the metal artifacts can be definitively identified as nails; however, extensive corrosion prevents any further study of the nail shape, type, or method of manufacture.

Many metal pins were recovered. One metal pin was found in Grave 10 and was recovered during sifting. Another metal pin was found within Grave 12 and was located on the individual's vertebrae and below the ribs. An additional 11 fragments of metal pins were recovered from Grave 11. Only one of the pins found in Grave 11 was complete, including the head of the pin and one loop on either side of the head. One of the fragmented pins likely had the same form, with one of the loops still connected to the head of the pin. The complete pin was found embedded within a piece of coffin wood near the vertebral column. Six of the pin fragments were also found underneath the vertebrae, and one of the fragments was located near the cranium. All of the metal pins from Grave 11 show signs of oxidation.

Coffin wood fibers and fragments were also very commonly recovered, although not all graves had the same level of preservation in this regard. The coffin wood from Grave 11 was the best preserved, with at least large 6 pieces that were catalogued with their length, width, thickness, and weight. The longest of these preserved pieces was 290mm, the widest was 111mm, the thickest was 15.39mm, and the heaviest was 112.0g. Beyond the decorated coffin lid and the 6 decently preserved pieces from Grave 11, the coffin wood recovered tended to be in small, more delicate fragments. However, all recovered coffin wood was found to be in a fragile and brittle state.

The coffin found within Grave 11 was well preserved compared to the rest of the coffins excavated at the Gause Cemetery at Seaside. On the outer surface of the coffin lid were many copper alloy tacks that spell out the initials and age-at-death for the deceased. The initials on the coffin are "J.A.G." and the age-at-death was recorded as one year and five months. Remnants of lining material is observed still underneath a few of the tacks, indicating that the entire coffin lid was originally covered with a linen or flax-like fabric. During excavation, transportation, and conservation, the once large and intact portion of wood had splintered into 8 pieces, and therefore the preserved lid was not measured in its entirety. However, each of the letters and figures that adorn the lid remain intact and each copper-alloy design was measured. Additionally, each design on the lid was composed of a different number of tacks, with only two identifiable places where tacks were missing from their original position (Table 4.6).

Table 4.6: Details of figures on coffin lid from Grave 11

Design	**Design height**	**Design width**	**Number of tacks**
J	78.22mm	48.93mm	16 present
A	77.83mm	84.85mm	22 present, 1 missing
G	73.75mm	66.90mm	19 present, 1 missing
Æ	49.24mm	73.20mm	24 present
1	47.12mm	8.89mm	5 present
Y	53.38mm	25.37mm	8 present
5	51.95mm	33.36mm	12 present
M	49.28mm	37.44mm	15 present
Quincunx	22.90mm	23.54mm	5 present

CHAPTER FIVE:
DISCUSSION

Although the sample size from the 2018 field season at the Gause Cemetery at Seaside (GCAS) is small (N=7), combining it with the sample from the 2017 field season at the Gause Cemetery at Seaside (N=3) provides a somewhat larger sample size (N=10). Therefore, comparisons both within and between the two distinct samples can provide useful information about the cemetery as a whole and about the people who were buried within it. Furthermore, analysis of the historical artifacts can lead to a more specific and assured date for the GCAS, thus allowing for the further contextualization of the skeletal remains as potential members of the Gause family and of the historic rural North Carolina population in general. Finally, all of these comparisons and analyses culminate in the creation of osteobiographies for each individual disinterred from the GCAS during 2018. The osteobiographies aim to contextualize the skeletal material and the historic artifacts, and to use the combination of each of these lines of evidence to better understand each individual's experiences in life and death.

Demographics of the sample

The demographic composition of the individuals recovered from the Gause Cemetery at Seaside in 2017 differs greatly from that of the individuals excavated from the same site in 2018. However, these differences are not especially meaningful given the small size of each sample, and the fact that the location of the graves excavated in 2017 and those in 2018 are interspersed throughout the cemetery landscape. It is far more telling to look at the demography of the Gause Cemetery at Seaside sample as a whole.

The four adults excavated in 2017 and 2018 all died between the ages of 20 and 40 years (see Quintana 2019 for the 2017 data). In addition, 60% of the sample consists of children, two dying between 6 and 8 years, one around 1 year and 5 months, and three around the time of birth. These results would indicate that few Gause family members lived past early middle age, and infant and childhood mortality was high. However, this small sample size and incomplete excavation of the family cemetery at Seaside prevents making strong conclusions along these lines.

However, this preponderance of children within a skeletal sample from the historic mid-Atlantic and southern region is unique. For example, the early 19th century Foscue Plantation burial crypt in Jones County, North Carolina is comprised of nine total individuals, two between 20 and 40 years but two more estimated to be 60+ years at the time of death. Four of these nine individuals were subadults – one aged 1-5 years and three aged 0-12 months (Seeman 2011). Other skeletal samples from historic cemeteries have a much lower representation of subadult individuals. For example, the Weir family cemetery archaeological population – located in Manassas, Virginia and dating to mid-19th to early-20th centuries – consisted of 18 adult individuals and only six subadult individuals (Little et al. 1992). Of the 18 adults, three were determined to be at least 60 years old at the time of death.. Similarly, the age-related demographic composition of an enslaved population excavated from Newton Plantation in Barbados was 60% adults and 40% subadults. Furthermore, out of 18 total subadults, only three died before the age of six (Schuler 2011). Therefore, the high rate of subadult individuals analyzed from the GCAS provides a relatively unique set of data regarding childhood health and frailty during the 18th and 19th centuries in the rural southeastern United States.

Dental health

The individuals disinterred from the Gause Cemetery at Seaside during both the 2017 and 2018 seasons present similar pathological patterns. All four adults (Graves 2, 3, 6, and 8) showed evidence of antemortem tooth loss (AMTL) and dental enamel hypoplasias. AMTL was also observed in the sample from Foscue plantation, with all five Foscue adults having lost at least one tooth before death. The highest occurrences of AMTL, three and sixteen, were seen in the two adult females aged 60+ years. The young adults (male and female) all aged under 40, show only either one or two cases of AMTL each (Seeman 2011). Conversely, the only individual with AMTL in the GCAS, the adult female (aged 20-29 years), lost 12 teeth antemortem. While the higher occurrences of AMTL in the Foscue sample can likely be attributed to advanced age, the high rate of AMTL for the adult female from the GCAS likely had nonage-related causes, perhaps diet and the subsequent occurrence of dental caries (Saunders et al. 1997). Similarly high rates of AMTL in young adults is also seen in a 19th century black cemetery population from Charleston County, South Carolina. This population had such prevalent AMTL that Rathbun notes it was, “not uncommon for all molar teeth to be absent by age 30” (1987: 244). Although this comparative sample is comprised of enslaved individuals, this rate and age of AMTL is comparable, although at a very small scale, to the adult female from the GCAS. The adult female buried in Grave 3 from the GCAS also exhibited dental calculus in small to moderate amounts on the lingual aspect of all of her mandibular teeth, with the exception of her six missing molars. Calculus was also noted as a significant pathology within the 19th century Charleston County black cemetery population, even within the younger adults (Rathbun 1987). On the other hand, only one out of the eight total individuals from the Foscue Plantation burial crypts displayed dental calculus (Seeman 2011). In addition to calculus, three large caries were observed in maxillary dentition of the adult female from the 2018 GCAS sample. Similarly large carious lesions were observed on all three adults from the 2017 GCAS sample. In the Charleston county black cemetery, both males and females were seen to have high rates of dental caries, with an average of 5.17 and 3.20 carious teeth respectively (Rathbun 1987). However, the adult female from GCAS 2018 did not show evidence of tooth polishing, as was observed on all three GCAS adult individuals from 2017. It is possible that this polishing obliterated other occurrences of DEH or calculus on these individuals.

Evidence of physiological stress

The most frequently observed pathology amongst the GCAS 2018 sample is dental enamel hypoplasias. The range of estimated occurrence for dental enamel hypoplasias (DEH) observed in both the GCAS 2017 and 2018 sample is from approximately 1 year to 6 years of age. All of the GCAS adults had at least one episode of childhood stress that led to DEH formation, as did the two older subadults aged approximately 6-8 years. The lack of DEHs in the infants and the ages that the DEHs formed may suggest that these stressors do not occur until after the first year after birth. The Foscue family crypt sample displayed a total of 29 dental enamel hypoplasias (DEH) among a total of 54 teeth (53.7%). Twenty-four of these defects occurred within one individual [the exact number of teeth with and without defects is not given for the Foscue sample (Seeman 2011)]. In the GCAS sample, a total of 43 DEH were observed amongst the 82 total present and observable teeth in the sample (52.4%). Therefore, the rates of observed DEH between the two samples is extremely similar. This is not surprising given the similar circumstances and geographic location of the Focues and the Gauses – both were plantation owning families living in 19th century North Carolina (Seeman 2011).

Other non-specific stress indicators observed within the GCAS sample include periostitis, porotic hyperostosis and cribra orbitalia (Figure 5.1). It is important to note that only porotic hyperostosis and cribra orbitalia were observed in the cemetery, and only in subadult individuals. While none of the adults from the GCAS exhibited periostitis, porotic hyperostosis, or cribra orbitalia, three of the subadults excavated during the 2018 season showed either active or healed cribra orbitalia lesions. Cribra orbitalia is seen disproportionately in subadult individuals in other archaeological skeletal populations as well, including the Charleston County black cemetery in South Carolina. At this cemetery, 80% of the subadults analyzed had cribra orbitalia lesions whereas only 35% of the adults exhibited similar lesions (Rathbun 1987). Rathbun subsequently notes that subadults are more often observed to have active cribra orbitalia, as opposed to healed lesions, which is the case in both cemetery samples being compared (1987). In addition, only one of the individuals from the Foscue Plantation burial vaults displayed periostitis (an adult female aged 34-38), and there was no observed porotic hyperostosis or cribra orbitalia (Seeman 2011). This is a much lower frequency of these pathologies when compared with the GCAS, where three subadult individuals exhibit cribra orbitalia.

The stature that is attained by an adult can also be indicative of physiological stress. However, it is important to note that stature is also influenced by genetic height potential, environmental factors, cultural factors, and nutritional adequacy or deficiency (Reitsema & McIlvaine 2014). More specifically, factors such as regional climate, diet, disease, and socio-economic status – which all effect an individual's overall quality of life – can hinder the genetic predisposition an individual has regarding stature (Vercellotti 2012). Despite the complex etiology for adulthood stature, physical stress experienced during childhood and the years of development are one of multiple reasons that an individual may not achieve their full genetic potential for height (Vercellotti et al. 2014). The only individual from the GCAS 2018 sample for which stature was estimated was the adult female buried in Grave 3. Her estimated stature of 55.7 inches to 61.2 inches is shorter than the estimated statures for both the male and female adults from the GCAS 2017. The estimated stature for the adult female from GCAS 2017 is between 61.6 inches and 66.7 inches, while the estimates for the adult male's statures are 66.9 inches to 71.7 inches and 70.3 inches to 75.2 inches. The estimated stature of the adult female from GCAS Grave 3 is also short when compared to the individuals from the Foscue Plantation burial crypt. The adult females from this sample were estimated to have statures between 61.1 inches and 68.6 inches, while the adult male was estimated to have a stature of between 66.1 inches and 71.3 inches (Seeman 2011). The comparatively short stature for the female from GCAS Grave 3 could be a result of genetic predisposition; however, it could also be a result of disease or nutritional stress during childhood that is also evidenced by the DEH observed in her dentition.

Figure 5.1: Cribra orbitalia in orbits of individual from Grave 10 – Burial 1

The only observed pathologies within the sample of human remains from the Gause Cemetery at Seaside that can likely be attributed to a specific disease are the affected ribs from the subadult individual from Grave 12. The individual from Grave 12 (aged 1 year and 5 months) had multiple observed pathologies in their ribs, including flaring of the sternal end, lateral flaring, and beading that are often associated with rickets (Ortner and Mays 1998). Lambert (2006) suggests that rickets is most common in subadults between the ages of 6 months to 2 years and 6 years to 15 years; the age of the individual from Grave 12 (1 year and 5 months) fits well within the former of these two age ranges. Additionally, while rickets has been more heavily associated with individuals of low socioeconomic status in the 19th century South, it did not affect this class exclusively (Lambert 2006). For example, a high rate of rickets was seen in a study of subadults from middle- and working class families buried in the burial vaults of the

Spring Street Presbyterian Church of New York City between 1820 and 1846. Thirty-four percent of left tibiae from the sample exhibited pathological indications of rickets (Ellis 2010). An example of high-class subadult individuals displaying pathological evidence of rickets comes from nine children buried in the Medici Chapels in Florence, Italy between the 16th and 17th centuries. In this case, the researchers suggest inadequate nutritional compensation at the cessation of weaning as the cause of the high status children's rachitic lesions (Giuffra et al. 2013). Although this sample is temporally earlier and geographically distant from the GCAS, the high status of the Medici children demonstrates that rickets can affect juveniles from all social classes.

Congenital conditions

No congenital conditions were observed in the seven individuals from the 2018 season at the GCAS. However, two out of the three adults analyzed from the 2017 season showed evidence of at least one congenital anomaly. The adult female from Grave 6, aged 25-34 years, was noted to have an occipitalized first cervical vertebra, which is a common condition that can result in both phenotypical and neurological symptoms (Quintana 2019; Barnes 2012). The adult male from Grave 8, aged 20-25 years, was observed to have *os calcaneus secundarius* in both calcanei. This is a congenital condition that results in the incomplete development of the calcaneus (Quintana 2019; Barnes 2012). Neither the adult nor the subadult individuals buried in the Foscue Plantation burial vaults showed any evidence of congenital conditions except for a spondolytic fracture of the L5 of a 60+ year-old female, which has a genetic factor (Barnes 2012; Seeman 2011).

Joint degeneration and bone loss

The adult individual from Grave 3 also displayed evidence of osteoporotic bone loss and arthritis in multiple post-cranial localities (first two cervical vertebrae and both acetabula). When considering only the GCAS 2018 individuals, the sole observation of these degenerative pathologies on the adult female buried in Grave 3 is likely due to her having lived into adulthood. However, none of the 2017 GCAS adult individuals – buried in Graves 2, 6, and 8 – had similar pathologies. This is likely due to unique lived experiences for the adult female from Grave 3 that lead to the development of arthritis in both her hips and neck. These unique experiences include the potential of different activities, trauma, or even genetics (Novak & Šlaus 2011). All but one of the adult individuals from the Foscue Plantation vault burials also showed evidence of osteoporotic bone loss and arthritis at relatively young ages. Although the two adults aged 60+ years displayed arthritic lesions, the three adults aged between 34 and 44 also displayed evidence of arthritis. The evidence for arthritis was seen in a wide array of locations on the Foscue adults when compared to the adult from the GCAS, including the at the elbow, wrist, knee, hip, and the thoracic vertebrae (Seeman 2011). This reveals that it was not exceptional for a relatively young adult from a plantation owning family to acquire arthritis.

Artifactual interpretations

Dating implications

Many of the artifacts recovered from the 2018 excavation at the GCAS dating to the historic period can provide relative dates for the use of the cemetery. For instance, the style of the decorated coffin lid recovered from Grave 11 (GCAS18-42 through GCAS18-51) (Figure 5.2) – informative tack designs used to hold down fabric lining – was common in the United

States prior to the mid-18th century (Tharp 1996: 80). Furthermore, Tharp (1996:80) suggests that the use of the tacks to spell out the name, initials, and date – or any combination of these three elements – was also common for the era. As an example, Tharp discusses the coffin of Nathaniel Harrison, who was buried in Surry County, Virginia in 1727. The lid of Harrison's coffin included tacks that form two rows outlining the edges, parts of what was once the individual's name spelled out, and a skull and crossed bones above a heart (Tharp 1996, 81). Similarly decorated coffin lids dating from 1731 to 1798 were found in the Wainwright family tomb, located in Massachusetts, and were decorated with heart shapes created with nails, similar to the lid of Nathaniel Harrison's coffin, along with the initials and date-of-death for the decedents. Finally, heart-shaped tack designs encompassing the deceased individual's initials and year of death were seen on twenty coffin lids from the Bulkeley family tomb in Connecticut, all of which date to between 1775 and 1826 (Seeman 2010). Another historic cemetery which was found to contain coffins decorated with brass tacks in a manner consistent with the Grave 11 coffin lid at the Gause Cemetery at Seaside is the Walton Family Cemetery, which is located in Griswold, Connecticut and dates to the mid-to-late 18th century. Burial 5 from this cemetery was discovered to have a hexagonal coffin with a two-piece lid. The lid itself was decorated with brass tacks that were made to form the deceased's initials, "NB", and the age-at-death, "13" (Bellantoni et al. 1997).

Figure 5.2: Coffin lid decorated with brass tacks, excavated from Grave 11 (GCAS18-42 through GCAS18-51)

Other dateable artifacts recovered from the GCAS are metal straight pins and bone buttons. The use of straight pins to fasten burials shrouds is known to have been common during the 18th century (Raemsch & Bouchard 2000). Similar metal straight pins were frequently recovered from both infant and adult burials at a Catholic cemetery, located in St. Mary's City, Maryland and which dates to between 1638 and 1730 (Riordan 2009). Based on Marcel (1994), plain bone buttons came into existence during the pre-colonial period, while carved or inlaid bone buttons did not appear until after 1850 (14). Olsen (1963) gives a more specific date range of 1750 to 1830 for plain bone buttons (553). Additionally, Marcel (1994) indicates that plain bone buttons during the 17th and 18th centuries were often homemade using cow or pig bone, and were give between two and five holes. The buttons recovered from GCAS Grave 3 had three holes each (GCAS18-2 and GCAS18-3), and the buttons from Grave 9 had five holes (GCAS18-13, GCAS18-14, GCAS18-15). The buttons found during the GCAS 2017 season were identified using South's (1964) button typology and found to be categorized as either type 15, type 19, or unidentified. The bone buttons from the GCAS 2018 field season all match South's (1964) type 19. This type is described as most often being about 23mm across, with the occasional button measuring 16mm or 13mm across. All of the measurable buttons from 2018 measure between 12 and 13mm across. Furthermore, South dates Type 19 buttons to the period between 1800 and 1865 (1964).

Burial garments

Many of the historical artifacts recovered from the GCAS are also indicative of garments that the deceased were buried in. Several instances of metal pins recovered from historical burial contexts, often children, have been interpreted by archaeologists as representing the prior existence of a burial shroud (Ubelaker & Jones 2003). Examples of other metal straight pins being recovered from historic cemeteries include the Walton Family Cemetery located in Louisa, Virginia and the Henry Lehman family cemetery located in Schoharie County, New York. At the 18th century Walton Family Cemetery, eleven burials produced copper, brass, and silver straight pins that have been associated with the use of burial shrouds for these individuals (Bellantoni et al. 1997). At the Henry Lehman family cemetery, straight pins were found associated with the burials of two infants (Raemsch & Bouchard 2000). Finally, a total of 163 metal straight pins were recovered from both adult and infant burials at a 17th-18th century Catholic cemetery in St. Mary's City, Maryland. However, an average of 8.8 pins was associated with each infant burial while an average of only 3.5 pins was associated with each adult burial (Riordan 2009). No metal pins were recovered from the GCAS during the 2017 field season. Additionally, all of the metal pins recovered during 2018 were found in association with subadult individuals. Therefore, the lack of metal pins recovered in 2017 may be due to the lack of subadult remains recovered during that season. This is supported by the association of burial shrouds with subadults in the aforementioned archaeological examples.

Buttons are also suggestive of burial garments that once adorned the body of the deceased. The buttons found during the 2017 season at the Gause Cemetery at Seaside are similar to those recovered in 2018 in both their material and lack of decoration, with only one exception. All but one of the buttons recovered from the site are made of bone, while one from 2017 was made of shell. The bone buttons recovered during 2018 consisted of three-hole and five-hole buttons, and these holes are what allow for the buttons to be sewed onto material (Marcel 1994, 4), thus suggesting that the individuals associated with the buttons were buried wearing garments.

Osteobiographical Interpretations

The above comparisons of both the skeletal sample and the associated artifacts as they relate to other contemporary 18th - 19th century populations in the U.S. allows for a better understanding of the historical context for the individuals from the Gause Cemetery at Seaside. Although individual identities cannot be ascertained for these individuals, information about their lived experiences can be garnered through a contextualized discussion of their skeletal remains and mortuary environments.

Grave 3 Individual

The individual buried in Grave 3 is the only adult to be recovered from the 2018 field season as the Gause Cemetery at Seaside. The individual was identified as a female, and her age-at-death was estimated to be between 20 and 29 years. Although a relatively young female, she experienced extensive dental problems in life, including the loss of 12 teeth, with only three of her molars present by the time that she died. Additionally, three carious lesions observed in her dentition suggest that the high rate of AMTL she experienced may have been due to caries development and subsequent infection (Saunders et al. 1997). Finally, this female experienced periods of stress intermittently from the age of about four until about six, as indicated by the DEHs seen in her teeth. DEHs occasionally can be attributed to weaning induced stress and vulnerability to disease; however, this age range is later than the suggested commencement of the weaning process before the end of the first year of life in 18th and 19th century North America (Katzenberg et al. 1996; Herring et al. 1998).

Outside of her dentition, the female from Grave 3 displayed limited pathologies with the exception of arthritis in her neck and hips. Due to her young age, evidence of arthritis between the atlas and axis suggest that this young female experienced either genetic predisposition, unusual activity, or trauma to her neck, rather than age-related degeneration (Roberts & Manchester 2005). Arthritis in the acetabula can sometimes be attributed to abnormality of the hip joints caused by metabolic or infectious disease, and this type of osteoarthritis is referred to as secondary and is associated with onset earlier in life (Ortner 2003). However, a lack of evidence for both metabolic and infectious disease in this individual's skeleton suggests that this was not cause of her arthritis. In addition, this female has a much smaller estimated stature of

55.7 inches and 61.2 inches when compared with the adult females from the 19th century rural North Carolina Foscue sample, whose estimated statures range from 61.1 inches to 68.6 inches.

Finally, the mortuary context of the female from Grave 3 included coffin wood and utilitarian coffin hardware in the form of nails, along with two personal artifacts in the form of bone buttons. These buttons are plain, with three holes each and suggest that she was buried in clothing as opposed to a shroud. It is likely that this clothing may have been undergarments, given that bone buttons were most commonly used as utilitarian buttons for undergarments during the 18th and 19th centuries (Rodman et al. 2000).

Grave 9 Individual

The individual buried in Grave 9 was estimated to have died at the age of between seven and eight years. Although the individual's sex would have been known and influential in life, in death it could not be determined based on the developmental stage of the skeletal remains. Only one of this individual's teeth displayed DEH, although three lesions are present on this tooth (right maxillary first incisor). The development of these lesions suggests that the individual experienced episodes of stress around the age of two, three, and again around four. With the first stress event occurring more specifically around 1.88 years old, it is possible that at least one of the DEH are related to weaning induced stress (Katzenberg et al. 1996; Herring et al. 1998). In addition, the active cribra orbitalia seen in this child may indicate that his person was suffering from one of a myriad diseases at the time of death, including iron deficiency anemia, megaloblastic anemia (vitamin B12 deficiency), metabolic diseases such as scurvy, or infectious disease (Oxenham & Cavill 2010; Steyn et al. 2016). Thus, this individual combatted repeated physiological stress as a juvenile, and that they succumbed to the stress-inducing condition speaks to the frailty of the child in life.

This individual's mortuary context included coffin wood and utilitarian coffin hardware only, in the form of nails. Additionally, four plain bone buttons were recovered, with five holes each, indicating that the juvenile was buried in clothing. While two of the buttons were recovered out of the sift and therefore out of their original context in relation to the skeletal remains, the other two were recovered from within the ribs. The location of these buttons suggests that this person was wearing a top, or longer garment, closed together with plain, functional buttons.

Grave 10

Although the individuals from Grave 10 can be considered separately in terms of their biological profiles (including sex and pathology), it is necessary to consider their combined mortuary contexts. The single interment within Burial 1 occurred before the later interment of the two infants within Burial 2, as indicated by the location of Burial 1 below Burial 2. While the exact time span between these two burials cannot be known for certain, it is probable that all three individuals were buried simultaneously. Additionally, because remnants of coffin wood were recovered from between the two burials, it can also be determined that the first and second burials each had a separate coffin. Finally, only coffin wood and utilitarian coffin hardware – nails – were recovered from either burial in Grave 10, suggesting the presence of coffins without elaborate decoration. The only personal artifact found was a broken metal pin, that was most likely used to close a burial shroud for one of the three individuals (Raemsch & Bouchard 2000).

Grave 10 – Burial 1 Individual

The juvenile buried in Grave 10 – Burial 1 was estimated to have an age-at-death of between six and eight years, thus precluding sex estimation. This child experienced the most periods of stress out of the sample, when interpreted solely using number of DEHs. With 27 total lesions, this individual experienced periods of stress starting at just under two years, and continued intermittently until just under five years of age. Like the individual buried in Grave 9, this person died experiencing active disease or anemia, as indicated by active cribra orbitalia on the frontal bone of the cranium. However, healing porotic hyperostosis was also observed, which could indicate either past disease experience or that the individual was in the process of at least some recovery of the disease episode that was active at the time of death. Possibilities for the physiological stress that caused the healed and active pathologies observed on this person include iron deficiency anemia, vitamin B12 deficiency megaloblastic anemia, metabolic diseases such as scurvy, and infectious disease (Oxenham & Cavill 2010; Steyn et al. 2016).

Grave 10 – B*urial 2 Individuals*

The remains disinterred from Grave 1- Burial 2 were commingled *in situ*; however, skeletal inventory determined that two individuals, both term infants, were buried here together. Their young age once again prohibited the estimation of sex, and the commingled nature of the remains makes it difficult to link the pathologies on different bones to the same individual. However, at least one of the individuals was experiencing active disease at the time of death as suggested by the presence of active porotic hyperostosis on a frontal bone. Further cranial pathologies were observed in the parietals and on frontal bone, including bone loss and reactive woven bone. Although more extensive and diverse pathologies were observed on the individual(s) from Grave 10 – Burial 2, the similarities in active cribra orbitalis indicate that it is possible that the children interred in Grave 10 may have died of the same affliction, resulting in a one-event burial with two separate coffins. However, because porotic hyperostosis is a nonspecific stress indicator, its commonality amongst the individuals buried in Grave 10 speaks more to the collective frailty of these children rather than suggesting that all three children suffered from the same physiological stress. Specific diseases that were common during the relevant time period in the American South include yellow fever and malaria (Lambert 2006), and it is known that there was a yellow fever epidemic in Wilmington, NC in 1821 (Patterson 1992). However, the nonspecific nature of porotic hyperostosis prevents this interpretation from being more than speculation.

Grave 11 Individual

The individual buried in Grave 11 was estimated to have died at the age of one year and five months old, as is indicated specifically by the metal tack décor on the lid of the coffin, and more generally by skeletal and dental development. The coffin lid further indicates that the initials of the deceased were J.A.G. The last initial, presumably for Gause, lends support to the idea that this cemetery was indeed used by the Gause family. However, the lack of a complete name prevents this assertion from being definitive. The ribs of J.A.G. were observed to have many instances of pathology, including flaring of the sternal end, lateral straightening, and beading. These pathologies are often seen as indicators of rickets (Ortner and Mays 1998), which is thought to be most common in subadults between the ages of 6 months to 2 years and 6 years to 15 years (Lambert 2006). J.A.G. noticeably falls within this former of these two age ranges during which rickets most commonly afflicts subadults.

The coffin lid comprised wood, copper alloy tacks spelling out the child's initials and age at death, and the remnants of some fabric underneath some of the tacks. While all of the burials excavated from the GCAS during 2018 showed evidence of a coffin either through coffin wood, nails, or both, J.A.G. is the only individual for which evidence of any coffin elaboration or décor was recovered. Beyond this distinction, there are no other unique factors about the mortuary context of J.A.G. to suggest a possible reason as to why their coffin alone would be decorated. It is possible that unexcavated burial within the GCAS also possess evidence of elaborated coffins, and that the seemingly distinctive coffin from Grave 11 is actually a result of sample or preservation bias. In addition to the coffin elaboration, J.A.G.'s burial also contained ten metal pin fragments along with one complete metal pin. The complete pin had a decorative end, with two loops sitting one on either side of the head of the pin. It is likely that the presence of multiple metal pins indicates that J.A.G. was buried in a burial shroud (Raemsch & Bouchard 2000).

Grave 12 Individual

The individual disinterred from Grave 12 was estimated to have an age-at-death of birth ± two months, and therefore does not have an estimated sex. Cortical erosion is seen across all elements of the skeleton that were recovered; however, this is a nonspecific indicator of disease, with many possible causes. This infant was buried in a coffin, as evidenced by the recovery of nails. Additionally, the presence of a plain metal pin found within the vertebrae and ribs suggests that the individual was interred wrapped in a burial shroud (Raemsch & Bouchard 2000).

Implications

Overall, the Gause Cemetery at Seaside skeletal population displayed an array of pathological lesions similar to the individuals buried in the burial crypts from the Foscue Plantation located in Jones County, North Carolina. This is unsurprising given that both families were a part of the plantation elite during the 19th century in rural North Carolina (Seeman 2011). Specifically, the GCAS sample exhibited high rates of non-specific stress indicators, including dental enamel hypoplasias and cribra orbitalia, that signifies a high level of frailty in 19th century elite children. This is important for developing a better understanding about the health of elite planter families in North Carolina, and in the rural Southeastern U.S., given the prior scarcity of bioarchaeological analyses on this demographic population.

CHAPTER SIX:

CONCLUSION

A total of seven individuals were exhumed from the Gause Cemetery at Seaside (GCAS) during the second field season of archaeological work which took place in 2018. Of these seven individuals, six were subadults and one was an adult. The single set of adult skeletal remains were determined to belong to a female with an estimated age-at-death of 20 to 29 years. The subadult ages-at-death are newborn, birth ± 2 mos., 1 year – 18 months ± 6 months, 6 to 8 years, and 7 to 8 years. This sample population experienced poor dental health as indicated by antemortem tooth loss and dental caries. Significant dental enamel hypoplasias overall and cribra orbitalia and porotic hyperostosis and possible rickets in some of the infants and children further indicate that the population experienced multiple periods of stress throughout childhood. The small sample size from this cemetery hinders broader interpretations of health and disease of the Gause family in the 17th and 18th centuries. One way to further address this question is to continue bioarchaeological research on the remains from the GCAS. There are many avenues open to future research on the Gause Cemetery at Seaside, as discussed below.

Future research

Chemical analysis of hair

The adult female individual disinterred from Grave 3 was observed to have approximately two-thirds of her skull still covered with a layer of hair. The length of the remaining hair is insufficient for sex and/or gender interpretation for the individual due to the fact that the level of preservation of the skeletal material indicates that the current hair length may not be truly representative of the individual's hair during life. However, the existing hair provides an opportunity for future research into the life of this individual through isotopic analysis. Analysis of stable carbon and nitrogen isotope compositions of this individual's hair would allow for insight into the individual's diet (Webb et al. 2015). In addition to stable isotopic analysis, levels of cortisol from samples of the hair could increase understanding of how this individual experienced stress during life (Webb et al. 2015). Cortisol is a stress hormone that is produced in the body as a response to stressors and therefore, measuring changes in cortisol levels in the hair of this individual could provide information regarding periods of stress during the months prior to death that is supplementary to what has been garnered from analysis of the dental enamel hypoplasias and stress experienced during the childhood of this individual (Webb et al. 2010).

Isotopic, radiographic, and histological analysis of dentition

The recovery of teeth as part of the skeletal sample from the GCAS provides yet another avenue for future research to be done on this population. For example, stable isotopic analysis of both carbon and oxygen could help to shed further light on weaning patterns as experienced by the subadults that have been disinterred from the cemetery. While the estimated ages for periods of stress that resulted in dental enamel hypoplasias (DEH) can be used to make general inferences regarding weaning, DEH are not solely caused by changes in nutritional consumption, but rather can result from myriad other stressors such as infectious disease (Wright & Schwarcz 1998). Therefore, it would be apt for more specific and in depth analysis to be done via stable isotopes so that comparisons can be made between levels of carbon, oxygen, and/or nitrogen. Examining $\delta^{13}C$ levels by age would allow for insights into the age at which other foods were used to supplement breastmilk (Tsutaya & Yoneda 2015). In addition, $\delta^{18}O$ of apatite and $\delta^{15}N$

analysis of collagen both reflect trophic level shifts that occur as breastmilk consumption decreases and food supplementation increases during weaning (Tsutaya & Yoneda 2015; Katzenberg et al. 1996).

In addition to isotopic analysis of the dentition, radiographic and histological analysis of the structures within a tooth can be undertaken to assess potential vitamin D deficiency. This would be pertinent due to the pathologies on the subadult disinterred from Grave 11 at the GCAS during the 2018 field season. The observed shape deformations on many of the ribs of this individual are characteristically associated with vitamin D deficiency in the form of rickets (Ortner & Mays 1998). One way to explore potential vitamin D deficiency through the dentition would be to analyze the heights and shape of the pulp horns through radiographs of the teeth. Past studies have demonstrated that individuals with vitamin D deficiency show more constricted pulp horns when compared to individuals without vitamin D deficiency (D'Ortenzio et al. 2017). Another useful method of analysis would be to histologically examine the teeth for interglobular dentin, the existence of which can be suggestive of vitamin D deficiency (D'Ortenzio et al. 2017).

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