TABBY:

THE ENDURING BUILDING MATERIAL OF COASTAL GEORGIA

by

TAYLOR P. DAVIS

(Under direction of Dr. Reinberger)

ABSTRACT

Tabby is a unique building material found along the coast of the Southeastern United States. This material is all that remains above grade of many past coastal cultures and illustrates much of the history of Coastal Georgia. In this master's thesis, I present the following areas of research: 1) an explanation of the history and origins of the different generations of tabby, 2) a list of historical tabby sites that I feel are pertinent to its history and cultural significance, and 3) the production of samples of tabby through historical means and the analysis of their compressive strength. With these three concentrations of study, I am able to compile new information on this culturally significant building material.

INDEX WORDS: Tabby, Coquina, Limekiln, Limerick, Oglethorpe, Thomas Spalding, Oglethorpe Tabby, Military Tabby, Spalding Tabby, Tabby Revival, Pseudo Tabby, Fort Frederica, St. Augustine, McIntosh County, Glynn County, Camden County

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TAYLOR P. DAVIS

Major Professor: Mark Reinberger

Committee: Wayde Brown

Larry Millard

Scott Messer

Electronic Version Approved:

Maureen Grasso

Dean of the Graduate School

The University of Georgia

December 2011

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CHAPTER 1

INTRODUCTION

All throughout the world lie the remnants and reminders of earlier generations of people and civilizations that are now gone. These tangible elements are studied and admired in order to gain an understanding of and to create a physical link to the collective past. Whether it is marveling at the architectural wonders of the ancient world, or studying the findings at a Native American archaeological dig site, people want to learn more about the journey and arrival to the cultural and technological level at which they operate today.

The second chapter of this thesis presents the origins and history of the coastal building material known as tabby. Its roots are traced from the shores of the Mediterranean Sea, its journey to the new world, the role that it played in the foundation of the United States, its use in the Plantation Era South, and the cultural significance that it has had on the coastal southeast. This chapter creates a narrative of the evolution of tabby that provides background information to better understand the significance of the material. Most of the information in this chapter is drawn from research compiled from the works of Janet Gritzner, Merton E. Coulter, Buddy Sullivan, and Thomas Spalding. Gritzner wrote her doctoral dissertation at Louisiana State University on the subject of tabby, Tabby in the Coastal Southeast: The Culture History of an American Building Material. This along with her presentation of the Distributions

of Tabby in the Southeastern United States: A Geographical Perspective that was given by her at the Historic Preservation Division of the Georgia Department of Natural Resources symposium of The Conservation and Preservation of Tabby, makes up one of the most comprehensive studies of the history of tabby and its diffusion throughout the coastal region of the United States. Buddy Sullivan was also a speaker at the Historic Preservation Division's symposium on the preservation of tabby. Many of his collected works regarding the history of McIntosh County, Georgia, contain information about the Plantation Era of tabby building. Sullivan's focus on this era of tabby construction creates a detailed narrative of the material from the nineteenth century. The first author/editor to study tabby in detail, was Merton E. Coulter. His book, Georgia's Disputed Ruins, is the first in-depth look at the legacy of tabby. Coulter compiled information from many researchers and archaeologists that helped to place the Plantation Era tabby ruins in their correct chronological time period, freeing them from the erroneous "Spanish Mission" myth. Perhaps the most important source on the subject of tabby is that of Thomas Spalding. Spalding is credited with reviving this building method during the early nineteenth century. He also wrote a detailed instructional letter on the process by which tabby is made, which is the only first-hand source on the subject. These selected works, along with others, help to place the multiple generations of tabby in their appropriate places in the heritage of coastal Georgia.

In the third chapter, tabby sites of particular importance in the counties of McIntosh, Glynn, and Camden are referenced. The purpose of this chapter is to create a survey of these structures that can help to illustrate the diffusion of tabby sites along the coast of these three counties, while also creating a visible link illustrating the

information found in the history of tabby. In this survey, photographs have been compiled along with brief historical summaries of the sites included. This creates reference points explaining the significance of these tabby sites. Also included are the Global Positioning System coordinates for ease of locating and experiencing this material outside of a museum setting.

There is little information to be found on the actual production of tabby. Most sources explain the theoretical process of making tabby, which is primarily based on Thomas Spalding's "Letter to Whiting." The fourth chapter of this thesis explains and illustrates the history of tabby production. Also in this chapter are the notes and results of an experiment in producing a small amount of tabby through historical means following Thomas Spalding's recipe. A comparison of compressive strengths of this historical tabby mix with that of a modern-day mixture using Portland cement is also performed and documented. This chapter examines the production method of this material which is crucial to understanding the importance of tabby and its connection to the culture of coastal Georgia.

This thesis examines the history and origins, specific examples, method of production, and physical properties of tabby. This information creates a chronological timeline linking the examples of tabby to their historical origins while also examining the previously poorly documented production of tabby. These three main points of research help to illustrate and explain the importance of tabby, this unique building material left to us by the settlers of the coastal southeastern United States.

CHAPTER 2

HISTORY OF TABBY

Origin of Tabby

Tabby is a masonry building material made up of sand, lime (procured through the burning of oyster shell), oyster shell aggregate, and water. These materials are mixed into a slurry, poured into wooden molds called "shuttering", and formed into foundations, walls, columns, or blocks; almost any application is possible. Examples of the material known as tabby exist in the coastal regions of northern Florida, Georgia, and into South Carolina. These examples were constructed by Spanish and British colonists and settlers during the eighteenth century, plantation owners during the first half of the nineteenth century, and later by people reviving this unique method of building construction during the twentieth century.

The word "tabby" likely has its etymological origins in the Spanish language; the Spanish word, 'tapia', which means "rammed earth", is commonly thought to be the origin word for "tabby".[1] Although true "tabby" is a building material primarily found along the coast of the southeastern United States, earthen materials being formed into walls has been a method of construction dating back to the dawn of civilization.

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[1] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 153

Evidence of earthen construction methods known as “pise” and “cob” construction that have been dated to before 4,000 B.C.E. can be found throughout the Middle East.[2]

The roots of modern tabby building can be traced to the shores of the Mediterranean Sea. The first evidence of a “rammed earth” material being molded within wooded forms was of ancient fences found in Tarentum, Spain.[3] These fences were made of gravel, straw, and clay rammed between two boards laid on edge horizontally, creating a mold. The Muslim travelers/explorers, Abeadari and Idrisi, came upon structures such as these in North Africa and identified them in their documentation as that of “tabiya” construction. Tabiya undoubtedly is a word influenced by the Spanish “tapia”, considering that the material had been in use in the region long before Abeadari and Idrisi had traveled to the area. The use of tapia migrated around the Mediterranean coast and by the tenth century, was dispersed throughout northern Africa, thus creating the Senegalese tabby origin myth.[4] In 1728, French explorer and clergyman, Pere Labat, wrote of his observations of tapia structures, most of which had employed lime obtained through the burning of shells. These tapia buildings, however, only existed around port cities where Spanish and Portuguese merchants traded. These structures also bore resemblances to Spanish and Portuguese building styles, thus any attribution of the origins of this building type to the

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[2] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 131
[3] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 130
[4] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 128

Senegalese culture would be hard to make. According to Gritzner, "These West African cultures were more often receivers than donors in any cultural exchanges with the Portuguese or Spanish."

Tabby in the New World

According to Gritzner's research, the employment of the Spanish building material of 'tapia real', translated as "royal rammed earth" (rammed earth material with lime added to the mixture giving it more strength), crossed the Atlantic Ocean and was brought to islands of the Caribbean by Spanish explorers such as Ponce de Leon. Ponce de Leon's house, Casa de Tapias, in Caparra, Puerto Rico, is said to be one of the earliest tapia real structures in the New World, circa 1509.[5] This massive tapia real house spawned the construction of many other tapia real structures throughout the Caribbean islands during the sixteenth and seventeenth centuries.

During the sixteenth century, the Spanish Crown laid claim to what is now the southeastern United States, and St. Augustine, Florida, was the Spanish stronghold city. St. Augustine contains possibly the earliest examples of what we have come to know as true tabby. The first evolutionary link to colonial tabby is that of the construction of the flat roofs of Spanish-style dwellings in St. Augustine. These roofs were known as 'acuteas y cal', meaning "sand and lime". Sand was mixed with straw and lime and poured over layered mats laid over flat rafters creating a cementitious, mortar-like

[5] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 136

material without the characteristic large oyster shell aggregate indicative of later tabby.[6] The major link to tabby in this construction method is found in a letter to the Spanish Crown dated 1580 and written by P. Menendez Marques, a Spanish military officer, "We have begun to make lime from shell."[7]

In the decades of rapid deforestation that followed, and the destruction of the primarily wooden city by fire after the British siege of 1702, tapia began to become popular in the construction of the buildings within the city of St. Augustine. This building method started with poured floors containing crushed oyster shell as aggregate, such as the floor found in the Gonzalez-Alvarez house, circa 1702.[8] This masonry construction process was used for the construction of government buildings and for the houses of the wealthy until a naturally occurring tabby-like stone was discovered on Anastasia Island to the southeast of the city of St. Augustine. This material was called "coquina" and is the sedimentary accumulation of seashell and sand under pressure, forming a very porous limestone. Since this material could simply be quarried and transported to building sites not very far away, it was preferred over tabby. During the time of the war between the British and Spanish colonies, all construction was halted on anything that was not immediately beneficial to the Spanish Crown's protection of its investments in St. Augustine. The fort, Castillo de San Marcos, along with many other defensive and fortified structures throughout the city, was

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[6] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 140
[7] E. Merton Coulter, ed., Georgia's Disputed Ruins (Chapel Hill, NC: University of North Carolina Press, 1937), 11
[8] St. Augustine Historical Society

constructed of coquina stone. During this time, tabby had a slight revival since coquina was the masonry of choice for the government buildings in the city; the town's people were able to construct their own dwellings and attachments of tabby. One method of tabby construction that was used in St. Augustine was that of 'ostion y potes' or "post and tabby". This method employed a wood frame construction with tabby being poured into molds around the timbers. This method also appears in some later tabby constructions. Tabby was used extensively throughout the city of St. Augustine, but the use was not diffused far from the city proper. It was not until the British colonists began to work with this building material that its influence spread up and down the southeastern coast of the United States.

As the British began colonizing the southeastern United States, increasing threats of violence arose between them and the Spanish to the south in Florida. The Spanish were likely the main factor influencing the British production of tabby, though the link is not well documented. The tabby fortification of Fort Prince Frederick, circa 1730-1734, near Port Royal, South Carolina, was one of the earliest British tabby constructions.[9] The use of tabby in this fort spawned the era of tabby construction known as "Military" or "Oglethorpe Tabby", though this distinction came more than a century later. At this time tabby was still hanging on to its Spanish etymological roots, being referred to as "tappy" or "tappy work." General Oglethorpe was known to have visited Fort Prince Frederick while deciding on the strategic positioning of Fort Frederica, the soon-to-be southernmost fortified protection of the British interests in the New

[9] South Carolina Department of Natural Resources, Property Description: Fort Frederick Heritage Preserve, https://www.dnr.sc.gov/mlands/managedland?p_id=33 (April 2011)

World. There is little doubt that General Oglethorpe borrowed the concept of a tabby fort and headed south to St. Simons Island. There in 1736 he, along with British regular soldiers, enlisted Scots, and other settlers, set about building a fortified town. The military men and settlers built a powder magazine, military barracks, and many dwellings, all with tabby being one of the major components. General Oglethorpe built his own house of tabby, just outside the protective confines of the town of Frederica.[10] There is virtually no source of stone in the coastal plain region, which also lacks suitable clay for brick making. This left the option of wooden embattlements or those of tabby. General Oglethorpe made a fateful decision that left us with a tangible link to this area's history and possibly ensured the continued British colonization of Georgia.

General Oglethorpe was key to the spreading of the popularity of tabby as the enduring coastal building material. Noble Jones of Wormsloe Plantation on The Isle of Hope near Savannah, Georgia, was a contemporary of General Oglethorpe. Oglethorpe helped Jones to build his fortified house and allotted a small garrison of enlisted men to help Jones defend it from a possible Spanish invasion. This locale also served as yet another buffer between the invaluable port city of Savannah and the "Debatable Lands" lying between Spanish controlled Florida and the established British settlements. Closer to home, Oglethorpe granted large tracts of lands to military friends to keep an ever-spreading protective foothold on the southeastern coast of Georgia. Major Horton was granted a large portion of Jekyl Island (historical spelling) where he built a large Georgian home and a brewery of tabby. Mark Carr was granted five hundred acres of

[10] Fort Frederica National Monument Visitors' Center Museum

land on a mainland peninsula that would become the city of Brunswick, Georgia. There he built several tabby buildings, including a fortified home that also served as yet another military outpost.[11]

General Oglethorpe's defensive plans came to the ultimate test in July of 1742, when Spanish troops landed on the south end of St. Simons Island and overtook Fort St. Simons. As the Spanish marched north toward Frederica, two skirmishes ensued: first was the battle of Gullyhole Creek within a mile of Fort Frederica's gates, and second was the Battle of Bloody Marsh, closer to the south end of the island. The British defeated the Spanish at both encounters, driving them back to their ships moored in St. Simons Sound, ultimately forcing the governor of the Spanish colonies, Manuel de Montiano, to withdraw his troops from Georgia, thus ending the great debate over control of these southeastern lands. Although the outcome of military occupation on St. Simons and the surrounding areas had a positive effect on British investments, the immediate effect on Fort Frederica was not as beneficial. With Spanish raids no longer a threat to the British colonies, King George II did not see fit to fund a military occupation of the area anymore. With British occupations and conflicts continuing throughout the known world, the British regulars were pulled out of the town of Frederica to take part in other military operations. As the military presence left the town of Frederica, so too went most of the economic relevance of the townspeople there. Within a few years, the once thriving town of Frederica was economically crippled, and with a great fire in 1758, all but the most intrepid inhabitants left. As the town fell into ruin, many of the tabby

[11] Jekyll Island History Center Museum

structures were essentially quarried by cutting out tabby blocks and using them in building projects elsewhere on the island and surrounding mainland, including the base of the original lighthouse on Saint Simons Island.[12] The sequence of events that led to the destruction of the town of Frederica may have easily been a closing chapter to tabby construction on the southeastern coast of the United States, but this material's legacy would yet again have a resurgence of popularity.

Plantation Era

> "I was born in the town of Frederica, in one of these Tabby houses; I had seen time destroy everything but them: I had seen them even sawed up into blocks, like a mass of living stone; and of such blocks, carved from Frederica, are the three first stories of the lighthouse built at St. Simon's. The coating of plaster, which covered these houses, having fallen off, the walls exhibited the manner in which they were constructed, as well as the materials, so distinctly, that there was no difficulty in following the example." –Thomas Spalding[13]

Thomas Spalding was born in March of 1774 in the mostly abandoned town of Frederica.[14] Inspired by his childhood spent among the stately ruins of Frederica, his interest and respect for tabby construction would eventually lead to a methodically

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[12] E. Merton Coulter, ed., Georgia's Disputed Ruins (Chapel Hill, NC: University of North Carolina Press, 1937), 81,82

[13] E. Merton Coulter, ed., Georgia's Disputed Ruins (Chapel Hill, NC: University of North Carolina Press, 1937)

[14] Janet Hazen Gritzner, Tabby in the Coastal Southeast: The Culture History of an American Building Material (PHD Dissertation, Louisiana State University, 1978), 101

efficient recipe that would become the benchmark of coastal construction for the nineteenth century. Having many distinct titles--Georgia senator, United States Representative, innovator--the one of southern planter would probably be his longest-lasting legacy. Spalding owned and controlled a large amount of land in the McIntosh County area. With this land came the necessity for the construction of permanent structures, and being very concerned with the longevity of traditional wooden structures in the storm-prone, humid climate of the coast of Georgia, Spalding chose to build with tabby. After studying the ruins of Frederica and experimenting with the material, Spalding developed a recipe for tabby that was methodically mixed with exact proportions and poured, using a uniform system of reusable, interconnecting molds, called "shuttering". This building technique created a much stronger, more cohesive structure than that of past tabby construction. This is explained in Thomas Spalding's letter to N. C. Whiting of Connecticut dated July 29, 1844 (see appendix A).

This letter extinguished any doubt about what this material should be called. With a stroke of the pen, Spalding forever silenced the debate in favor of the word "tabby" over the more Spanish-inspired "tappy". Among some of the structures that Spalding built of tabby were his home and plantation support buildings on the south end of Sapelo Island and that of his mainland house of Ashantilly near Darien, Georgia. Being known for a very high personal standard, Spalding built his homes with the strictest adherence to quality.

Upon seeing the economic and structural benefits of using tabby as the primary building material, many other planters in this part of the Georgia coast employed this

practice. There are untold numbers of sites that bear the remnants of tabby structures built during this "Spalding Era" of tabby production. Many have been lost to development or reclaimed by the maritime forest. Among the most notable sites are those of the holdings of Spalding, Couper, Butler, and Hamilton, plus many other plantations, along with the sugar mills of Grant, McIntosh, and at the Thicket and the warehouses on Darien's waterfront. All of the tabby elements of these and many other sites bear a striking resemblance to those that Thomas Spalding innovated. Being very outspoken, and a popular member of the southern planter gentry, his ideas and instruction were greatly valued and well-heeded.

This resurgence of the use of tabby as a building material lasted from 1804, when Spalding began most of his construction projects, until the 1830s. A subsequent lull in tabby production was due to several factors: the "Great Hurricane" of 1824, economic downturns, yellow fever outbreaks, growing concerns about the continuance of the institution of slavery, and a growing superstition that masonry buildings were detrimental to good health due to "miasmic air" conditions within. In the decades that followed, little was produced in the way of tabby building, and this continued until the outbreak of the Civil War, which changed the socioeconomic culture of the South. Thomas Spalding died in 1851, leaving a substantial legacy of his built environment. He is buried near his mainland tabby home of Ashantilly in the St. Andrews Cemetery, along with members of his family, many of whom were laid to rest in crypts constructed of tabby. Even with the death of one of its biggest promoters and the economic hardships

on the area that would come with the Civil War and Reconstruction, tabby would yet again see a revival of its usage.

Tabby Revival

During the last two decades of the nineteenth century, tabby saw a surge of popularity that rivaled the previous eras of tabby building, most of which took place in the commercial construction sector. Many tabby warehouses, storefronts, and other commercial buildings were constructed during this time. This renewed interest in tabby construction may have its origins in a nostalgia of antebellum times in the south, but most likely tabby was simply used because of its economic and structural attributes. Many of these buildings today have been demolished or hardly resemble tabby due to stuccos and paint. In Brunswick and Darien alone are many examples of late nineteenth century tabby architecture. Many of these structures are still being used today, alongside of the more traditional brick construction.

During this era, tabby building took two higher uses: that of a home building material for the wealthy and that of a material for the construction of houses of worship. At least two wealthy businessmen from the northeastern United States, who used coastal Georgia as a winter retreat, employed the use of tabby in the construction of their lavish homes. A member of the Jekyl Island Club, Charles Stewart Maurice of the Union Bridge Company, had his winter house, Hollybourne, built of a Portland cement mixture poured into a late nineteenth century version of “post and tabby”

construction.[15] On Cumberland Island just to the south of Jekyll stand the ruins of Thomas Carnegie's mansion, Dungeness. This massive structure utilized many building materials including brick, granite, wood, and tabby. The foundations and surrounding retaining wall, in addition to many of the exterior walls, were made of a Portland cement tabby mix employing crushed rather than whole shells.[16] Both of these mansions, having been completed in 1889 and 1890, exhibit the far-reaching possibilities of this material when used to its fullest. Between Brunswick, Darien, and Woodbine, Georgia, there are at least four remaining churches built of tabby. Two of these churches are predominantly African American houses of worship--Saint Cyprians in Darien and Saint Athanasius in Brunswick--which could be a link to the plantation culture of a few decades earlier.

As the twentieth century dawned, few new buildings were constructed of tabby. According to many accounts, the last true tabby structure to be built in the area was that of St. Mark's Episcopal Church in Woodbine, circa 1904.[17] The end of this era of tabby construction came about from several factors. The developing railway system allowed materials such as mass-produced clay bricks to be shipped directly to the areas in which a lack of these bricks had led to the initial use of tabby in the first place. This, along with industrialized logging operations in the old growth cypress and pine forests

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[15] William Barton McCash, June Hall McCash, The Jekyll Island Club: Southern Haven for America's Millionaires (Athens, GA: University of Georgia Press, 1989), 58,59
[16] Patricia Barefoot, Images of America: Cumberland Island (Charleston, SC: Arcadia Publishing, 2004), 31-37
[17] Marguerite Reddick, Eloise Bailey, ed., Virginia Proctor, ed., Camden's Challenge: A History of Camden County, Georgia (Camden County, GA: Camden County Historical Commission, 1976), 272,273

along the Altamaha River, led to quicker, less laborious construction methods. Probably the most culturally significant factor that discouraged tabby building was that people started to appreciate the historical and cultural past of the area in which they lived, namely the American Indians' tenure on the Georgia coast. Since American Indian middens, or trash mounds which are primarily made up of discarded oyster shells, were the primary source for oyster shell, tabby building greatly depleted any information that could be gained from studying them. Early twentieth century fascination with archaeology may have aided in the preservation of much of the indigenous culture that we have been able to study these past one hundred years. It would not be until the 1970s that tabby would see yet another resurrection.

As the coastal region of Georgia grew in population, more and more people moved to the barrier islands, many of whom found the local history and aesthetic of partially-eroded tabby ruins romantic. This semi-eroded tabby aesthetic appealed to many people who were building their homes in the area. All that was needed was someone to pick up the torch and run with it. Max Emery was the self-proclaimed "King of Tabby".[18] He helped to develop an exterior stucco finish that was much like any other stucco, except that crushed oyster and cockleshell fragments were applied to the still-wet stucco finish, creating the appearance of the semi-eroded tabby. Some even went so far as to score horizontal lines in the stucco to imitate pour separations. This

[18] Florida Times Union, Accessed at the Bryan Lang Library in Woodbine, GA

"pseudo tabby"[19] style has become so popular that it is one of the most prominent house, office, and resort exterior finishes in the area, and it does not seem to be losing any momentum as of yet.

Tabby has had a presence and lasting effect on the architectural and cultural aspects of the coastal regions of Georgia, South Carolina, and Florida. This material has evolved, along with the culture of the area, creating a connection between the indigenous peoples, the invading Europeans and planters, and our culture of today. Much of our history can be traced using the evolutions of a locally innovated building material known as tabby.

[19] Lauren B. Sickles-Taves, Michael S. Sheehan, The Lost Art of Tabby Redefined: Preserving Oglethorpe's Architectural History (West Olympia, WA: Minuteman Press 1999)

CHAPTER 3

TABBY EXAMPLES

Along the coast of Georgia lie many historic sites containing the ruins of multiple generations of tabby. All of these sites help to illustrate the history and evolution of this coastal building material. Since there are tabby ruins in South Carolina, northern Florida, and in all six coastal Georgia counties, this chapter will primarily focus on the more accessible tabby sites in the counties of McIntosh, Glynn, and Camden. These three counties have the largest concentration of tabby sites along the southeastern coast. This chapter's purpose is to identify and briefly describe historical tabby sites in various stages of use that lend themselves to illustrating the historical timeline of this coastal building method.

Tabby Sites in McIntosh County

Most of the tabby sites of McIntosh County, Georgia, are concentrated around the city of Darien. Throughout the past two centuries, Darien has been a major hub of commerce for the southeastern United States. The first European settlement in the area was that of Fort King George. This was originally a British fort built in 1721 and meant to serve as protection for the Carolina colonies to the north. After its abandonment due to poor funding, disease, and desertion, General Oglethorpe stationed enlisted soldiers from the Scottish Highlands there. Eventually their new settlement expanded and was named Darien.[20] In the century that followed, Darien saw many economic boom times due to its proximity to the Altamaha River, the largest thoroughfare for the transportation of goods in southern Georgia. These economic boom times are illustrated by the remnants of permanent structures that were built at these times. The plantation era of McIntosh County left many physical reminders of the culture that existed in this area of the Georgia coast.

Thomas Spalding is credited with reintroducing the method of tabby building among his plantation-owning compatriots and business owners of the time. The tabby structures that remain from this era exist in conditions varying from the ruined to the rundown and to the rehabilitated. There are also many examples of the era of "tabby

[20] Bessie Lewis, They Called Their Town Darien (Darien, GA: The Darien News, 1975)

revival"[21] in the town of Darien. These historic tabby sites are easily visited, leading to a better understanding of the history and culture of this area's past inhabitants.

The list that follows includes only a few examples of sites containing tabby construction that are of particular interest and importance. A brief history and GPS coordinates will be included for easy location and interpretation outside of a museum setting.

Sapelo Tabby Sites:

Thomas Spalding's South End Plantation Complex

Some of the structures left over from Thomas Spalding's tenure on Sapelo Island still remain today. The remnants of his South End House and Long Tabby have been reclaimed, and the original tabby walls have been utilized to house the Georgia Department of Natural Resources and a post office in Long Tabby, while his South End House is now remembered as the historic home of both Howard Coffin, of Hudson Automobile fame, and later R. J. Reynolds, who owned and operated a cigarette corporation. Both of these sites can be easily visited by taking the ferry from the mainland to Sapelo Island and meeting a local tour guide at the dock.[22]

Coordinates: N (31.397129), W (-81.277050)

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[21] Lauren B. Sickles-Taves, Michael S. Sheehan, The Lost Art of Tabby Redefined: Preserving Oglethorpe's Architectural History (West Olympia, WA: Minuteman Press 1999)

[22] Sapelo Island Visitors' Center Museum

Chocolate Plantation Ruins

The ruins at Chocolate Plantation date to around 1815 and were originally built by the Danish sea captain, Edward Swarbreck, who attained the land from two Frenchmen. Swarbreck's plantation proved profitable, but in 1827 he sold his Sapelo lands to a northerner, Dr. Charles W. Rogers, who continued the tradition of tabby construction by building and making additions to the existing structures out of tabby. Eventually these tabby structures fell into ruin until Howard Coffin bought the majority of Sapelo Island, including Chocolate Plantation, in 1912.[23] Coffin "restored" the Rogers barn, and today this is an interesting example of early twentieth century preservation of tabby. Chocolate Plantation can be visited by appointment. It is situated on the northwestern side of Sapelo Island adjacent to the Mud River.

Coordinates: N (31.500844), W (-81.254465)

Tabby Sites in and around Darien, Georgia:

Ashantilly (see figure 24)

Also known as "Old Tabby", this was Thomas Spalding's mainland home, built around 1820. The structure burned in 1937 while in the possession of the Haynes family. Artist and printer, William G. Haynes began a lifelong process of rehabilitating the house. Much of his work

[23] Buddy Sullivan, Sapelo: A History (Darien, GA: McIntosh County Chamber of Commerce, 1988),8-10

was focused on bringing Ashantilly back to what it was before the fire with some mid-twentieth century alterations.[24] Ashantilly and the neighboring Saint Andrews Cemetery can be visited by appointment. The property is controlled by the non-profit Ashantilly Center with the mission of preserving the legacy of both the house and of the lives lived within.

(Ashantilly eastern façade)

Coordinates: N (31.381147), W (-81.413075)

The Thicket at Tolomato Island (see figures 25, 26)

The ruins at The Thicket are all that remain of the William Carnochan sugar and rum distillery operation. Here, much like many other sugar operations inspired by Thomas Spalding, are the tabby ruins of an octagonal sugar mill and many other supporting structures. William Carnochan received very high praise from Thomas Spalding himself regarding his mill and distillery; Spalding said that the Thicket was "neatly

[24] The Ashantilly Center

executed in tabby." The Carnochan sugar operation was destroyed by the great hurricane of 1824 and was not rebuilt. William Carnochan died the following year. Like many other sites in the area, the tabby walls were utilized for other building projects in later eras. During the early part of the twentieth century, the ruins at The Thicket were thought to be the remains of the Spanish mission of Tolomato. This was later proved to be another inaccuracy in the evolution of tabby, since the mission of Tolomato was actually several miles to the south.[25] These ruins are now the center point for the Tolomato Island subdivision. They are protected from vandals by a fence, but can be easily observed from a few feet away.

(Ruins at the Thicket)

[25] Buddy Sullivan, Early Days on the Georgia Tidewater: The Story of McIntosh County and Sapelo (Darien, GA: McIntosh County Board of Commissioners, 2001), 101-107

(Ruins at the Thicket)

Coordinates: N (31.428414), W (-81.384453)

Laurel Grove Plantation "Kell's Landing" (see figures 27, 28)

All that remains of John Kell's Laurel Grove Plantation is a tabby foundation of a once fine home over looking the marshes between the mainland and Black Island. John Kell's son, John McIntosh Kell, served in the Confederate States Navy during the Civil War as the Executive Officer aboard the famed Confederate ship, the CSS Alabama, which was sunk by the USS Kearsarge in the English Channel. John Kell and his wife are interred in the St. Andrews Cemetery, along with many other notable landowners of McIntosh County.[26] This site is on privately owned land, but is accessible through a path off of McIntosh Road near Fort King George.

[26] Buddy Sullivan, Early Days on the Georgia Tidewater: The Story of McIntosh County and Sapelo (Darien, GA: McIntosh County Board of Commissioners, 2001), 77, 326-327

(Kell House foundation at Laurel Grove Plantation)

(Kell House foundation at Laurel Grove Plantation)

Coordinates: N (31.368623), W (-81.416296)

Darien's Waterfront Tabby Warehouses (see figures 29, 30)

Darien's waterfront was an important and influential point of commerce in Georgia. Being situated on the Darien River with close access to the Altamaha River gave Darien the geographical advantage of being downstream from the inland cotton producers along the

Ocmulgee, Oconee, Ohoopee, and Altamaha rivers. Today there are the remnants of several tabby buildings along the bluff above the Darien River. Most of these structures are in ruins now, but still help to illustrate the history of Darien's, at one time, booming commercial district. The majority of these buildings were constructed around 1815, replacing a series of wood frame buildings that burned in 1812. Here were multistoried building complexes that served every aspect of the cotton industry from the cotton exchange to storage to lodging for merchants. Most of these structures were left in ruin after a devastating fire in 1863 which destroyed much of the commercial district of Darien.[27] Today the ruined foundations of many of these tabby warehouses can easily be visited at any time along with one remaining intact tabby structure, the Strain Building.

(Darien's Waterfront Warehouses)

[27] Buddy Sullivan, Cotton Port on the Altamaha (Darien, GA: The Lower Altamaha Historical Society, 2002), 1-11

(Strain Building)

Coordinates: N (31.368607), W (-81.436555)

Saint Cyprians Episcopal Church (see figures 31, 32)

Saint Cyprians is an example of Romanesque style tabby construction. It was originally built in 1876 for the "Colored People of McIntosh County". With funding coming in from England, Philadelphia, and local citizens, the church was primarily built by the future parishioners.[28] Being of tabby construction, this illustrates the long-term effect that working and living in and around tabby structures of the plantation era had on future generations of African Americans. The grounds of this church can be visited at any time, while the interior can be seen by appointment or during Sunday services.

[28] Georgia Historical Marker

(St. Cyprians Episcopal Church)

(St. Cyprians Episcopal Church)

Coordinates: N (31.366765), W (-81.432212)

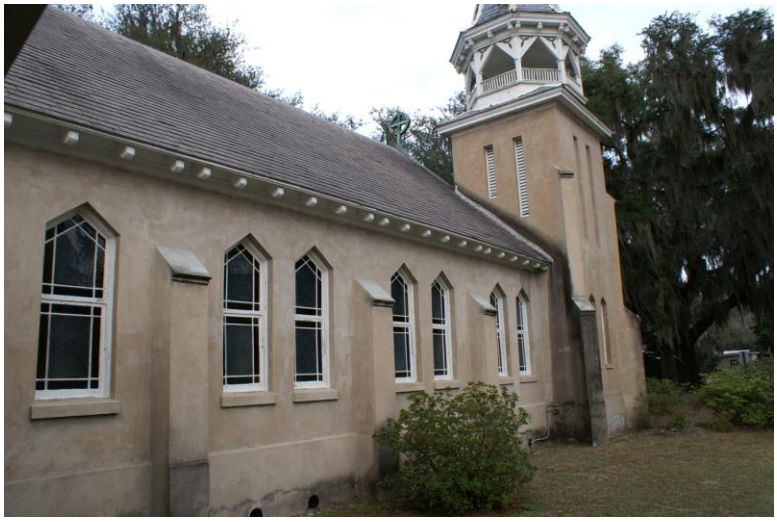
First Presbyterian Church of Darien (see figures 33, 34)

Darien's First Presbyterian Church is considered to be the first Presbyterian Church to be chartered in Georgia in 1736. The church has lived through several architectural incarnations, the latest being that of the present-day church built in 1900.[29] This is one of the few examples of

[29] Bessie Lewis, They Called Their Town Darien (Darien, GA: The Darien News, 1975), 54,

Gothic Tabby architecture. The grounds can be visited very easily any time, but the interior can be seen by appointment or during Sunday services.

(First Presbyterian Church)



(First Presbyterian Church)

Coordinates: N (31.371982), W (-81.436282)

Buddy Sullivan, Early Days on the Georgia Tidewater: The Story of McIntosh County and Sapelo (Darien, GA: McIntosh County Board of Commissioners, 2001), 304-308

Tabby Sites in Glynn County

Glynn County, Georgia contains probably the widest array of historic tabby sites, the earliest of which include that of General James Oglethorpe's Fort Frederica. This site dates back to 1736, when General Oglethorpe set up this southernmost fortified colony in Georgia to protect Savannah and the Carolinas from Spanish invasions from Florida to the south. From this site, Thomas Spalding was inspired seventy years later to resurrect this building material to be used on his plantations in McIntosh County. He also encouraged many of his neighboring plantation owners to employ tabby building in their own operations, leading to the largest concentration of tabby structures in all of the tabby eras. From this popularity rose another resurgence of tabby building known as tabby revival. Examples of this can be found in the city of Brunswick, Georgia, and Jekyll Island. Many of these structures are still being used and are a testament of the strength and longevity of tabby as a building material.

The list that follows includes only a few examples of sites containing tabby construction that are of particular interest and importance. A brief history and GPS coordinates will be included for easy location and interpretation outside of a museum setting.

Saint Simons Island Tabby Sites:

Fort Frederica (see figures 35, 36, 37)

This site is maintained by the National Park Service and is very easily visited seven days a week. It contains the remnants of the fort and town that General James Oglethorpe founded to guard the southern

British colonies against invading Spanish forces from the south. These tabby ruins are the oldest in the three-county area being covered in this survey. Most of the tabby remnants consist of foundations with only two examples protruding up past grade. These structures are known as the soldiers' barracks and the "King's Stores" or powder magazine. Both have been altered during the twentieth century to conform to a more fort-like appearance through the addition of crenellations on the parapet and the reconstruction of the southern portion and western wall of the powder magazine. Although there have been additions that have altered the physical appearance of this site, it is still invaluable in regards to the history of the formation of the United States, as well as that of the history of tabby.[30]

(Soldiers' Barracks)

[30] Fort Frederica Visitors' Center Museum

(Powder Magazine)

(Home/Tavern Foundation)

Coordinates: N (31.223371), W (-81.389259)

Butler Plantation at Hampton Point (see figures 38, 39)

Hampton Point is located at the extreme north end of Saint Simons Island. Here Major Pierce Butler invested in Sea Island long staple cotton plantation operations. Butler Plantation was very large and contained many tabby support structures. All are in ruins today, and many have been destroyed by neighborhood development. The ruins

that remain help to illustrate an important cultural narrative along with the book, Journal of a Residence on a Georgia Plantation in 1838-1839. This was an expose of the institution of slavery written by the British Actress, Fanny Kemble. She was, for a short time, the wife of Major Pierce Butler's grandson and namesake. Although the ruins on Butler Plantation are in a subdivision called Hampton Point, some of the ruins are accessible due to historically sensitive street layout and neighborhood planning. Three tabby sites can be easily visited and are adjacent to the road.

(Ruins at Hampton Point)

(Ruins at Hampton Point, Overseer's House)

Coordinates: N (31.293331), W (-81.342769)

Cannon's Point, Couper Plantation (see figures 40, 41)

Cannon's Point is located directly across Jones Creek from Hampton Point at the extreme north end of Saint Simons Island. The first European to settle this area was a Frederica inhabitant and carpenter, named Daniel Cannon. He was granted permission to move to this location from Frederica to raise hogs and cattle. After this failed venture, he and his family moved to Charleston, South Carolina, in 1741. This site, like many other tabby sites, was located near Native American shell middens made up primarily of discarded oyster shell, a large percent of the native peoples' protein diet. Just before the turn of the nineteenth century, the Scottish merchant, John Couper, acquired the property. The primary residence at Cannon's Point is that of the Couper House. This house was built in two phases, one of which is an example of "post and tabby" construction. Aspects of this section of the Couper house could

date back to the Cannon tenure at this location. Today all that remains are the foundation walls, which are around five feet in height, and the two partial chimney stacks of the original portion of the house. Very nearby is the brick kitchen chimney built atop a tabby floor.[31] Entry to Cannon's Point is only gained through permission as of now, but there are plans in the works to give public access to this site through the work of the Saint Simons Land Trust.

(Couper House at Cannon's Point)

[31] John Solomon Otto, Status Differences and the Archeological Record: A Comparison of Planter, Overseer, and Slave Sites from Cannon's Point Plantation (1794-1861), St. Simons Island, Georgia (Ann Arbor, MI: Xerox University Microfilms, 1975), 118-132

(Couper House at Cannon's Point)

Coordinates: N (31.287305), W (-81.326525)

Tabby Cabins at Epworth (see figures 42, 43)

The Tabby Cabins at Epworth are intact remains of the Hamilton Plantation. James Hamilton's plantation was on the southwestern side of Saint Simons Island, on the banks of the Frederica River. There exist several tabby remnants of this plantation's history but the "Tabby Cabins" are the most notable. These two cabins were home to slaves that worked and lived at Hamilton Plantation. They are operated by the Cassina Garden Club of Saint Simons Island and are opened to the public on Wednesday mornings during the summer, and also by appointment. One has been restored to an interpretation of a slave dwelling, while the other is used for Garden Club activities. This building also contains a display of artifacts found on site as well as historical photographs.[32]

[32] Cassina Garden Club

(Hamilton Plantation Cabins at Epworth)

(Hamilton Plantation Cabins at Epworth)

Coordinates: N (31.171093), W (-81.407657)

Jekyll Island Tabby Sites

The Horton House and Brewery (see figures 44, 45)

On the western side of Jekyll Island lie the remains of Jekyll's oldest residence. The Horton House was the two-storied Georgian home of Major Horton and his family.[33] Built during the 1740s, the ruins of this

[33] Jekyll Island Historical Markers

house were stabilized in 2004 by the application of a new protective stucco finish that left it with a “splotchy” appearance. Across the street lie the tabby remnants of a brewery built by Major Horton and a cemetery of later inhabitants of Jekyll. This site is easily visited by car.

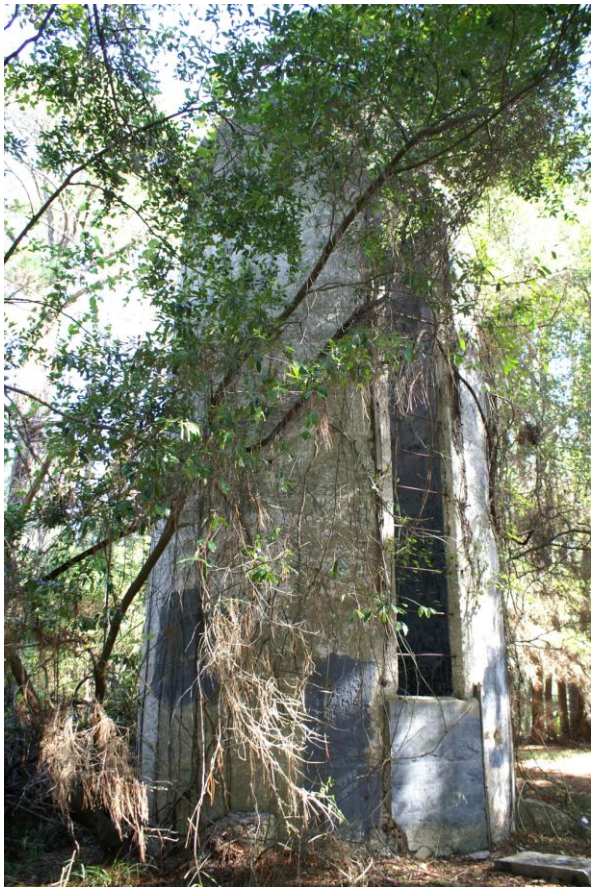
(Horton House)

(Horton Brewery site)

Coordinates: N (31.101897), W (-81.414615)

Tabby Silo (see figures 46, 47)

The Tabby Silo lies in the woods on the western side of Jekyll Island, south of the Horton House site. This structure was most likely part of a late nineteenth century dairy farm. The importance of this structure lies in the fact that it appears to be reinforced with iron reinforcing rods within the tabby walls. Also, it appears to be constructed of a Portland cement tabby mixture rather than a lime-based cement, placing this structure within the tabby revival era. The Tabby Silo is easily found on a dirt road just off Riverside Drive on the western side of Jekyll Island.



(Dairy Silo)

(Detail of reinforced tabby of silo)

Coordinates: N (31.0786889), W (-81.424034)

Hollybourne House (see figures 48, 49)

Hollybourne, also known as the Maurice House, is located within Jekyll Island's Historic District. This is an example of tabby revival executed in a very high style. This house was designed by a bridge designer, which is evidenced by the truss system that supports the lower floors and extends up into the attic space of the house. This house is an architectural amalgamation of coastal Georgia building materials, Flemish gables, brick quoining, and terracotta brackets and detailing. The Hollybourne House is maintained by the Jekyll Island Authority and is in a stable, yet unrestored condition. The exterior can be easily visited seven days a week, while an interior visit may take special permission.

(Western façade of the Hollybourne House)

(Detail of Hollybourne gable)

Coordinates: N (31.06221), W (-81.423136)

Brunswick and Glynn County

Elizafield Plantation (see figures 50, 51)

This site contains the tabby ruins of the Elizafield Plantation built by Doctor Robert Grant of Scotland. Most notable of the tabby examples on this site is that of the sugar mill. Like Thomas Spalding's mill on Sapelo and the William Carnochan's mill at The Thicket, this sugar mill had an octagonal mill house in addition to a rectilinear tabby building adjacent to

it. Upon visiting this structure, one can see the effects of the forest over-taking the ruins. Many steel brackets and threaded rods have been placed to curtail further destruction from live oak roots undermining the structure. A very important attribute of this site is that here was where the Spanish Mission myth regarding the origins of tabby was disproved. During the 1930s, a Civilian Conservation Corps performed an archaeological excavation at the site hoping to identify the origin of the structure. The information yielded by this survey was that the octagonal portion of the structure was not that of a Spanish Mission chapel but a sugar mill grinding house. All the artifacts date from the early to mid-nineteenth century rather than that of the seventeenth century.[34] This site is located just south of the Altatmaha River delta and the neighboring Hofwyl-Broadfield Plantation. The property is now owned and operated by what is now known as Morning Star Youth Estate, and permission is needed to access the tabby ruins.

[34] E. Merton Coulter, ed., Georgia's Disputed Ruins (Chapel Hill, NC: University of North Carolina Press, 1937)

(Octagonal millhouse of Elizafied Plantation)

(Elizafield Plantation ruins)

Coordinates: N (31.314681), W (-81.467814)

Saint Athanasius Episcopal Church (see figure 52)

Saint Athanasius Episcopal Church is an example of tabby revival. This church is one of the best examples of a historic tabby structure that is still being used as originally intended by the designers. During the early twentieth century, the Saint Athanasius School was razed, but the church was spared. The school was a two-storied massive tabby structure, which

served the African American community and was located just to the south of where the church still stands. The grounds of this site can be easily visited any time, while the interior can be seen by appointment or during Sunday services.

(St. Athanasius Episcopal Church)

Coordinates: N (31.149779), W (-81.491606)

Commercial Downtown Brunswick (see figures 53-58)

At the dawn of the twentieth century, the three primary building materials in the commercial district of Brunswick, Georgia, were wood, brick, and tabby. There were many tabby structures serving as shops, restaurants, and warehousing.[35] Today most of these tabby buildings have been lost. The ones that remain help to tell the story of Brunswick's coastal heritage, while still carrying on a vital role in the historic district of Downtown Brunswick.

[35] Sanborn Fire Insurance Maps, Brunswick, GA, 1943, Brunswick, Glynn County Public Library

(1600/1602 New Castle St.)

(1313 New Castle Street)

(500 Monck St.)

(1400 New Castle St.)

(1326 New Castle St.)

(Rear of 1326 New Castle St.)

Coordinates: N (31.15056), W (-81.495801)

Tabby Sites in Camden County

Throughout Camden County lie many examples of historic tabby construction, primarily from the plantation era, including one massive and intact example which led the imaginations of some visitors to create confusion as to the origins of the plantation era tabby ruins along the coast. Perhaps the most important of the other tabby structures found in Camden County are of later tabby construction. These help to illustrate the desire of later cultures to retain a portion of their collective architectural history while using a proven method of substantial construction.

The list that follows includes only a few examples of sites containing tabby construction that are of particular interest and importance. A brief history and GPS coordinates will be included for easy location and interpretation outside of a museum setting.

Cumberland Island

Dungeness/Green Cottage (see figure 59)

Dungeness is located on the Southern tip of Cumberland Island in Camden County. The ruins of the 1889 Thomas Carnegie mansion sit atop the ruins of Revolutionary War hero Nathanial Greene's summer home of the same name. The original Dungeness was a four-storied tabby house, which at the time was considered one of the largest homes on the eastern coast of the United States and the largest tabby dwelling ever constructed. This Dungeness was abandoned and destroyed by fire in the years following the Civil War. In the 1880s, Thomas Carnegie, steel

baron Andrew Carnegie's brother, bought the Dungeness site. After his death, his wife, Lucy, continued building what would become the second incarnation of the Dungeness mansion. Much bigger and more sprawling than the first mansion, the Carnegie Dungeness illustrates the wealth that was migrating to the southern barrier islands to escape the harsh northeastern winters. Today, all that remains of this mansion are the ruined walls and foundations after a fire destroyed the house in 1959. Several other tabby structures scatter the grounds surrounding Dungeness, the oldest of which is the last remaining element of the Greene tenure of the island, the Greene's gardener's cottage.[36] There is also a tabby revival pergola and two tabby structures near the marsh's edge directly south of the mansion. Dungeness is made up of many building materials, with a Portland tabby mix being the primary material for the foundations and many of the exterior walls of the structure. This site can be visited fairly easily by taking a National Park Service contracted ferry out of downtown Saint Marys, Georgia.

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[36] Marguerite Reddick, Eloise Bailey, ed., Virginia Proctor, ed., Camden's Challenge: A History of Camden County, Georgia (Camden County, GA: Camden County Historical Commission, 1976), 215-219,
Patricia Barefoot, Images of America: Cumberland Island (Charleston, SC: Arcadia Publishing, 2004), 14, 31-37, 44

(Entry drive to Dungeness)

Coordinates: N (30.748466), W (-81.470867)

Camden County Area

Saint Marks Episcopal Church (see figures 60, 61)

Saint Marks Episcopal Church is a small, nondescript chapel in Woodbine, Georgia, just south of the Satilla River. This is an example of tabby revival, and it still serves the Episcopal parishioners of Woodbine today. Having been built in 1904, this is known to be one of the last tabby structures to have been constructed in the area.[37] Viewed at a cut away section of the wall, you can see that ships' ballast stones were used in addition to the tabby. The grounds of this site are easily accessible and can be visited for Sunday services or by appointment.

[37] Marguerite Reddick, Eloise Bailey, ed., Virginia Proctor, ed., Camden's Challenge: A History of Camden County, Georgia (Camden County, GA: Camden County Historical Commission, 1976), 272

(St. Marks Episcopal Church)

(Cross-section of wall showing tabby and ballast stone)

Coordinates: N (30.969236), W (-81.407657)

Houston McIntosh Sugar Mill (see figures 62, 63, 64)

The Houston McIntosh Sugar Mill, built during the 1820s, contains probably the most intact and expansive plantation era tabby ruin in this three-county area. This two-storied, sprawling complex, complete with columns, is the remainder of John Houston McIntosh's sugar processing mill in connection to his New Canaan Plantation sugar cane production. The mill consisted of three main sections: a milling room, a boiler room, and a curing room. This sugar mill also led local and visiting authors and intern local historians to reinterpret this area's history. It was here that W. J. Hoxie, contributor to The Savannah Morning News, wrote of his imaginative thoughts of the harrowing tales of Spanish friars defending themselves against a "great siege" or fiercely battling off "marauding pirate bands" all while trying to save the souls of the "savage natives". It was hard for him to believe that such a well-built structure could have been used for agricultural purposes. In his article, Hoxie is quoted as saying: "I have yet discovered any published work that throws any light on the origin and history of this building." But the damage was done. Savannah Morning News readers were taken by this fictional idea. This helped to start and spread the "Spanish Mission myth" regarding tabby construction. This myth was perpetuated by James T. Vocelle's book, History of Camden County, where he states as fact that these tabby ruins were that of the Spanish missions. For decades it was thought that all of the plantation era tabby ruins were that of the lost Spanish missions.

Later this error in the chronology of tabby would be corrected, and the literature on the subject from then on would reflect the annotation.[38] The Houston McIntosh Sugar Mill can be easily visited at any time. It is just off of Charlie Smith Sr. Hwy, across from Kings Bay Naval Base and down a marked path.

(Houston McIntosh Sugar Mill)

[38] E. Merton Coulter, ed., Georgia's Disputed Ruins (Chapel Hill, NC: University of North Carolina Press, 1937)

(Houston McIntosh Sugar Mill)

(Houston McIntosh Sugar Mill)

Coordinates: N (30.793228), W (-81.578835)

Tabby Cabins at Dover Bluff (see figures 65, 66)

These tabby cabins date back to the plantation era and are located on Dover Bluff in northeastern Camden County on lands once known as Register's Point. These two structures are indicative of tabby slave dwellings throughout the coastal plantations. Sometime after the Civil War, this land was purchased by William R. Register, who rebuilt a substantial home using the two tabby ruins.[39] In their rough, unrestored state, these ruins bear a resemblance to the restored cabins of the Hamilton Plantation located at Epworth. This site is located on private property owned by the Dover Bluff Club. Permission is needed for access to this site.

[39] Marguerite Reddick, Eloise Bailey, ed., Virginia Proctor, ed., Camden's Challenge: A History of Camden County, Georgia (Camden County, GA: Camden County Historical Commission, 1976), 186-187

(Cabins at Dover Bluff)

(Cabins at Dover Bluff)

Coordinates: N (31.020837), W (-81.509503)

Camden County Public Library (see figure 67)

Constructed in 1989, the Camden County Public Library is one of the latest in the revival of tabby architecture. This building illustrates the communities of Camden County coming to agreement that they wanted to celebrate their collective past through reviving the historic local building material. The 16,000 square foot library cost about 1.6 million

dollars to build. The exterior walls of the structure consist of a Portland cement and oyster shell mix, which was poured into wooden forms measuring 24 inches high and 6 inches in depth. Though these are not the dimensions of historic tabby, it is technically a structural tabby wall.[40] This library is located on Hwy 40 between Kingsland and St. Mary's, Georgia, and can be visited from 10-5 pm, six days a week.

(Camden County Public Library)

Coordinates: N (30.786892), W (-81.645743)

[40] Camden County Tribune (September 22, 1988) 3a

CHAPTER 4

TABBY PRODUCTION

History of Tabby Production

Most advanced civilizations of the past have developed and instituted some form of cementitious, permanent building material. Most of these examples, like many other cultural advancements, lead back to Rome. For viable cement to be made before the innovation of Portland cement, a natural cement was needed, the most common of which is lime. Lime is a material that has been utilized for centuries in construction practices. It is used as mortar for clay bricks as well as for strengthening earthen construction by mixing it in with other earthen building techniques. Lime is procured through a process in which limestone or seashell is heated, driving off the carbon dioxide from the calcium carbonate (seashell) inturn, creating “quicklime” or “builder’s lime” (calcium oxide). In the New World, however, the Spanish and British colonists had to adapt building technologies from their prospective cultures to build permanent structures that were relatively efficient to construct and could be made from local materials.

The production of tabby has a somewhat clouded history. There is ample documentation of the uses of tabby, but few sources documenting the process by which tabby is produced. Thomas Spalding’s letter to Whiting is most notable for its process instruction, yet he does not explain the production process of the key ingredient, lime.

There are many sources that refer to the production of lime from islands in the Caribbean. These are mostly accounts of producing lime from limestone rather than oyster shell, but both were used. The means by which these sources describe the lime production is through the use of a "lime rick". The Caribbean version of a lime rick is a conical-shaped stacking of wood with alternating layers of limestone or oyster shell. The heat is controlled by the amount of air allowed to pass by the material packed between the mixed hard woods and softer woods.[41]

The lime production method that is widely accepted in the coastal areas of the southeastern United States is that of a lime rick resembling a "log cabin". According to the National Park Service, this design consists of a pit dug out just a couple of feet deep with pine trunks stacked "Lincoln-Log" style over the pit. Small, green timbers measuring anywhere from one inch to four inches in diameter are placed horizontally between the stacked logs. These small, green timbers create racks on which the oyster shells are placed. A typical example of one of these lime ricks usually stands about four to six feet above the ground, depending on the diameter of the pine logs used, and

[41] Jeff Price, Virginia Limeworks

usually has two to three layers of oyster shell racks within the rick.[42] This structure is then set on fire and left to burn itself out, after which, there is a large amount of ash mixed with charred wood and oyster shells in various states of chemical breakdown. These lime burns are fueled by pine and some hardwoods, which produce a very erratic fire with unreliable temperatures. To get a fire with sustained temperatures of over 900 degrees (the temperature that is needed to expel carbon dioxide from the calcium carbonate) is unlikely with a lime rick unless it is extremely well-executed.[43] The lime rick burning demonstrations in the coastal area do draw a crowd but rarely yield viable lime.

It is believed by some that this was most likely not the primary process that was employed in the production of "Oglethorpe" or "Spalding Era" tabby. A more efficient design of a lime kiln was more likely to have been used for lime production. A lime kiln made of clay bricks could have been reused many times as well as dismantled and moved to another site, whereas a lime rick built of logs would have a one-time use life span. Perhaps most important is the fact that the temperature in a lime kiln could be more easily controlled than that of a lime rick. The intensity of the heat used to expel the carbon dioxide from the calcium carbonate, producing calcium oxide, is crucial. It is somewhat doubtful that usable, active lime could be produced in an uncontrollable pine pyre, whereas in a brick kiln, it seems more likely. Also, the lime produced in a kiln would be a more pure, uniform lime than that produced with a lime rick since the

[42] Fort Frederica National Monument Visitors' Center Museum
[43] Brian Robinson, Formerly of the Jekyll Island Authority

charred wood, ash, and non-converted oyster shell material would be mixed in with whatever lime was yielded.

General Oglethorpe, along with many of the British settlers in the New World, would have been familiar with flare kilns used for the production of lime in England. These kilns would consist of a vertical hole dug straight down through the top of a hill and met by another horizontal hole dug through the side of the hill. Fuel, either hard wood or coal, would be stacked in alternating layers of limestone pieces filling up the vertical hole. This would then be set afire through the horizontal hole and left to burn for days. In the end, the fire would have been so well-contained that the lime would collect at the bottom and be gathered through the horizontal access hole.[44] It is odd, however, that Thomas Spalding made no mention of the process in which he produced the lime that he used and that there are not any remnants of brick lime kilns that have been studied in the area.

Lime Kiln Construction

The brick lime kiln constructed for research for this master's thesis was fired twice. It was inspired by a similar kiln that was built for demonstrative purposes on the grounds of Ashantilly, Thomas Spaulding's mainland residence. No historical evidence was used to support this design. The kiln was simply built for the most efficient way to produce a small amount of lime for experimental purposes. Before construction of this lime kiln could take place, a suitable location had to be found, one with few overhanging tree limbs and far enough out in the county where the risk of fire was acceptable. The

[44] Ruth Siddall, "Kiln Architecture and Technology" http://www.ucl.ac.uk/~ucfbrxs/limes/Kilns.htm (April 2011)

first step of construction was to lay a small slab foundation of concrete in the dimensions of 36”x24”. On top of this slab was where the refractory liner floor of the firebox was laid, which consisted of 4”x8”x1” firebricks. Then came the 4”x8”x2” firebrick, building up the vertical walls of the refractory liner. A 12”x24” piece of expanded steel lathe with flat bar reinforcement was used to serve as a shelf to support the oyster shells over the fire. Construction continued on with the laying the firebrick, creating a vault over the oyster shells to capture as much heat as possible in the shell chamber. No mortar or clay was used when laying the firebrick. After completion of laying the firebrick refractory, a permanent protective surround out of 4”x8”x2” red clay bricks was built (see figure 3). For the top of the kiln, where the vaulting begins, earthenware potters’ clay was used as mortar, so that after the firing, the top portion of the kiln could be easily dismantled, making retrieval of the cooked oyster shells possible without destroying the kiln in the process. Three courses of red clay block two blocks deep were placed on the top of the vault. These clay blocks had two voids in them and when laid horizontally, they served as a four-barreled smoke stack (see figure 7). The purpose of this was again, to keep as much heat inside of the shell chamber as possible.

The next step after building the kiln was designing a way to force air into the combustion chamber or firebox. Historically there would have been something similar to a blacksmith’s bellows. This would have been operated by hand for most of the duration of the burn. Having to constantly monitor fuel consumption and temperature, the less labor-intensive and least complex alternative of employing a shop vacuum cleaner was used. A vacuum hose was run from the exhaust port of the shop vacuum to

a length of 3/4 inch diameter copper tubing. This tubing was soldered to a 3/4 inch to 1/2 inch diameter turndown and split from which ran two 1/2 inch diameter copper tube lines that ran the length of the interior of the firebox along the walls. Six holes were drilled in these two copper tubes, three on each tube, which, when the vacuum was turned on, acted as six jets of air being forced into the combustion chamber feeding the fire and raising the temperature to well above 1000 degrees.

Upon completion of the building of the kiln and the forced-air apparatus, the shell shelf of the kiln was loaded with oyster shells and the vaulting on the top of the kiln was reconstructed using earthenware clay as mortar. Having measured, cut, and chopped local live oak and slash pine, there was a substantial stockpile of fuel ready for the kiln. A Fluke brand infrared thermometer and an Ashcroft thermocouple with an analogue gauge were used to measure the temperature. The Fluke infrared thermometer only registers temperature up to 1000 degrees. The Ashcroft thermocouple's gauge also goes up to 1000 degrees, but is graduated so as the needle continues around the gauge the temperature measurements remain accurate. On Friday, September 2, 2011, the lime kiln was fired up for the first time (see table 1).

After the kiln cooled to a little over 300 degrees, the bricks that made up the top portion of the kiln were removed. These were simply lifted out of place since the clay mortar, though still holding in heat, was no longer adhering to the brick. Once the top of the kiln was removed, the still very hot shells were accessible. The cooked shells were transferred to a wheel barrow where they were introduced to water. Expecting a

violent reaction, there was disappointment to see that nothing happened. The shells turned to a dark gray color and yielded no lime.

Over the next week, more research and experimentation had been preformed including an experiment of heating an oyster shell with an oxy-acetylene torch to an extremely high temperature. When water was introduced to this cooked shell, it reacted violently due to the hydrophilic nature of quicklime, and within seconds it took the form of a white putty. After multiple experiments with identical outcomes the necessary conclusions were made. These experiments led to the conclusion that the kiln was not being run hot enough to drive off the carbon dioxide from the calcium carbonate. A review of how the lime burn operation was conducted was needed to see if the lime kiln could be brought to a higher temperature for a longer time while keeping the kiln intact. Another factor was that the temperature measuring technique was not as accurate as it could be. During the first run of the kiln, the Fluke infrared thermometer was used to check the temperature from underneath the shell grate. This method was most likely getting a much higher temperature reading from the expanded steel which conducts heat better than oyster shell.

On Friday, September 9, 2011, the second attempt to run the lime kiln took place. This time the shell grate was reinforced with pieces of steel flat bar stock, the blower was left to run for the duration of the lime burn, and the temperature measurements were made with the Ashcroft thermocouple which was placed down the smoke stack to the shells themselves to get an accurate measurement of the temperature of the shell chamber. (see table 2)

After opening the kiln, the cooked oyster shells were immediately removed with the use of welding gloves and a trowel to pick them up (see figures 9, 10). A small sample of these shells were placed in a metal paint bucket and then introduced to distilled water. The reaction was delayed by about ten seconds, but when the shells did react, it was noticeable. The hydrophilic nature of the quicklime created a violent, boiling reaction that produced quite a bit of steam and within a minute transformed the oyster shells into a powdery paste (see figures 12, 13, 14). This time the lime burn was a success.

Making and Testing Tabby

After the lime had been slaked, the tabby samples were mixed. These samples were mixed according to the recipe found in Thomas Spalding's letter to Whiting. This is the resource that states that the mix should be made with three equal parts by volume: sand, lime, and shell aggregate. In order to remove as many variables as possible, the oyster shells were thoroughly washed to rid them of any residual salts and dirt (see figure 2). The shells that were used for both the lime and the aggregate were obtained from a local seafood source who stocks locally harvested oysters, in this case from Valona, Georgia, which is just north of Darien. Washed and kiln-dried sand was used, along with distilled water to avoid any modern-day additives. To replicate a shell midden, the oyster shells were buried in the earth for about 18 months before being used in this experiment (see figure 1).

The molds that were used were that of plastic GDOT highway concrete testing cylinders. These were chosen in order to be able to test the compressive strength of the

samples at the highway department lab. Since the highway department concrete testing cylinders molds are relatively small (6 inches in diameter x 12 inches in height), the oyster shell aggregate had to be broken up into smaller pieces for a more proportional mixture (see figure 16). The tabby was mixed in a metal tub using a hoe to stir in the water and mix it all thoroughly into a slurry (see figure 17). Then the tabby mixture was poured into two plastic highway department concrete testing cylinder molds (see figures 18, 19). The lime that was yielded from the lime kiln was very reactive which was illustrated be chemical burns to the author's unprotected skin. Lime produced from limestone was also obtained for the use in this experiment. This stone lime was used to make another two samples of tabby cylinders following the same recipe. The tabby cylinders that were made using the shell lime are about three inches shorter than that of the other samples due to the amount of lime that produced with the kiln (see figure 20). Two smaller cylinders were made for a comparison rather than one full sized with some left over. There is an adjustment chart for cylinders of differing heights for the compression test at the Georgia Highway Department Lab.

Over the next few weeks, the progress of the setting of the tabby samples was monitored. During the first two days, both the shell lime and the stone lime mixes were generating heat while setting, but by the third day, the heat had dissipated and the mixture had not yet set. By the fourth week of the shell tabby mix setting, the samples had become firm. It was not known if the lime had cured or if the moisture had simply evaporated, leaving a cake-like mixture possessing little or no strength. The limestone samples progressed along similar lines. In addition to the lime tabby samples, two sets

of sample cylinders using Portland cement were made for comparison. These samples were made following the same recipe, only substituting the lime with Portland cement, and in one sample set granite gravel was used to serve as the aggregate to compare its strength to that of shell aggregate. After six weeks, neither the oyster shell lime nor the limestone lime samples had set as expected. The two sample sets of Portland, along with the shell lime and stone lime cylinders were all taken to the Georgia Department of Transportation's District Five Highway Department Lab in Jesup, Georgia. Here the compressive strengths of these samples were tested. The results appear in the following table:

Results from Testing The Tabby Cylinders

Shell lime tabby mix- 1159 pounds of pressure=41psi

Shell lime tabby mix- 1250 pounds of pressure=43psi

Stone lime tabby mix- 860 pounds of pressure=30psi

Stone lime tabby mix- 840 pounds of pressure=30.5psi

Portland cement with shell- 106060 lbs. of pressure=3751psi

Portland cement with shell- 102520 lbs. of pressure=3626psi

Portland cement with gravel- 134700 lbs. of pressure=4860psi

Portland cement with gravel- 134420 lbs. of pressure=4754psi

Of the samples tested, Portland cement with granite gravel had the highest compressible strength, with oyster shell aggregate not too far behind. As for the lime samples, making tabby is a lost art. There were many factors that could have had an

effect on the outcome. The tabby mixtures were poured into plastic cylindrical molds with only six inches of surface area exposed to the air. This may not have allowed enough moisture to escape during the curing process. Traditionally the tabby mixture would have been molded between wooden shuttering giving the mixture a much larger exposure to air, while the wood absorbed moisture from the sides. This and many other factors could be more closely examined, but the fact remains that the shell lime tabby mixes held 41-43 psi, which is a substantial amount of weight. When poured into forms in large volume, this would possess considerable strength.

CHAPTER 5

CONCLUSION

Though the use of the material that is known as tabby is not very geographically widespread, its roots lie in the many cultures around the world that have had the innovative ability to construct permanent structures from the local materials at hand. When studying past cultures that settled in new lands, one needs to examine how they met one of their most basic of needs, housing, before being able to fully appreciate the historical and cultural significance of their surroundings.

In tracing the history and factors leading to the development of tabby, one can better understand the importance of this material. Having its roots primarily in Spain, tabby had become a building material that is, for the most part, unique to the southeastern United States. Much of the history of this area is illustrated by the tabby remnants that have been left by past generations of coastal cultures. In most cases, all that remains of these past cultures, above grade, are their tabby structures. Studying these tabby remains can yield insight into the past of this region helping to bring a better understanding of this area's history.

The specific examples of historical sites containing tabby construction that are included in the third chapter of this thesis, should help to provide a physical timeline that can convey the progression of tabby as well as giving a tangible link to these past cultures. These sites show how tabby had been utilized and by whom. They serve as a

collection of buildings that were deemed to be of enough importance that they should be made, by the builders, to last for centuries. The sites that are included should help to illustrate the importance of this building material and how it helped to shape the culture of coastal Georgia.

As far as the production of tabby goes, producing a historical building material from historical documents is not as easy as some writers on the subject would like to think. Implementing a recipe that is over one hundred and fifty years old can be problematic. Experience with the material and trial after trial will eventually yield the desired product. Though there is little documentation on the actual production of tabby, the samples that were produced in the research of this thesis do have some compressible strength, and when poured in large amounts could possibly resemble the tabby of General Oglethorpe or Thomas Spalding. This chapter helps to lead the reader to a better understanding of the importance of tabby through creating a clearer narrative of the process by which it was made and the materials and labor that went into the of making it.

This thesis helps to consolidate several areas of research to better illustrate the history and origins, specific examples, and physical attributes of this unique building material. Future studies could take some of the information provided in this work to aid in the preservation attempts of tabby. The future of the tabby sites along the Georgia coast are threatened by a semi-tropical climate of frequent storms, expanding development, and by people who fail to see the importance of these sites. This thesis

can be used to educate later generations about the cultural significance of this material as well as being a springboard for research in stabilizing the endangered tabby ruins of the area. This coastal building material remains one of the most important cultural elements of the area. Tabby serves as one of many threads that are woven into the fabric of the coastal Georgia narrative illustrating the different peoples and cultures that make up its history.

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APPENDICES

A) THOMAS SPALDING'S LETTER TO WHITING

Dear Sir,

Your letter of the 4th of July, but postmarked the 17th, came to hand yesterday; I am old, and very infirm, and with more of writing than I can well do, but it is not in my nature to decline complying with a request conveyed in the manner and the terms of your letter.

Tabby and not Tappy, as it is printed, is a mixture of shells, lime and sand in equal proportions by measure and not weight, makes the best and cheapest buildings where the materials are at hand, I have ever seen; and when rough cast, equals in beauty stone.

When Gen. Oglethorpe settled Frederica, on St. Simons Island, the island south of Sapelo, and only distant five miles, the fort, his barracks, the entire buildings for his officers and men, were of these materials; Gen. Oglethorpe was a gentleman and a scholar, as well as a soldier, and probably had either seen these buildings in Spain or in other countries along the Mediterranean; or was sufficiently acquainted with them to determine him to adopt them, and the Spanish in the adjacent Province of Florida afforded him the means of getting men to instruct his own people. My maternal ancestor was an officer of Gen. Oglethorpe; and I

was born in one of these houses of Tabby. Frederica was burned down before the revolutionary war and there was nothing left standing but my father's house and one other. Frederica was abandoned but the naked walls stood erect (the most venerable and imposing ruins in the United States,) while within a few years, when it having been discovered that Tabby walls could be sawn into good building stone, spoilers from every quarter came and have sawed them up and have carried them away. I have given this narrative that you may better understand the value of the material.

The shells that I have used were old shells from ancient Indian Barrows, some of them of great extent scattered over our Sea Islands from Charleston to St. Johns River in Florida. The drift shells, after the oyster is dead, thrown up along the shores of our rivers, are also used, but the salt should be washed out. I have built good tabby from rough gravel taken up from the bed of the Altamaha, near Darien. Stone broken up by the sledge hammer, if more easily procured, would answer equally well, used the same equal proportions; what we want is a substantial material, upon which the calcareous matter of the lime, and the flinty matter of the sand unite and set. In my immediate neighborhood, from following my example, there are more Tabby buildings than all Georgia besides. There is little art required in the

construction of these buildings. A view for fifteen minutes of a house erecting would explain everything.

Manner of building.

Two planks as long as convenient to handle, 2 inches thick and about 12 inches wide, are made to unite and to the round of your building. These planks are kept apart by spreader pins with a double head as thus, the first head keeps the outer plank in its place, the last with the pin run through the point, keeps the inner plank firm while the workmen are filling in the material and setting it down, either with a spade or a light rammer, which, if shells, bring these into a flat position. Then, the planks at the ends are let into each other thus: with an iron wire with eye to draw it out at each round of Tabby. The corners of the building are thus: the same kind of iron wire binding the sides together.

All that is necessary when you construct doors or windows, is to drop a short board across the wall between the outer and inner planks and steady it with two poles, to be drawn out at each round and replaced at the next, and so continue until you have reached the height you intend your doors and windows. When you then drop your Lintall into the Tabby Box so as to secure the next round of Tabby your wall then becomes an entire whole.

I have attempted to represent with the pen the manner in which the walls are carried round.

The Cost:

My people did me, when the materials were at hand, 30 cubic feet each per day, that is, they mixed the mortar and filled the boxes. My walls were extensive enough to employ six hands for three days to complete the rounds, mixing mortar one day and filling in two, thus making two rounds a week, as much as is prudent ever in Georgia, our rains are sever and our winds are higher, and you ought to do the same in Connecticut, from the 1st of March to the 1st of August. We stop for the season in August and cover up our work from the Autumnal storms of our almost Tropical climate, hanging the boxes on the last round. If I had received your letter two months sooner I might have found someone who would have received my instructions and communicated to yourself more distinctly my directions, but the season is past for that.

1st-YOUR BEGINNING. The shells are not broken, they are old shells, and I prefer them whole.

2nd-They are not washed, but no salt water should be permitted, as it produces decay. Where the shells have much vegetable mold with them they would be better for washing.

3rd-They are taken from both natural and artificial deposits, as explained above.

4th-Either shell or stone lime is used, the cheapest is always employed.

5th-I burn my own lime, and use it as soon as convenient after slacking, without the trouble of sifting or other process.

6th-I use pit sand and prefer it, as being free from salt. I like a mixture of fine and coarse sand, but I am not particular on that subject. Salt must be avoided, it produces decay.

7th-I generally made my people mix the materials one day and put it into boxes the following, very soft, as the better to amalgamate. 10 Bushels of lime, 10 Bushels of sand, ten bushels of shells and ten bushels of water make 16 cubic feet of wall. I have made my walls 14 inches thick; below the lower floor 2 feet; for the second story 10 inches— beyond that I would not erect Tabby buildings. My house at Sapelo is one story, 4 feet from the ground, and sixteen (16) feet in the ceiling, 20 feet in the wall. It is 90 feet by 65 feet in depth, besides the wings. The roof is of tar and sand upon sheathing paper three fold resting on 2 layers of boards. The house is of the Ionic order. This house was built by six men, two boys and two mules (one white man superintending) in two years. I have lived in it for thirty two (32) years. The roof is now as good as the day it was built. Two barrels of tar and two men put on every year a fresh coat, so that it is now about 3 inches thick of terrace.

I am fearful you will find it difficult to understand me and yet a glance of your eye in ten minutes would tell all.

and I remain yours

T. Spalding.

Sapelo Island Georgia

29th July, 1844

N. C. Whiting, Esq.,

New Haven,

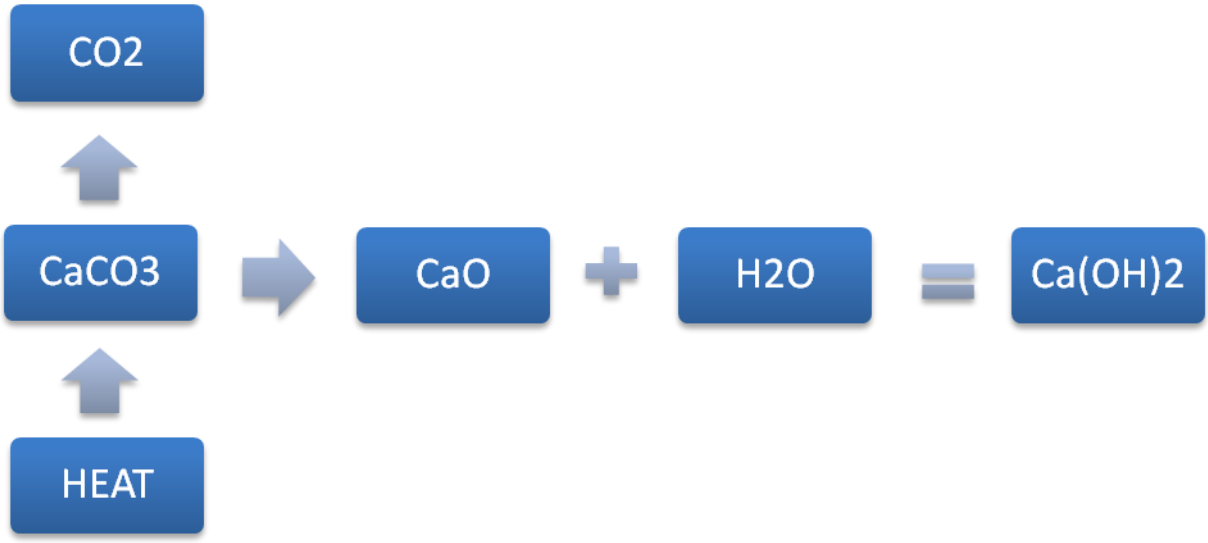
Connecticut.

N.B.

The boxes at every round should be taken off and inside up laid over the wall the day you are mixing the material. The pins are one inch above the lower edge of the plank.[45]

[45] E. Merton Coulter, ed., Georgia's Disputed Ruins (Chapel Hill, NC: University of North Carolina Press, 1937), 72-76

B) LIME CYCLE



C) PHOTO LOG

(Figure 1)-Digging up shells

(Figure 2)-Washing shells

(Figure 3)-Kiln under construction

(Figure 4)-Supplying fuel for kiln

(Figure 5)-Kiln in operation

(Figure 6)-Kiln in opperation

(Figure 7)-Temperature rising

(Figure 8)-Kiln at temperature-1100 degrees


(Figure 9)-Opening kiln vault


(Figure 13)-Lime reaction


(Figure 10)-Opening kiln vault


(Figure 14)-Examining lime


(Figure 11)Kiln vault dismantled


(Figure 15)-Combining materials


(Figure 12)-Adding water to burnt shells


(Figure 16)-Broken shell aggregate

(Figure 17)-Mixing materials

(Figure 18)Pouring slurry into molds

(Figure 19)-Leveling molds

(Figure 20)-Tabby samples

(Figure 21)-Portland mix cylinder in compression test

(Figure 22)-Lime mix cylinder in compression test


(Figure 23)-Portland mix cylinder

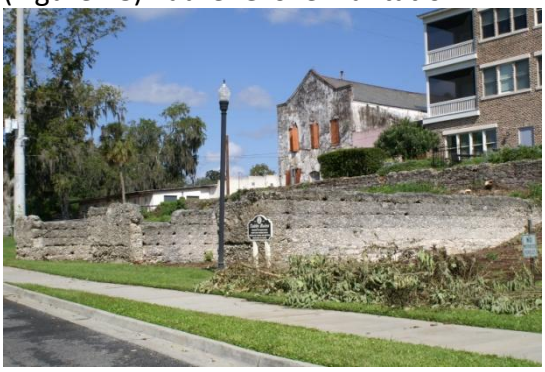

(Figure 24)-Ashantilly


(Figure 25)-The Thicket


(Figure 26)-The Thicket


(Figure 27)-Laurel Grove Plantation


(Figure 28)-Laurel Grove Plantation


(Figure 29)-Darien's Waterfront


(Figure 30)-Strain Building


(Figure 31)-St. Cyprians


(Figure 32)-St. Cyprians


(Figure 33)-First Presbyterian


(Figure 34)-First Presbyterian


(Figure 35)-Ft. Frederica-Barracks


(Figure 36)-Ft. Frederica-Caldwell House


(Figure 37)-Ft. Frederica-Powder Mag.


(Figure 38)-Butler Plantation


(Figure 39)-Butler Plantation


(Figure 40)-Couper House

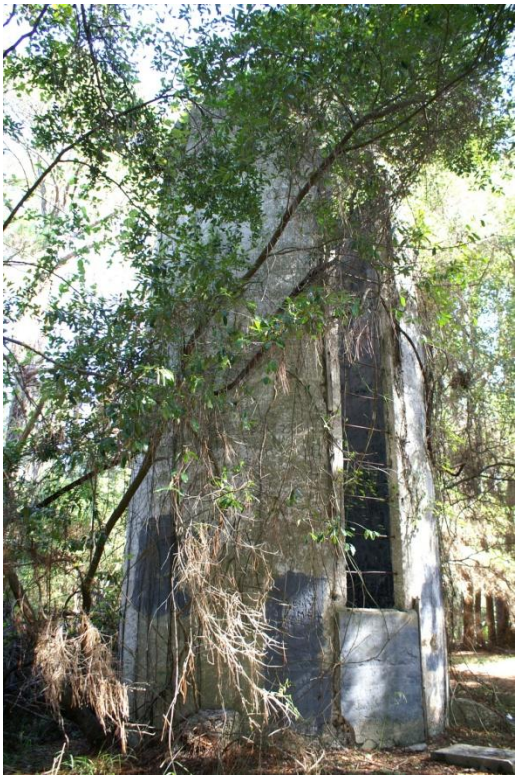

(Figure 41)-Couper House


(Figure 42)-Hamilton Plantation


(Figure 43)-Hamilton Plantation


(Figure 44)-Horton House


(Figure 45)-Horton Brewery


(Figure 46)-Dairy Silo


(Figure 49)-Hollybourne House


(Figure 50)-Elizafield Plantation


(Figure 47)-Dairy Silo


(Figure 51)-Elizafield Plantation


(Figure 48)-Hollybourne House


(Figure 52)-St. Athanasius

(Figure 53)-1600/1602 New Castle St. BWK

(Figure 57)-1326 New Castle St. BWK

(Figure 54)-1313 New Castle St. BWK

(Figure 58)-1326 New Castle St. BWK-rear

(Figure 55)-500 Monck St. BWK

(Figure 59)-Ruins of Dungeness

(Figure 56)-1400 New Castle St. BWK

(Figure 60)-St. Marks


(Figure 61)-St. Marks


(Figure 62)-McIntosh Sugar Mill


(Figure 63)-McIntosh Sugar Mill


(Figure 64)-McIntosh Sugar Mill


(Figure 65)-Dover Bluff


(Figure 66)-Dover Bluff


(Figure 67)-Camden Public Library

TABLES

Table 1: Lime Kiln Operation Details: First Attempt

I loaded the limekiln with oyster shells in the shell chamber and a mix of pine and oak in the firebox the night before and covered it with a tarp.

8:15
lit wood in firebox, started kiln
8:50
temperature around 400 degrees, started forcing air
8:52
972 degrees
9:00
1000+ degrees, turned off air
9:02
970 degrees
9:05
turned air on
9:11
1000+ degrees, turned air off, noticed shell grate bowing from heat
9:16
turned air on
9:27
1000+ degrees, turned air off
9:30
960 degrees, turned air on

9:37
912 degrees, turned air off to add wood to firebox
9:42
air hose became detached
9:45
air hose reconnected and temperature rising
9:51
1000+ degrees, turned air off
9:56
1000+ degrees
10:05
970 degrees
10:11
900 degrees, turned air on
10:15
1000+ degrees, turned air off
10:20
1000+
10:24
870 degrees, added wood and turned air on
10:28
900 degrees
10:32
970 degrees
10:35
1000+ degrees, turned air off
10:41
1000+ degrees
10:50
1000+ degrees

10:56
920 degrees, added wood, turned air on
11:00
1000+ degrees
11:04
1000+ degrees, turned air off
11:11
1000+ degrees
11:20
1000+ degrees, turned air on
11:24
1000+ degrees
11:32
1000+ degrees, turned air off, added wood
11:40
1000+ degrees
11:50
930 degrees, turned air on
11:56
1000+ degrees, added wood
12:00
1000+ degrees, turned air off, added wood
12:05
1000+ degrees
12:13
970 degrees
12:21
950 degrees
12:29
930 degrees, turned air on

12:35
1000+ degrees, turned air off
12:45
960 degrees, turned air on
12:50
1000+ degrees
12:55
1000+ degrees, added wood
1:07
1000+ degrees, turned air off
1:15
1000+ degrees
1:25
930 degrees, turned air on
1:34
1000+ degrees, turned air off
1:46
950 degrees, turned air on
1:57
980 degrees, turned air off, added wood
2:05
860 degrees, air hose became disconnected
2:09
830 degrees, air hose reconnected
2:11
900 degrees
2:13
940 degrees
2:20
970 degrees, turned air off, added wood

2:25
920 degrees
2:31
900 degrees, turned air on
2:33
1000+ degrees, grate is red hot and bowing more
2:38
960 degrees, added wood
2:48
950 degrees, turned air off
2:55
930 degrees, turned air on
3:00
1000+ degrees, turned air off
3:05
930 degrees, turned air on
3:10
1000+ degrees, added wood
3:15
1000+ degrees, turned air off
3:20
950 degrees, added wood, turned air on
3:23
1000+ degrees, turned air off, added wood
3:30
1000+ degrees
3:35
900 degrees, added wood, turned air on
3:39
1000+ degrees, turned air off, too much wood in firebox

3:42
1000+ degrees
3:47
930 degrees, turned air on
3:53
1000+ degrees
3:57
980 degrees, added wood
4:01
990 degrees
4:06
1000+ degrees, turned air off, added wood
4:10
1000+ degrees
4:13
1000+ degrees
4:17
960 degrees, turned air on
4:24
1000+ degrees, turned air off
4:32
950 degrees, added wood, turned air on
4:40
1000+ degrees, turned air off
4:45
910 degrees, turned air on
4:50
1000+ degrees
4:55
940 degrees

5:01
860 degrees
5:10
670 degrees, turned air off
5:35
450 degrees, not more than a couple of coal still glowing
6:47
320 degrees, opened the top of the kiln

Table 2: Lime Kiln Operation: Second Attempt

8:40
lit fire in kiln, added pine (2)
8:50
480 degrees
8:55
600 degrees, added oak (2)
8:56
600 degrees, turned air on
9:00
750 degrees, added oak (1)
9:05
800 degrees
9:15
900 degrees
9:20
980 degrees, noticed that the shell chamber is hotter at one end, started taking temperature measurements at both ends, north and south
9:28
north

1000+ degrees, south
890 degrees, added pine (1)
9:37
north
1050 degrees, south
820 degrees, added oak (1)
9:46
north
1050 degrees, south
850 degrees, added pine (1)
10:00
north
1150 degrees, south
880 degrees, added oak (1)
10:15
north
1150 + degrees, south
1000+ degrees, added pine (1)
10:28
north
1200+ degrees, south
1050 degrees, added oak (2)
10:42
north
1100+ degrees, south
1000+ degrees, added oak (2)
10:53
north
1100+ degrees, south
1000+ degrees
11:10
north
1100+ degrees, south
900+ degrees, added pine and oak
11:20
north

1150+ degrees, south
950 degrees, oak (1)
11:38
north
1150+ degrees, south
940 degrees, added pine and oak
11:57
Air hose rupture, repaired, no temp data recorded, oak and pine
12:15
north
1150+ degrees, south
1000 degrees
12:29
north
1200+ degrees, south
960 degrees, added oak (1)
12:46
north
1150+ degrees, south
950 degrees, added oak (1)
1:04
north
1150+ degrees, south
930 degrees, added pine and oak
1:24
north
1200+ degrees, south
1150+ degrees, oak (1)
1:45
north
1200+ degrees, south
1000+ degrees, pine (1)
1:58
north
1200+ degrees, south
1000+ degrees, oak (1)

2:32
north
1150+ degrees, south
950+ degrees, oak (1), pine (1)
2:48
north
1150+ degrees, south
940+ degrees, pine (1)
2:58
north
1200+ degrees, south
1000+ degrees, oak (1)
3:11
north
1100+ degrees, south
890 degrees, oak (1), pine (1)
3:28
north
1200+ degrees, south
1000+ degrees, oak (1)
3:39
north
1200+ degrees, south
1000+ degrees, oak (1)
3:50
north
1200+ degrees, south
1000+ degrees, oak (1)
4:06
north
1150+ degrees, south
1000+ degrees, oak (1)
4:28
north

1150+ degrees, south
950 degrees, oak (1)
4:45
north
1150+ degrees, south
1000 degrees, pine (1), oak (1)
5:01
north
1200+ degrees, south
1000+ degrees, pine (1), oak (1)
5:16
north
1200+ degrees, south
1000+ degrees, oak (2)
5:30
north
1200+ degrees, south
1000+ degrees, pine (1), oak (1)
5:45
north
1200+ degrees, south
1000+ degrees, oak (1)
5:57
north
1200+ degrees, south
1050+ degrees, oak (1)
6:14
north
1200+ degrees, south
1050+ degrees
6:27
north
1200+ degrees, south
1050+ degrees

6:32
turned air off
6:47
opened the kiln, still very hot