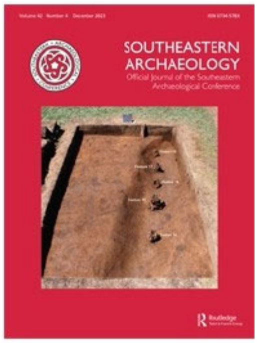

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Bluff Field (9CH160) ceramics and radiocarbon dating and their implications for chronology building on Ossabaw Island and the Georgia coast

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ABSTRACT

We present the results of the 2022 excavations at the Bluff Field site (9CH160), wherein we consider the juxtaposition of Bayesian radiocarbon modeling against the current ceramic chronologies derived for the Georgia coast. New evidence from AMS radiocarbon dating and statistical modeling pushes both the timing and span of Wilmington series ceramics beyond the ranges afforded by current models. Short-lived carbonized hickory nuts from within excavation units and shovel tests returned dates that are hundreds of years later in time than the currently accepted timing for Wilmington ceramics. These ceramics contribute the largest proportion of the ceramic assemblage recovered from the site and within the levels from which we dated for chronological modeling. Our modeling of these dates that are in stratigraphic sequence calls into question not only the use history of the Wilmington ceramic series, but also the demographic history of the island that is currently predicated upon the timing of this and other ceramic styles. We recommend reinterrogating existing chronologies in order to bring the settlement chronologies for the Georgia coastal region up to present-day methodological and statistical standards.

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Georgia coast; ceramic chronology; radiocarbon; Woodland period; Mississippian period

Introduction

While dating technologies continue to improve, becomingincreasingly more accurate, cost effective, and highly flexible, a large amount of current archaeological practice remains overly reliant on potentially inaccurate models for interpreting the past In this paper, we report on the first systematic excavations at the Bluff Field site on Ossabaw Island (9CH160) along the Georgia coast. Following our presentation of the general findings of the work, we then center on the types of ceramics recovered from the excavations and the modeling of a series of associated radiocarbon dates and its implications for understanding ceramic chronologies at Bluff Field. We then compare our chronologies for Bluff Field with an evaluation of the original data and modeling of dates that archaeologists used in the original creation of the ceramic chronologies associated with the Late Woodland and Early Mississippian transition along the region. The data and radiocarbon modeling of the Bluff Field, along with excavation data from other sites on Ossabaw Island, indicate discrepancies between the two chronologies and that a reevaluation and refinement of the coastal ceramic sequence is necessary for the region.

Bluff Field is the second-largest archaeological site on Ossabaw Island after Middle Place. C. B. Moore (1897) conducted the earliest excavations of the site. Moore excavated nine burial mounds on Ossabaw Island, three of which were mounds at Bluff Field. These excavations were focused entirely on mound contexts, and Moore's description of ceramics from these excavations indicated that two of the three mounds at Bluff Field were associated with the Savannah period (AD 1150-1350), with the remaining mound likely associated with the Irene period (AD 1350-1550; Pearson 2014). Importantly, Moore also recovered a thick-walled whole vessel with clay tempering from the mounds, which is potentially of the Wilmington plain style, suggesting that the mound was in use during the time the Native people (Ancestral Muskogeans [Guale]) produced these types of vessels. Following Moore, Chester DePratter (1974, 1991) and Charles Pearson (2014) conducted additional surface collections at Bluff Field in the 1970s, but otherwise Bluff Field has never been thoroughly investigated.

During the summers of 2018, 2019, and 2022, the University of Georgia (UGA), along with the Georgia Department of Natural Resources (GDNR), conducted preliminary surveys and evaluations of Bluff Field primarily to assess portions of the site that were in danger of erosion by the adjacent tidal river. While the investigations reported here are small-scale, they nevertheless

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provide some important considerations for archaeologists working along the Georgia coast and coastal plain. First, since Moore excavated three of the mounds at the site, the location of these has never been relocated by modern archaeological research. We relocated at least one of these mounds via LiDAR and verified its location during our work on site. Understanding the exact location and context of this mound will be important as the repatriation of ancestors and their belongings moves forward The second important implication of this work includes AMS radiocarbon dating of contexts with previously defined ceramic series on the Georgia coast, most notably, the Savannah and Wilmington series. Dating and defining the series of coastal ceramics remains problematic; all the dates used in the original chronology were uncorrected shell dates (see DePratter 1991). Further attempts at understanding the Marine Reservoir Correction (MRC), while productive, have not yet reached the level of accuracy and precision necessary to critically assess past chronologies (see Thomas 2008) and could possibly vary among different areas of the coast (see Hadden et al. 2023). The dating results we present here highlight some of the larger issues with the coastal chronology and suggest that a redating project focusing on short-lived botanical samples represents the best way to refine and reevaluate the chronology. Short-lived species are preferred for modern radiocarbon analyses because they alleviate the offsets attributed to the in-built age of longer-lived organisms (Hamilton and Krus 2018). Ceramics associated with the broader Woodland period (ca. 1100 BC to AD 1000) especially seem to be problematic as these time frames have seen little direct research, and especially radiocarbon dating, on the coast compared to the Late Archaic (3000-1100 BC) and more recent past (i.e., AD 1350-1700s). This project contributes new data and interpretations for understanding this relatively understudied topic, and reassesses prior models, combining legacy data sets with Bayesian statistical modeling to evaluate the precision of those older models. These considerations could have potentially far-reaching implications for our understanding of coastal settlement over time, shifting the current ceramic chronologies and allowing for a potential reimagining of the demographic history of the Georgia coast

Archaeological and environmental context

Ossabaw Island is a barrier island situated along the South Atlantic Coast of Georgia, USA (Figure 1). The island is part of the Georgia Bight, a large barrier island complex that extends along the Atlantic Coast from the southern coast of North Carolina to northern Florida.

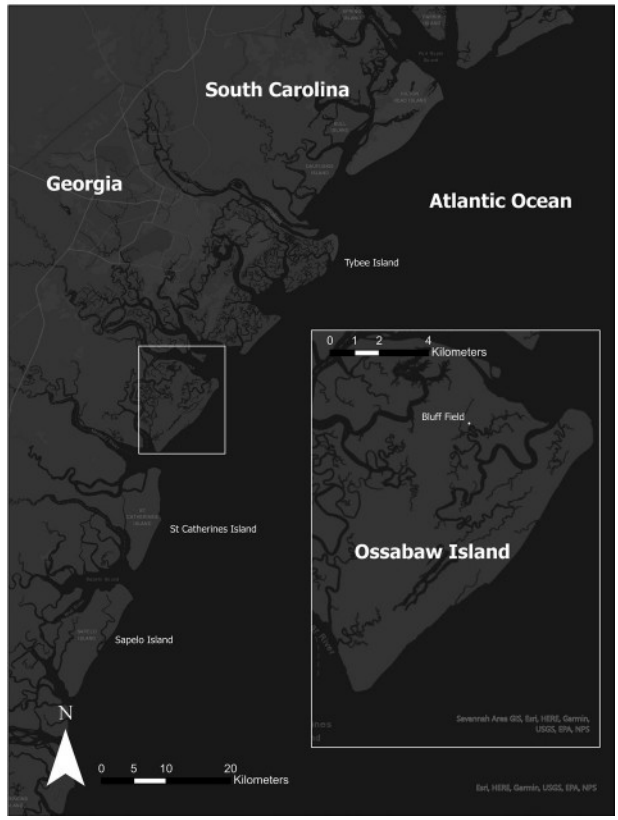

Figure 1. Map showing the Barrier Islands of the Georgia coastal plain, and the general location of Bluff Field on Ossabaw Island.

Ossabaw Island measures roughly 13.7 km long, 6.3km wide, and contains approximately 4800 hectares of high land (Pearson 2014). It lies just 20 km south of Savannah, Georgia, and is separated from the mainland by an expanse of salt marsh, tidal streams, and rivers about 5-8 km wide. As with other barrier islands along the Georgia Bight, Ossabaw Island is characterized by a Holocene beach ridge that formed ca. 4,500 BP and a Pleistocene core that formed ca. 40,000 BP (Reitz et al. 2009; Thomas 2008; Thompson and Turck 2010).

Archaeological data indicate that Indigenous Native Americans occupied Ossabaw and other islands along the Georgia coast for at least 5,000 years, from the Late Archaic period (3000-1100 BC) and up until the time of European colonization (Thompson and Turck 2009). Throughout the Late Archaic period, Native American communities along the coast were utilizing estuary resources and living at large shell ring villages, such as the Ossabaw Shell Ring and the Sapelo Shell Rings (DePratter and Howard 1981; Garland et al. 2022; Thompson and Andrus 2011; Turck 2011). During the Early Woodland period (1100-400 BC), Ossabaw Island, as well as the rest of the Georgia coast, experienced a transformation in socioecological systems (Garland et al. 2021; Pearson 2014; Thompson and Turck 2009; Thompson and Worth 2011; Turck and Thompson 2016). This transformation correlated with a decrease in sea level and a concomitant environmental change, which likely resulted in the resettlement of people in upland settings away from estuarine environments (Thompson and Turck 2009, 2010; Turck and Thompson 2016, 2019). During the Late Woodland and Early Mississippian periods (approximately AD 500-1100), however, Ossabaw Island witnessed a rebound in population size and settlement expansion, which can be seen archaeologically through the reemergence of large and intensively occupied sites, as well as the construction of large shell midden mounds (Garland et al. 2021; Pearson 2014). This change may be in part tied to the immigration of people from the Middle and Lower Savannah River Valley during the twelfth and thirteenth centuries (Garland et al. 2021; Ritchison 2019; Ritchison and Anderson 2022).

Bluff Field: site description and previous research

Bluff Field is located on the northeastern edge ofOssabaw Island's western Pleistocene core. The site is bounded on the southern side by Cabbage Garden Creek and salt marsh, and on the western and northern sides by Long Pond and low wet areas (Figure 2). Moore (1897) identified three mounds, which he labeled as mounds A, B, and C. Mound A, which was reported to be 150 feet from the bluff edge, measured 27 in. tall and 56 feet in diameter. Excavations by Moore recovered 13 ancestor burials and one ancestor cremation. Mound B was located along the southwestern extreme of Bluff Field and measured 19 in. tall and 40 feet in diameter. It included an additional six ancestor burials. Mounds A and B are both probably dated to the Savannah period (AD 1150-1350), based on the ceramics associated with mounds. Mound C was located in a rice field about 150 yards north of Mound B, and was recorded as 30 in. in height and less than 50 feet in diameter. No evidence for the presence of any of the three mounds was found duringeither of the investigationsof the site by DePratter (1974) or Pearson (1977, 2014).

During the 2018 field season, we were able to identify the remains of Mound A through LiDAR images and on-the-ground observations, but were unable to relocate Mound B or Mound C. Moore (1897) originally records the distance from Mound A to the Bluff edge at 150 feet, but the field team recorded this distance in 2018 at 104 feet, showing significant evidence for erosion that has occurred over the past 123 years (Tucker and Thompson 2018). The encroachment of Cabbage Garden Creek into the southern edge of the shell midden can also be seen in comparing the map of surface features recorded during Pearson's 1977 survey and current satellite and LiDAR imagery, both of which show the creek much closer to Cabbage Garden Road than in Pearson's map. Pearson also notes the heavy impacts of agriculture on portions of Bluff Field, resulting in the majority of the middens being plowed and dispersed (Pearson 2014).

Materials and methods

2018 investigation

The 2018 investigation consisted of a single day of survey to conduct a preliminary assessment of the Bluff Field site. This investigation encompassed 14 shovel tests which were conducted along the bluffs edge at roughly 20-meter intervals. Each shovel test was excavated as a 50-cm x 50-cm test pit in arbitrary 10-cm levels until two consecutive sterile levels were reached. The contents of the shovel test deposits were dry screened through ¼-inch mesh. Additionally, we conducted a controlled surface collection across the site. As described in the result section in more detail, the shovel tests and surface collection yielded 213 total finds: 193 ceramics, 18 lithics, and one metal fragment. In addition, **10** taxa of invertebrate fauna} remains were recovered and weighed and nine radiocarbon dateswere run on burned hickory nuts (*Carya* spp.) from the shell deposits to determine the span of occupation associated with the shell midden deposits.

Ceramics collected during surface collections and shovel tests at Bluff Field were placed into typological categories described by DePratter (1991; see also Williams and Thompson 1999). Following from these typological categories and using the reference collections within the Laboratory of Archaeology, ceramics were identified by style, as well as by temper and surface pattern. All ceramics were counted and weighed in order to quantify the relative distribution of ceramic types within the test units, which further aids in determining the relative chronology of the Bluff Field site. For zooarchaeological materials, the invertebrate faunal material from each shovel test was identified and weighed to determine the diversity of invertebrate fauna} remains present at the site, as well as the relative frequency of various shellfish species. Fauna} materials were also examined for wear patterns and evidence of potential human modification. Macroscopic carbonized fragments of hickory nuts recovered from the shovel test units were sampled for radiocarbon dating following

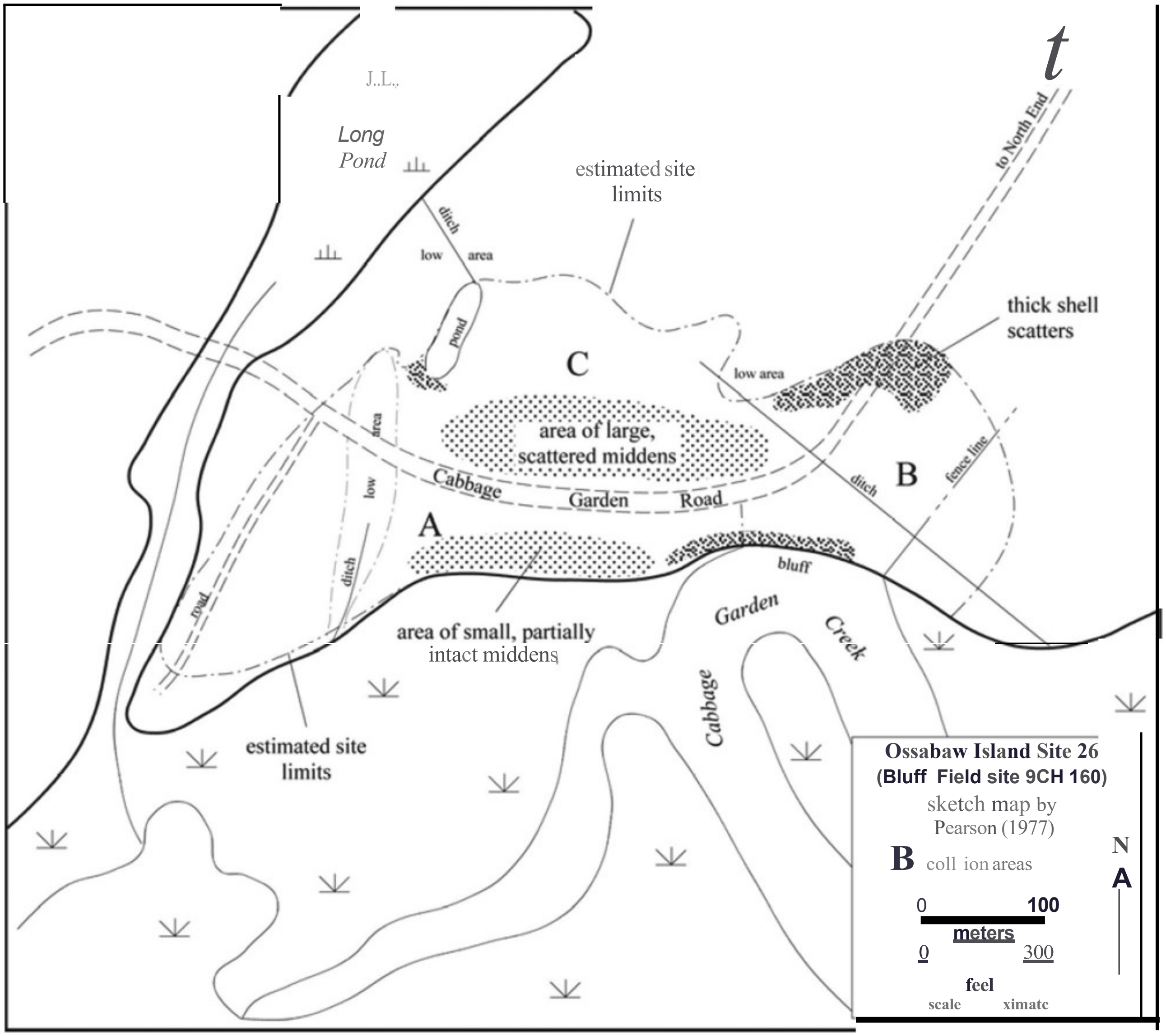

Figure 2. Surface features at the Bluff Field site adapted from Pearson (1977).

the recommended sampling procedures of the Center for Applied Isotopes (2022).

2022 investigation

Research resumed again in 2022 at Bluff Field to assess the state of erosion as it continues to impact the site, as well as to more comprehensively evaluate the settlement through additional shovel testing, and excavation units. Our investigations at the site were split into two major targeted excavations that included a large distribution oflate pre-Colonial archaeological deposits and an adjacent large Late Archaic occupation, which is reported on separately. This article addresses the implications resulting from the survey and excavations of the Woodland-Mississippian components of Bluff Field, which included an additional eight shovel tests and two **1-m** x 2-m excavation units within the original project area (Figure 3). Shovel tests were excavated in 20-cm intervals up to 20 cm into sterile subsoil. Excavation units were excavated in 10-cm intervals up to 20 cm into sterile subsoil.

Materials were analyred using the same strategy employed during the 2018 field school, yielding 461 additional ceramic sherds and 15 lithic specimens. Units A-1 and B-1 contained abundant charcoal from short-lived carbonized plants, allowing for five additional radiocarbon dates of the Woodland-Mississippian component of the Bluff Field site.Abundant faunal materials were also collected and weighed and archived for future analysis.

Radiocarbon and Bayesian modeling

Over the course of the two field seasons, we ran a total of 14 radiocarbon dates on short-lived carbonized plant

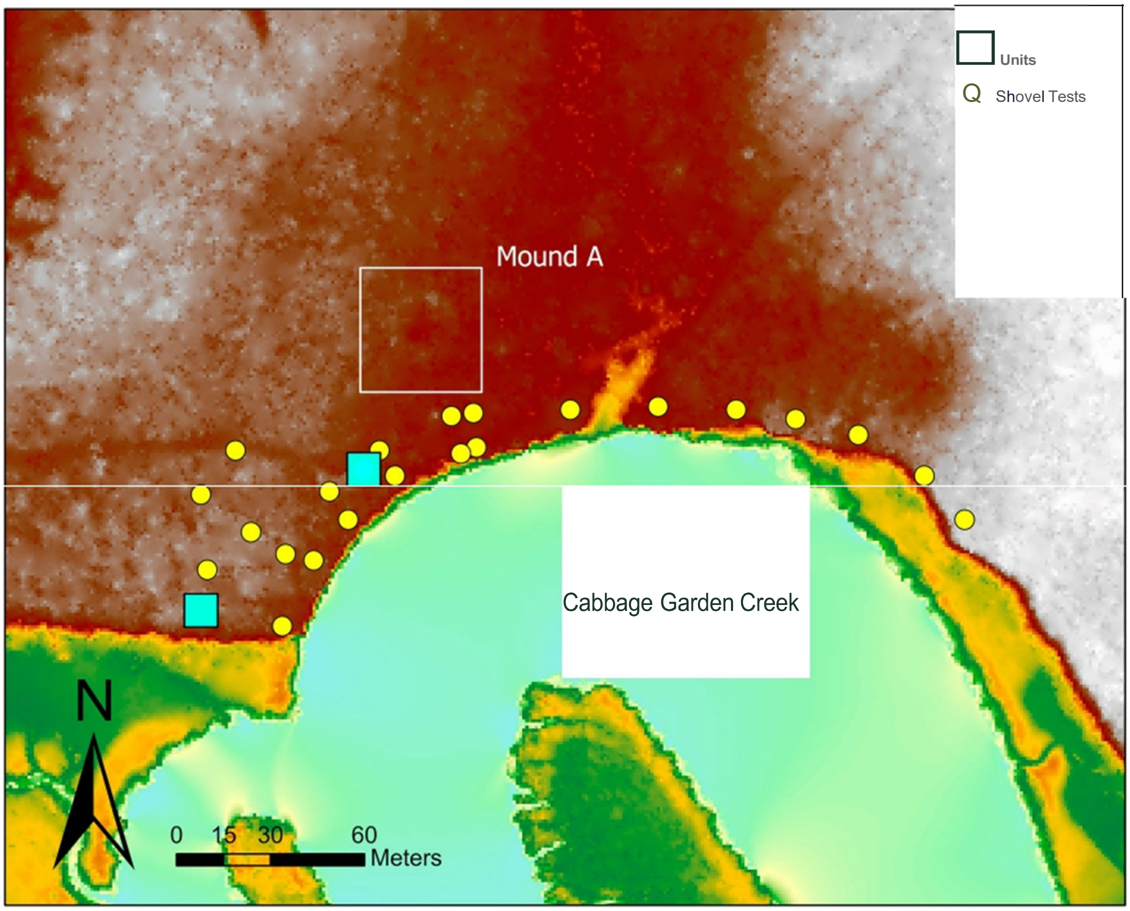

Figure 3. LiDAR image ofBluff Field, showing the location of Mound A, Units A-1 and B-1, and all shovel tests.

remains, which in this case exclusively consisted of hickory nut shells *(Carya* spp.). These samples were all collected from shovel tests and excavation units for the Woodland-Mississippian component of the site and were subsequently modeled using Bayesian statistics in OxCal 4.4 using the InCAL20 curve (Bronk Ramsey 2009; Reimer et al. 2020). This was done to provide a chronological assessment to determine when the vast majority of the shell deposits were disposed of at the site, as well as to provide an age estimate and duration of occupation for the site as a whole.

Bayesian modeling wasfurther used to assess levels of the excavations that were dominated by Wilmington ceramic types in order to review the span of this ceramic series within the context of the site and provide a point of comparison to previous ceramic chronologies generated for the Georgia coast Of the original 14 radiocarbon dates obtained from the site, we determined that 12 were within levels containing majority Wilmington ceramics, which were sequenced according to their depth and excavation contexts to produce a model for the deposition of the Wilmington ceramic style.

The advantage of the Bayesian approach is the ability to incorporate a priori information into the model, which helps to constrain and sequence the distributions of radiocarbon dates. This allows a researcher with knowledge of the context within which radiocarbon dates are recorded to influence the output of the model by integrating this prior information. For our model, we use this Bayesian framework to build a model that includes two types of priors: the association of dates with others from the same context, and the sequencing of radiocarbon dates based on their depth within the excavation units.

Model assessment

In addition to new data collection, we made an effort to reassess the data used to support the current ceramic chronology model, in order to compare it with our findings. By combining the original data used to construct the ceramic chronology of the coast with modern statistical modeling and updates to both the local and global Marine20 reservoir correction (Heaton et al. 2020), we can effectively assess the accuracy and precision of the current model. For this process, the original corrected dates taken from shell samples on St. Catherines Island were reevaluated using a single-phase Bayesian model with the current Marine20 curve and local delta values for St. Catherines. Additionally, the total ceramic contents of the dated excavation units were recorded from data provided by the American Museum of Natural History to better compare the cultural stratigraphy from St. Catherines Island alongside those recorded during the 2018 and 2022 field schools on Ossabaw Island. For these assessments, we utilize the same primary data recorded by Thomas (2008) and granted access by the American Museum of Natural History. The ceramics from St. Catherines Island are recorded by count (as opposed to weight) and represent cultural stratigraphy deemed to be diagnostically Wilmington or Wilmington/St. Catherines according to the publication (Thomas 2008:414-415). Most ceramics were able to be given a typological designation, but several ceramics that had vague or nondiagnostic features were grouped together as a single "other" category. Through this process, we were able to reevaluate the fit of the current ceramic chronology using an updated statistical approach with a more accurate radiocarbon curve.

Results

Cultural and natural stratigraphy

The surface of the site consists primarily of sparse grass and patchyvegetation, with a thin layer ofhumic topsoil and denser, sandier soils that follow a consistent natural stratigraphy. The area is flat and open, with a few small midden deposits that appear as shell-dense midden-mound features less than a meter high and a few meters across. The topsoil tends to be 10-20 cm of neutral or dark gray sand with shell midden and other organic materials present. The second stratigraphic horizon is approximately 20-30 cm of dark gray or black fine sand, which typically contains the highest concentration of cultural material deposits, as well as a denser concentration of shell compared to the other strata. The third horizon is a light gray or light grayish brown fine sand for another 10-20 cm, within which the cultural materials begin to taper off. The lowest horizon is a dark brown fine sand that is typically damp and sterile. We expect that the uppermost soil horizon was subject to some taphonomic modification as a result of historic plowing during the post-sixteenth-century agricultural developments of the barrier islands, but we have high confidence that the remaining strata represent undisturbed cultural deposits, as they are consistent in depth, matrix composition, and color throughout the units, shovel tests, and soil probe sampling.

Unit A-1 represents an excavation into one of the noted shell midden-mounds, which has a soil coloration and texture that is distinct from the shovel tests and Unit B-1, all of which were placed along the bluff edge. The location of these shell middens along the bluff edge is consistent with previous surveys of the site (Pearson 2014:66). A-1 consists of a single horizon of dark brown fine sand with greater than 50% shell matrix, below which is a sterile layer of gray fine sand and minimal crushed shell. The western edge of the midden grades into the typical natural strata, which can be seen in the western profile of the unit as a partial top horizon of black fine sand. Figure 4 below provides an example of the strata encountered in the south and west profiles of Units A-1 and B-1, which best represent the strata encountered through the excavations and shovel testing. Determinations of color, grain size, and matrix composition were made using a Munsell soil color chart. Unit B-1 also contained features that were identified in the field as potential pits. These features were screened separately from the other unit contexts and were found to primarily consist of a denser matrix ofburned and crushed shell, with some faunal materials. No ceramics reported were collected from these feature contexts.

Ceramics recovered

A total of over 4700 g of ceramic sherds were recovered during the 2018 and 2022 excavations of Bluff Field. Approximately 1800 g of sherds were recovered from the excavation units and 2900 g were recovered during shovel testing and surface collection. For the most part, identification of the ceramic sherds determined that the sherds mostly reflected the same types as previous researchers have documented (DePratter 1974; Pearson 1977), with some exceptions. All three investigations determined the presence of Wilmington, Savannah, and Irene period ceramics, and St. Catherines ceramics were identified by DePratter (1974) and most recently within the excavation unit B-1. Additionally, the 2018 field school recovered a single sherd tentatively identified as Weeden Island period Red Filmed style. This is the only diagnostic Weeden Island Period ceramic that has been recovered. Styhstic examples of these ceramics are shown in Figure 5. Of the ceramics for which temper could be identified, the majority of sherds were clay tempered (2694 gr), with the Wilmington ceramic type being the most common type recovered from the shovel tests, excavation units, and surface collection. Conversely, Pearson (1977) reported that the most common ceramic types recovered were Savannah Fine Cord Marked and Savannah Check Stamped (sand and grit tempered), with only three of 122 recovered sherds being clay tempered This

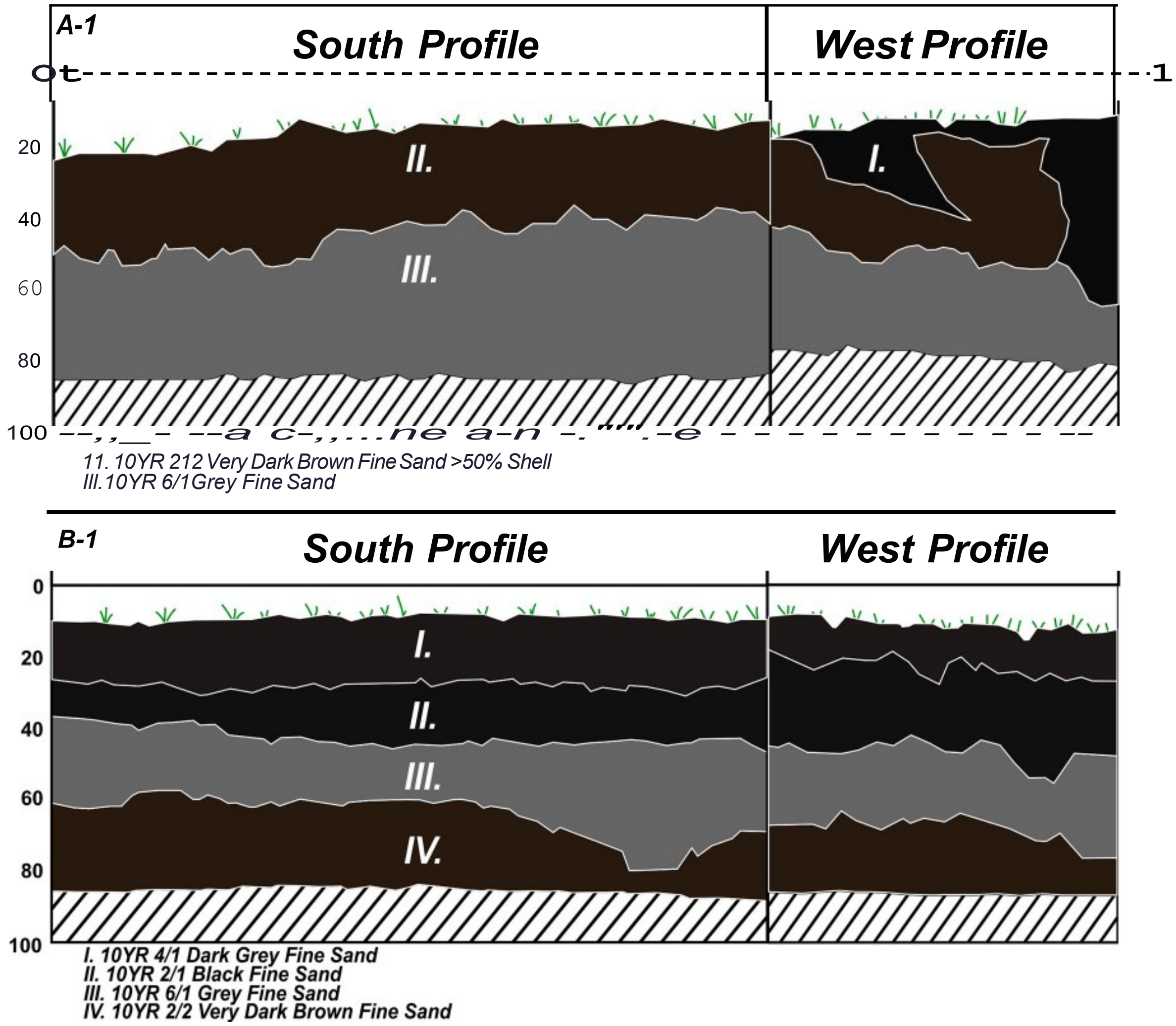

Figure 4. Illustration of the natural stratigraphic levels in the south and west profiles of excavation units A-1 and B-1, including depth (cm), Munsell Soil Color Chart values, and grain size for each of the strata.

discrepancy may relate to differences in survey strategy, as the 2018 and 2022 field school collection areas were relatively constrained along the bluff edge.

Table 1 shows the total distribution of ceramic types by weight found within the Woodland-Mississippian component of the Bluff Field site, including the two excavation units, shovel tests, and surface collections. Figures 6 and 7 show the distribution of ceramic types by depth within excavation units A-1 and B-1 respectively. Figure 8 shows the distribution of ceramics by type across all shovel tests associated with the Woodland-Mississippian component of the site. The distributions display a number of general trends for the site. Overall, shovel tests, surface collections, and excavation units all contain very high quantities of Wilmington ceramics. The current ceramic chronology for the Georgia coast posits that Wilmington ceramics are utilized from about AD 350-1000, based on the data from David Hurst Thomas's investigation of St Catherines Island (Thomas 2008:1014-1015) and the surveys of Chatham County and Ossabaw Island conducted by Chester DePratter (1974, 1991). This ceramic type is generally thought to transition to the St Catherines ceramic type around AD 1000-1200, which lasts until around AD 1280, after which it is succeeded by the Savannah ceramic style until around AD 1350. From the ceramic data, we can see that the ceramics at the Bluff Field site follow this sequence of ceramic type succession, but show considerable overlap between individual levels. Wilmington ceramics are present in nearly every level of the excavation units above the very lowest level and are intermixed with ceramic styles that supposedly occur hundreds of years later in the current ceramic chronology.

There are significant differences between the two excavation units. Unit A-1 was positioned on the top of a shell midden-mound previously identified by Pearson (1977), and contained primarily Late Woodland and Early Mississippian ceramics, with a notably high

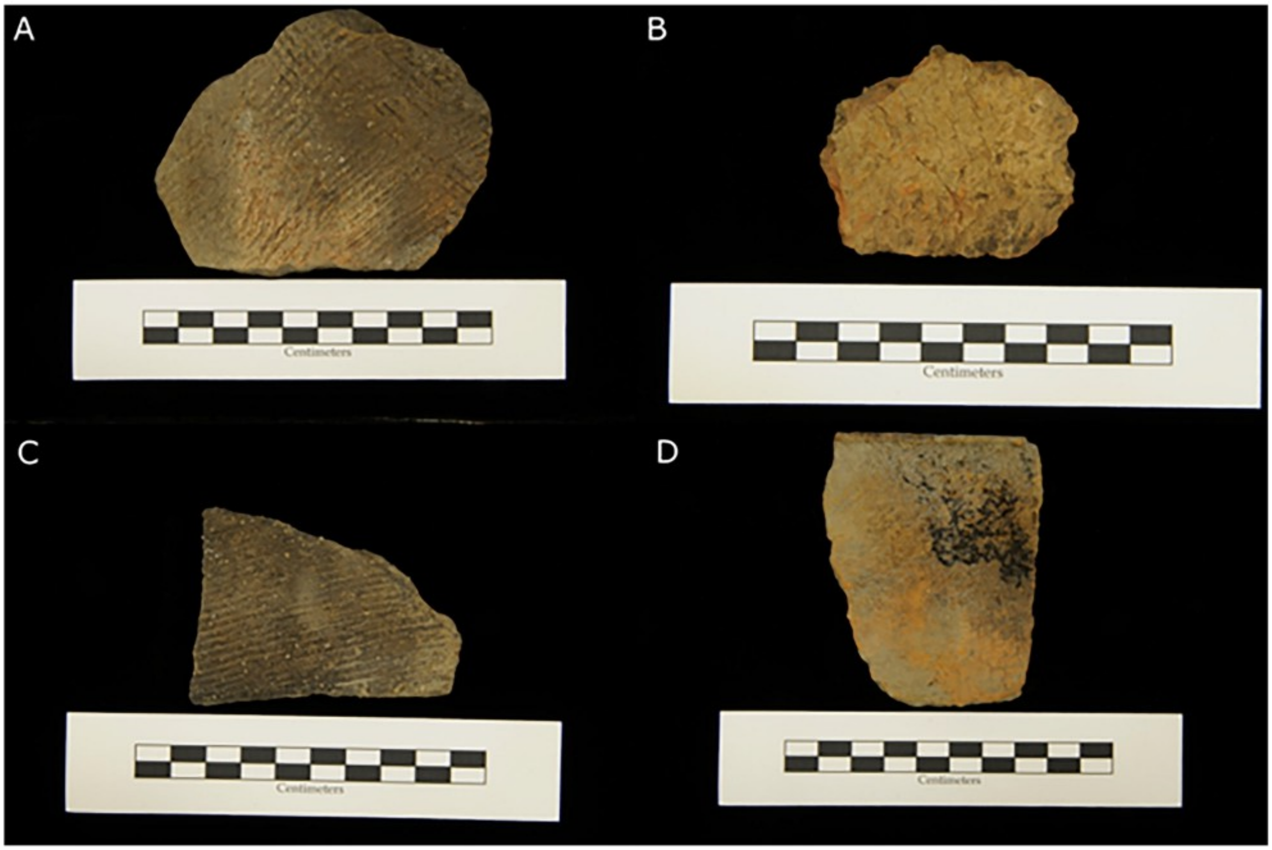

Figure S. Examples of recovered ceramics from surface collection and shovel tests: Wilmington Cord Marked (A and B); Savannah Fine Cord Marked (C); Clay Tempered Stamped (D).

concentration of Wilmington ceramics and a smaller number of Savannah fine cord-marked ceramics in the upper levels. Unit B-1 was positioned along the bluff edge approximately 60 m northeast of A-1 at the location of a shell scatter with a layer of dense anthrosol approximately 20-30 cm in depth, revealed by a split spoon probe. Unlike Unit A-1, Unit B-1 contains a broader suite of ceramic styles that span from the Late Woodland through the Late Mississippian, including a single Irene sherd. The overall distribution of ceramics by depth generally follows the expected trend, with the lower levels containing primarily Woodland ceramic styles and higher levels including increasingly later styles moving upward. The singular Irene sherd appears slightly out of sequence, but may be fall-in from the surface during excavation, as no other Irene ceramics were recovered from either excavation unit and all other identified Irene sherds at the site were collected from pedestrian survey.

Radiocarbon dating

All unmodeled and modeled dates are shown in Table 2, and the context and uncorrected dates for each sample in Table 3. The model is a basic phase/sequence model which incorporates the superposition of dated samples as a prior information based on our observation of stratigraphic layering of the deposits in the excavations. Additionally, dates from Units A-1 and B-1 were sequenced, which was justified by an order command that returned a likelihood of98.7% that radiocarbon dates from the start of Unit A-1 occurred before dates from the start of Unit B-1 (see Supplemental Material, Code). A single radiocarbon date (UGAMS 37296) was flagged in the model as an outlier, as it is a dramatic departure from the other dates and may have been the result of fall-in from a higher level or the shovel test surface, or bioturbation of the sediments within the upper levels. The basic structure of the model can be observed in Figure 9. The primary model exhibits an Amodei of 105.3 and an Aoverall of 104.8, both above the accepted threshold of 60 (see Bronk Ramsey 2009; Hamilton and Krus 2018).

The model returned a start date range of cal. *AD 920-990* (68%) and cal. *AD 850-990* (95%) and an end date range of cal. *AD 1190-1250* (68%) and cal. *AD 1180-1300* (95%). The span of occupation ranges from 230 to 320 years (68%) and 200-400 years (95%),

Table 1. Ceramic weights (grams) for non-shell ring shovel tests and units A-1 and B-1.

Ceramic type	A-1	B-1	Shovel tests/surface collection	Total
Early/Middle Woodland				
Deptford Check Stamped	0	40.4	4.7	45.1
Late Woodland				
Walthour Check Stamped	0	0	11.8	11.8
Weeden Island Red	0	0	5.9	5.9
Wilmington Cord Marked	7.8	184.7	1549.9	1742.4
Wilmington Heavy Cord Marked	0	35.2	0	3S.2
Wilmington Simple Stamped	0	0	6.2	6.2
Wilmington Plain	662.1	29.2	19.3	710.6
Early/Middle Mississippian				
St. Catherines Cord Marked	0	122.7	7.7	130.4
St. Catherines Net Marked	0	0	7.1	7.1
St. Catherines Burnished Plain	0	0	8.5	8.5
Savannah Burnished Plain	0	0	62.1	62.1
Savannah Complicated Stamped	0	20.3	22.8	43.1
Savannah Cord Marked	0	51.6	278.5	330.1
Savannah Fine Cord Marked	35.6	119.8	34.3	189.7
Savannah Check Stamped	0	11	73.9	84.9
Savannah Plain	0	0	4.1	4.1
Late Mississippian				
Irene Complicated Stamped	0	3.3	23.2	26.S
Untyped ceramics				
Oay Tempered Plain	17.7	149.7	196.7	366.1
Clay Tempered Eroded	0	8.8	38.9	47.7
Clay Tempered Simple Stamped	0	2.4	00.8	83.2
Clay Tempered Cord Marked	0	0	17.4	17.4
Oay Tempered Fabric Marked	0	0	13.8	13.8
Clay Tempered Check Stamped	0	0	11.6	11.6
Clay/Grit Tempered Stamped	0	4.1	0	4.1
Sand Tempered Plain	0	13.7	S9.1	72.8
Sand Tempered Burnished Plain	0	11.7	0	11.7
Sand Tempered Cord Marked	0	0	5.4	5.4
Sand Tempered Stamped	0	0	33.3	33.3
Sand Tempered Eroded	0	0	S.03	5.0
Sand/Grit Tempered Eroded	0	8.9	0.8	9.7
Sand/Grit Tempered Plain	21.2	84.4	44.2	149.8
Sand/Grit Tempered Stamped	0	0	33.3	33.3
Grit Tempered Stamped	0	0	7.7	7.7
Residual Sherd lets (<2 cm)	22.8	150.8	260.8	434.4
Grand Total	**767.2**	**1052.7**	**2930.8**	**4750.7**

respectively. Because this area of the curve results in multiple intercepts, dating of samples with known stratigraphic information is critical to accurately constraining these dates. Units A-1 and B-1 were sequentially ordered, with Unit A-1 returning a date range of cal. *AD 890-1020* (68%) and cal. *AD 880-1030* (95%) and Unit B-1 returning a date range of cal. *AD 1160-1220* (68%) and cal. *AD 1050-1230* (95%).

Combined with the ceramic analysis, these modeled ages pose a challenge to the current conceptual framework for the occupational chronology of the Georgia coast Wilmington ceramics were the greatest in both weight and count of any ceramic style within both units, despite the units having an overall chronological range of more than 300 years that pushes well into the Middle Mississippian period, significantly beyond the supposed threshold for the use of Wilmington ceramics. This points to several potential incongruencies in the theoretical framework for the settlement of the Georgia coast

Reassessment of the coastal chronology

Ceramics synthesized from the primary data from the original excavation units on St. Catherines Island present some notable characteristics (Figure 10). While the researchers clearly targeted their radiocarbon dating efforts toward units and levels that were similarly dominated by Wilmington ceramics, there is considerable heterogeneity both within the levels used for radiocarbon samples and throughout the units as a whole. Some of the dates were sampled from units within which Wilmington sherds did not represent a majority. Three of the units sampled appear to consist entirely of Wilmington ceramics, but the remaining excavation units include a suite of both younger and older ceramic styles, similar to the contents of Bluff Field Unit B-1, though with a greater quantity of older Woodland period ceramic styles.

We additionally performed a reanalysis of the original radiocarbon dating used to formulate the current

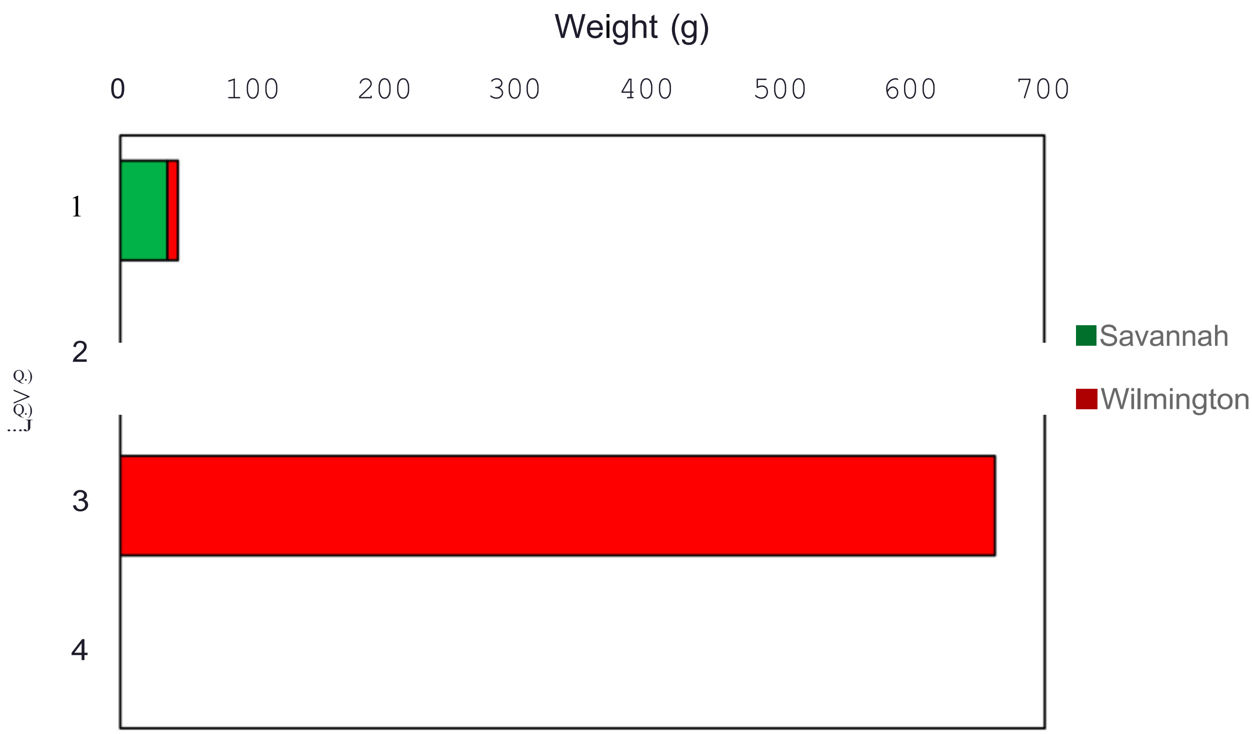

Figure 6. Weight of identifiable ceramics by type within 10-cm levels of excavation unit A-1.

ceramic chronology in order to address disparities between the Bluff Field model and the current ceramic chronology. Twenty corrected radiocarbon dates from shell materials were run in a single-phase Bayesian model to assess the overall boundary spans of these dates using the current Marine20 radiocarbon curve and a local delta value of -286 ± 68 averaged from the nine values originally used by Thomas (2008). The

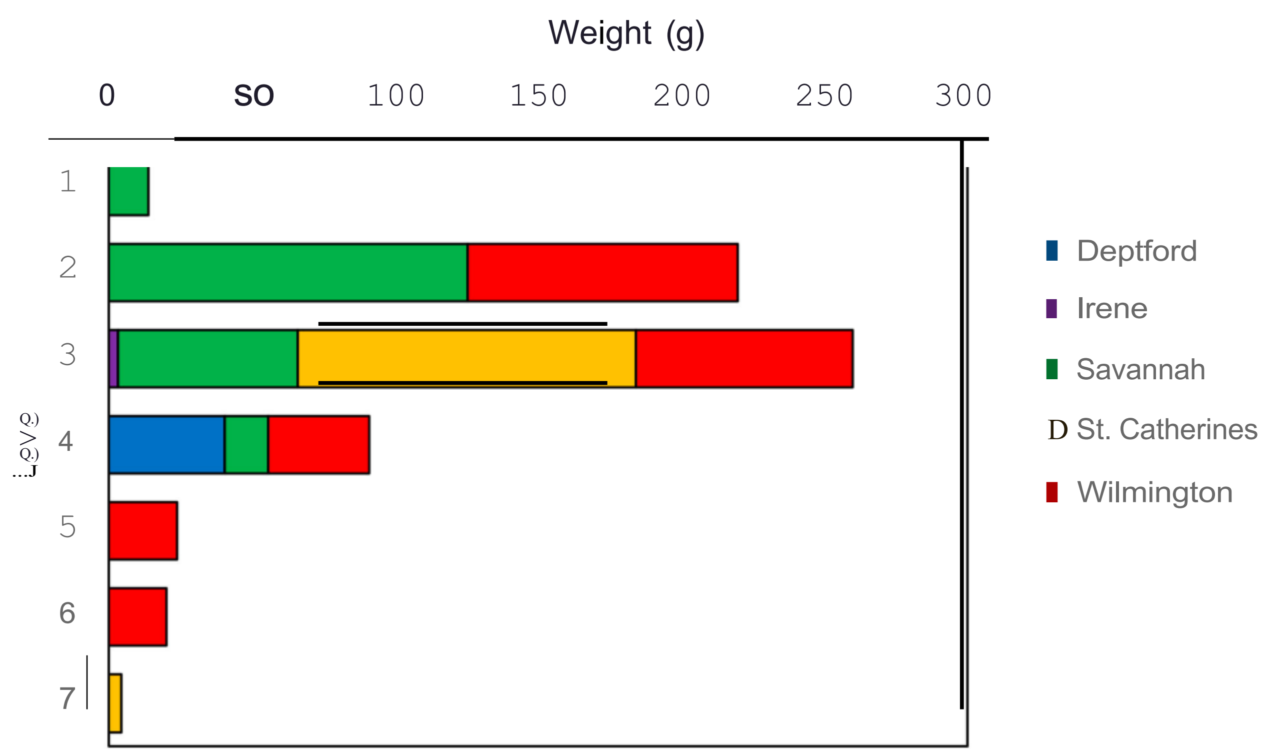

Figure 7. Weight of identifiable ceramics by type within 10-cm levels of excavation unit B-1.

Figure 8. Weight of identifiable ceramics by type within 10-cm levels of radiocarbon dated shovel tests.

modeled dates and boundaries are shown in Table 4. The model returned a start boundary range of cal. *AD 250-460* (68%) and cal. *AD 140-570* (95%) and an end boundary range of cal. *AD 910-1130* (68%) and cal. *AD 830-1250* (95%). The span of these dates ranges from 550 to 780 years (68%) and 450-930 years (95%).

Both the age boundaries and the overall span diverge considerably from the original chronological model derived from these shell dates. The single-phase shell date model start boundary range encompasses Thomas's estimate of around AD 350 for the start of the Wilmington period, but the end boundary range extends several centuries beyond the original estimate of AD 800 (Thomas 2008:414-415; see Supplemental Materials, Figure S2). Moreover, when we compare the single-phase shell date model to our Bluff Field model the overall span of the shell date model is double that of Bluff Field, although some of this may be a result of the broad age range distributions for the individual dates and the boundaries themselves (see Figure **11**). While the start boundary conforms more closely to prior models, the end boundary of the shell date model is far closer to the end boundaries of our Bluff Field model, which pushes the end of the Wilmington period potentially into the Early Mississippian and overlaps considerably with the later St. Catherines and Savannah ceramic periods.

Table 2. Modeled radiocarbon dates from Blufffield.

	Unmodeled (BC/AD)						Modeled (BC/AD)						Indices: Amodei 105.3; Aoverall 104.8	
Name	From	To	%	From	To	%	From	To	%	From	To	%	A	C
Sequence														
boundary start all Bluff field							920	990	68.3	850	990	95.4		%.6
Phase all dates Bluff field														
Sequence A-1, B--1														
Sequence A-1														
R_Date 5992S	890	980	68.3	880	990	95.4	950	990	68.3	910	1000	95.4	%.3	99.1
R_Date S9924	900	1020	68.3	890	1030	9S.4	980	1020	68.3	%0	1030	9S.4	115	99.S
Span Span A-1							0	SO	68.3	0	80	95.4		99.7
Sequence B-1														
R_Date 59929	1170	1220	68.3	1050	1230	95.4	1160	1190	68.3	1050	1210	95.4	84.6	99.S
R_Date S9928	1170	1220	68.3	11S0	1230	9S.4	1170	1200	68.3	1160	1220	9S.4	105.3	99.7
R_Date 59927	1160	1220	68.3	1050	1220	95.4	1180	1220	68.3	1170	1220	95.4	109.4	99.7
Span Span 8--1							0	40	68.3	0	150	95.4		99.8
Phase shovel tests														
Sequence														
R_Date 372%	1300	1400	68.3	1300	1400	95.4	1300	1400	68.3	1300	1400	95.4		99.4
R_Date 37294	990	1030	68.3	900	1030	95.4	990	1020	68.3	980	1030	95.4	101	99.4
Sequence														
R_Date 37292	1040	1200	68.3	1040	1220	9S.4	1040	1170	68.3	1030	1180	9S.4	108.4	99.6
R_Date 37295	1050	1210	68.3	1040	1220	95.4	1150	1210	68.3	1050	1220	95.4	100.9	99.7
R_Date 37288	1040	1170	68.3	1030	1200	95.4	1040	1170	68.3	1030	1180	95.4	99.4	99.4
R_Date 37293	1150	1220	68.3	1040	1220	9S.4	1150	1210	68.3	1040	1220	9S.4	99.4	99.4
R_Date 37291	11S0	1220	68.3	1040	1220	9S.4	1150	1210	68.3	1040	1220	9S.4	99.4	99.1
Interval shovel test interval							230	310	68.3	200	400	95.4		95.9
Boundary all end Bluff field							1190	1250	68.3	1180	1300	95.4		98.1
Span							230	320	68.3	200	400	9S.4		9S.9

Table 3. Uncorrected AMS dates and context for each sample. See Table 2 for corrected and modeled dates.

UGAMS#	MATERIAL	CONTEXT	613C, ‰	14(years (BP)	±
37295	*Carya* spp. (Hickory nut)	ST--01, Level 2	-25.93	900	20
37292	*Carya* spp. (Hickory nut)	ST--01, Level 3	-24.63	910	20
37288	*Carya* spp. (Hickory nut)	ST--02 Level 3	-27.52	920	20
37293	*Carya* spp. (Hickory nut)	ST--03, Level 3	-26.62	890	20
37294	*Carya* spp. (Hickory nut)	ST--04, Level 4	-26.06	1050	20
37296	*Carya* spp. (Hickory nut)	ST--05, Level 2	-26.79	620	20
37289	*Carya* spp. (Hickory nut)	ST--05, Level 4	-24.52	1750	20
37291	*Carya* spp. (Hickory nut)	ST--05, Level 2	-26.64	890	20
37290	*Carya* spp. (Hickory nut)	ST--09, Level 3	-25.76	940	20
59924	*Carya* spp. (Hickory nut)	Unit A-1, Level 2	-24.63	1070	20
59925	*Carya* spp. (Hickory nut)	Unit A-1, Level 3	-24.06	1120	20
59926	*Carya* spp. (Hickory nut)	Unit B-1, Level 2	-27.7	100	20
59927	*Carya* spp. (Hickory nut)	Unit B-1, Level 4	-26.65	800	20
59928	*Carya* spp. (Hickory nut)	Unit B-1, Level 6	-23.82	860	20
59929	*Carya* spp. (Hickory nut)	Unit B-1, Level 7	-24.58	870	20

Discussion

Site erosion and mitigation

In comparing the current distance from Mound A to the bluff edge (104 ft) to that recorded by C. B. Moore during his excavation of the mounds (150 ft), it is evident that the Bluff Field site has been actively eroding over the past century. This is further evidenced by the distance of Cabbage Garden Creek to Cabbage Garden Road recorded during Pearson's (1977) investigation of the site compared to present-day satellite and LiDAR imagery. Further excavation of the site is planned for the future toaddress thesalvage of the eroding midden and to further characterize the activities and occupation across the site.

The rapid erosion of the site will inevitably lead to the destruction ofboth the Mississippian component of Bluff Field, as well as a recently discovered shell ring that may represent one of the earliest occupations of the Georgia coast in the archaeological record. Efforts to address further damage to the site should include accelerated analysis and documentation of the contained archaeological structures and site features, including geophysical survey of the mound and shell ring features, further refinement of the ceramic and radiocarbon chronologies of the sites, as well as additional testing around the shell ring unit to determine the extent of the pre-Mississippian component of the Bluff Field site.

Assessing the ceramic chronology of the Georgia coast

Analysis of the collected ceramics and radiocarbon dates points toward the primary deposition of the shell midden during the later portion of the Wilmington period and into the St Catherines period. This range extends beyond the typical Wilmington period dates (AD 500-1000) and into the St. Catherines period (AD 1000-1200; DePratter 1991:11), which juxtaposes the large amount of Wilmington ceramics and relatively small number of St. Catherines ceramics recovered during the surveys.

Wilmington and Savannah ceramics occur simultaneously within individual levels throughout both Units A-1 and B-1 and shovel tests. St. Catherines ceramics are also intermixed within the levels of Unit B-1. The cultural chronology for the Georgia coast relies on these ceramic chronologies as the basis for cultural change over time. The chronology constructed by DePratter (1991) for the Georgia coast estimates that the Wilmington, St. Catherines, and Savannah ceramic styles occur over a total span of over 800 years (AD 500-1325), with the Wilmington and Savannah periods separated by at least 200 years. Thomas (2008:414-415) estimates the Wilmington period to be from AD 350-800 and the later St. Catherines period AD 800-1200. When compared against the radiocarbon evidence from the most recent excavations of Bluff Field, this presents two problems.

First, the existing chronologies place the Wilmington, St. Catherines, and Savannah periods significantly earlier in time compared to age estimates from current Bayesian modeling of recent samples (see Figure 12). The radiocarbon dates used to build the chronologies by DePratter and Thomas are derived from invertebrate shell dates (genus *Mercenaria* and *Crassotrea),* which are subject to considerable marine reservoir effect, producing age estimates that are hundreds of years older due to the uptake of marine carbon (Hadden et al. 2023; Thompson and Krus 2018). This lowered precision has significant impacts on archaeological interpretations, especially as these ceramic chronologies fall along the transition from the Woodland period to the Mississippian period and could alter our current understanding of coastal settlement patterning, which is particularly dynamic during this time span on the Georgia coast (Garland et al. 2021; Pearson 2014; Ritchison 2019; Ritchison

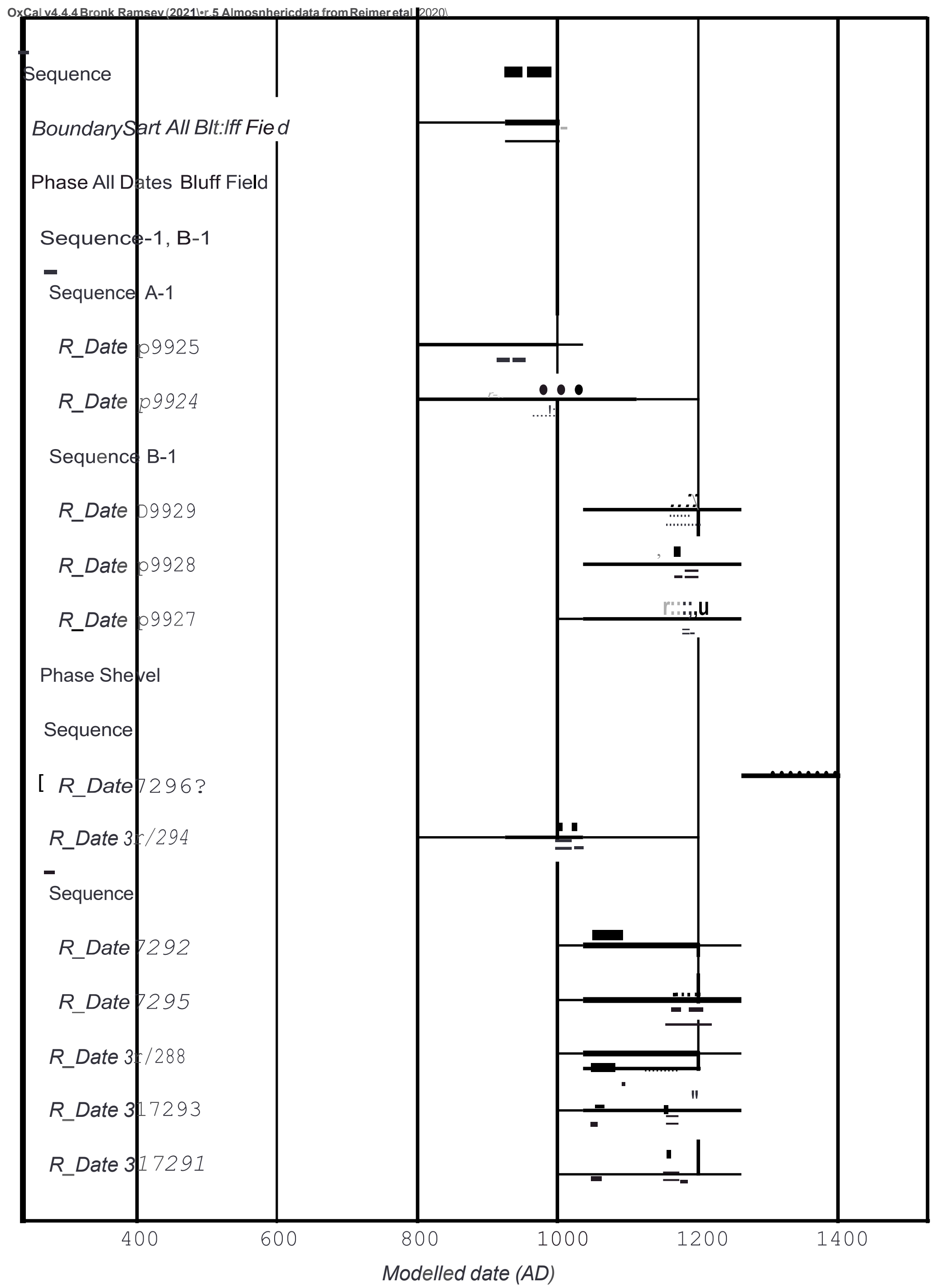

Figure 9. Probability distributions for the Bluff Field shell deposits. The white curves with black outline represent calibrated distributions and the solid black distributions alone represent the posterior density estimates based on the model that incorporates archaeological information.

and Anderson 2022). Comparing the chronological spans of the Bluff Field model and the single-phase marine shell model, there are distinct differences in the overall chronological range, as well as a significant difference in the precision of the models (Figure 11). The single-phase marine shell model contains broad boundaries of several hundred years and a total span of 800 years or more. The Bluff Field model, derived entirely from short-lived terrestrial samples, has considerably more precise boundary ranges and a narrower overall duration.

The second problem for existing chronologies is the assertion that these periods are separated into discrete temporal ranges (Figure 12). Evidence from the Bluff

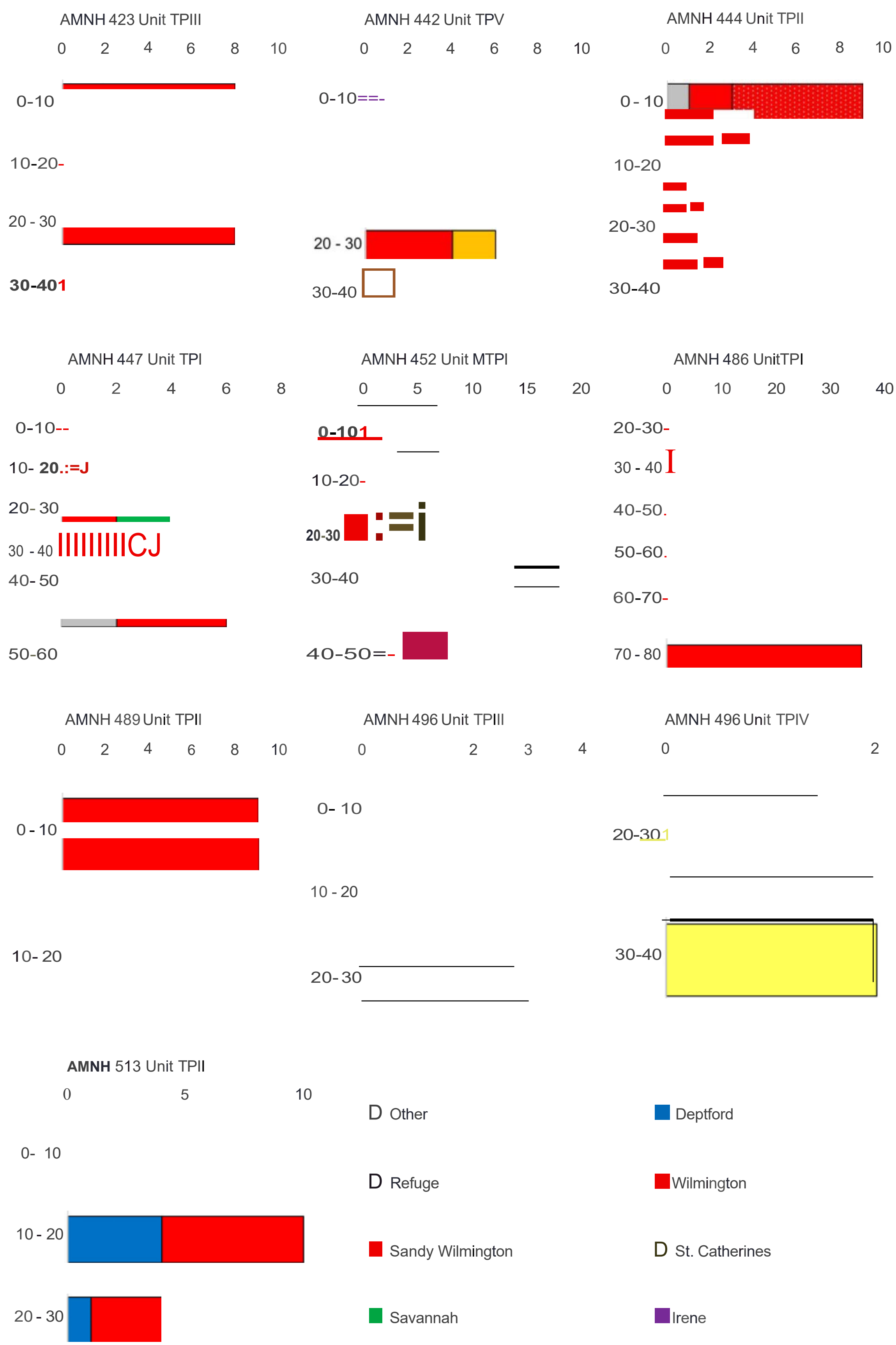

Figure 10. Count of identifiable ceramics by type within 10-cm levels of test units on St. Catherines Island with radiocarbon dated shell samples.

Table 4. Single-phase Bayesian model for shell-<lerived radiocarbon dates.

	Unmodeled (BC/AD)						Modeled (BC/AD)						Indices: Amodei 133.1; Aoverall 80.4	
Name	From	To	%	From	To	%	From	To	%	From	To	%	A	C
Sequence														
Boundary Start Thomas							250	450	68.3	140	570	95.4		97.3
Phase 1														
Curve Marine20														
Delta_R(-286,68)	-3S6	-216	68.3	-423	-149	9S.4	-404	-271.5	68.3	-4S2	-179.5	9S.4	88.6	97.9
R_Date UGA	590	820	68.3	460	930	95.4	550	780	68.3	430	890	95.4	96	99.4
R_Date Beta--21404	440	680	68.3	300	800	95.4	420	650	68.3	310	770	95.4	101.7	99.4
R_Date Beta--21403	530	760	68.3	410	880	95.4	470	700	68.3	370	830	95.4	98.4	99.3
R_Date Beta--218096	860	1140	68.3	720	12S0	95.4	780	1020	68.3	670	1130	9S.4	92.9	99.4
R_Date Beta--20818	880	1160	68.3	750	1280	95.4	780	1020	68.3	680	1140	95.4	89.3	99.3
R_Date Beta--218095	820	1040	68.3	710	1150	95.4	770	980	68.3	680	1080	95.4	94.4	99.3
R_Date Beta--217225	480	700	68.3	370	810	95.4	450	660	68.3	350	780	95.4	98.5	99.4
R_Date Beta--217226	400	620	68.3	2(i()	700	95.4	380	S90	68.3	270	680	95.4	101.6	99.2
R_Date Beta--217227	310	560	68.3	200	660	95.4	340	550	68.3	240	640	95.4	105.8	99.1
R_Date Beta--20823	730	960	68.3	650	1060	95.4	680	900	68.3	610	1020	95.4	96.7	99.5
R_Date Beta--20826	970	1210	68.3	850	1290	95.4	840	1060	68.3	750	1170	95.4	71.6	99.3
R_Date Beta--20819	980	1220	68.3	840	1310	95.4	840	1060	68.3	740	1170	95.4	69.S	99.3
R_Date Beta--20827	390	640	68.3	240	730	95.4	380	600	68.3	260	700	95.4	104.6	99.3
R_Date Beta--21402	230	530	68.3	00	6S0	95.4	320	S60	68.3	220	660	95.4	104.7	99.1
R_Date Beta--21401	4S0	690	68.3	330	830	9S.4	440	660	68.3	320	790	95.4	100.9	99.5
R_Date Beta--21400	330	590	68.3	190	680	95.4	350	570	68.3	250	670	95.4	107.1	99.2
R_Date Beta--217230	500	720	68.3	410	830	95.4	470	680	68.3	370	780	95.4	97.4	99.4
R_Date Beta--2140S	520	770	68.3	400	890	95.4	470	700	68.3	360	840	95.4	98.9	99.5
R_Date Beta--217231	490	700	68.3	400	820	95.4	460	670	68.3	370	780	9S.4	97.4	99.4
R_Date Beta--217240	550	780	68.3	430	890	95.4	490	730	68.3	400	850	95.4	97.4	99.5
Boundary End Thomas							910	1130	68.3	830	1250	95.4		97.2
Span							S50	780	68.3	450	930	95.4		

Field excavations juxtaposes this interpretation, as several levels of the excavation units and shovel tests show intermixed ceramics from the Wilmington, St. Catherines, and Savannah periods despite the tight age ranges associated with the units, which contradicts the assumption that Wilmington and Savannah pottery styles were ternporally isolated from one another. This further complicates the ongoing issues with overreliance on ceramic chronologies as standard models for estimating the age of archaeological sites, and underscores the necessity for integrating more robust absolute dating methods into the scope of archaeological investigations. This is not the only evidence in support of this comingling of Late Woodland and Middle/Late Mississippian ceramic styles on Ossabaw Island Wilmington pottery is noted in the lower levels of excavations at Finley's Pond, directly below Late Mississippian Irene styles (Garland et al. 2021). Pearson (2014:22) notes the inclusion ofWilmington ceramics within shell midden test units on Ossabaw Island that primarily consisted of Savannah and Irene styles, and further postulates that this cord-marked, clay-tempered pottery may actually be an early Savannah style that uses clay tempering instead of the sand/grit temper typical of Savannah ceramics. Combining this with a lack of ceramic styles typical of the Early Mississippian within both of these contexts, it is possible that their conspicuous absence in these instances is the result of a longer use history for the Wilmington style.

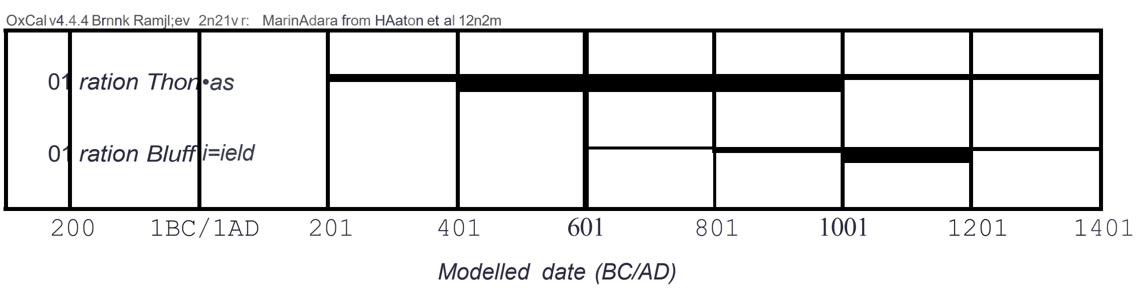

Figure 11. Comparison of chronological spans from the Thomas single-phase marine shell date model and the sequenced Bluff Field terrestrial radiocarbon model. The OxCal "Date" command is used to combine the dates within both models into discrete, normalized distributions that represent the overall likelihood of the total dated materials falling within a given chronological range.

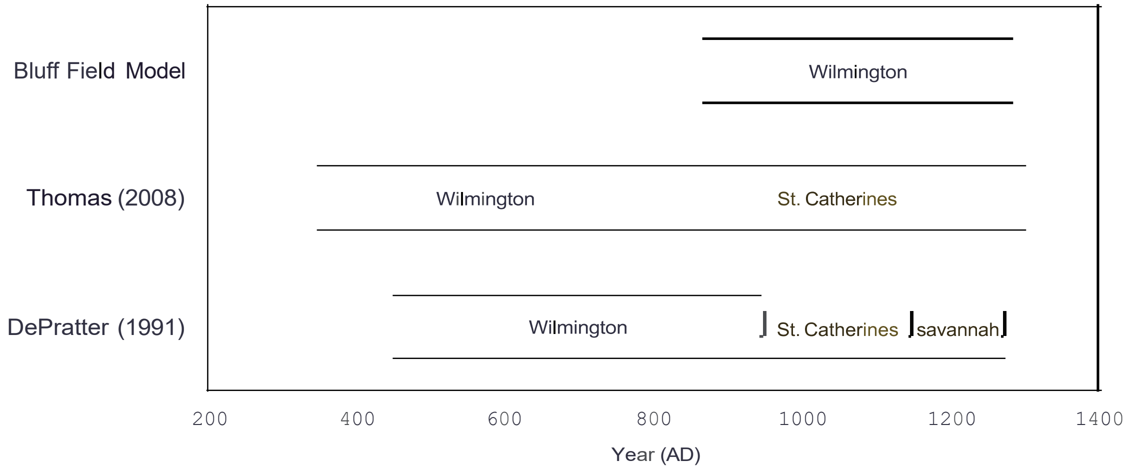

Figure 12. Comparison of the modeled dates for the Bluff Field project to the ceramic chronologies as devised by Thomas (2008) and DePratter (1991).

Axe these differences the result of highly localized differences in ceramic utilization between the barrier islands, or should we consider modifying the current chronology to account for more overlap between ceramic styles? The best way to address both of these issues is to conduct a broader reassessment of Georgia coastal archaeologicalsites through more robust radiocarbon dating of discrete ceramic phases. The scope of this research project is limited to a single site, and cannot be used exclusively as sufficient data for reconstructing the ceramic chronology for the entire Georgia coast. Rather, strategically targeting sites for radiocarbon sampling and identifying samples with appropriate context from legacy collections would provide much-needed clarity for understanding the coastal chronology going forward.

An alternative chronological model that pushes the use of Wilmington ceramics later into the Early Mississippian period or potentially into the Middle Mississippian period could have cascading impacts to our understanding of demographic change and settlement histories for the Georgia coast. Recent scholarship posits a wave of migration that occurs during the fourteenth and fifteenth century in the Savannah River Valley, resulting in a massive uptick in the population of the Georgia coast over previous centuries (Ritchison 2019; Ritchison and Anderson 2022). In part, this framework is based on the significant increase in the number of archaeological sites during this time span, as identified through archaeological surveys of the coast. However, ifwe assume that sites with Wilmington ceramics stretch further into the Mississippian period, it would effectively taper the known increases in the distribution of sites, resulting in a more gradual demographic transition and a longer use history of this ceramic style by Mississippian period settlements. This, of course, is not to say that the migration did not happen, but rather its amplitude and cascading social effects may be more muted if the later chronology for Wilmington holds true for other areas of the coast. Further exploration of the timing of these cultural occupations from a more regional scale would better inform not only our understanding of coastal histories, but also our conceptualization of subsistence and migration, so often linked to these broad changes in material goods.

Conclusions

The results of recent excavations at Bluff Field present an argument for reconsidering the chronological model for settlement of the Georgia coast The combination of ceramic analysis, radiocarbon dating, and Bayesian statistical modeling indicate a contradiction between current explanations for the development and utilization of ceramic technologies and the cultural and demographic transformations associated with these technological and stylistic shifts. Contrary to the current model, we suggest that the utilization of Wilmington, St. Catherines, and Savannah ceramic styles overlapped considerably more than previously thought, resulting in a shift not only in the cultural associations of each style, but also a more gradual growth of population during this time span.

Fully justifying this alternative framework will require a more extensive reevaluation of coastal archaeological assemblages and significantly more robust dating of coastal sites, but this case study provides a framework for integrating this broader investigation into the individual efforts of singular field surveys. Legacy collections may also provide a useful avenue for reevaluation, as abundant datable material with solid stratigraphic context undoubtedly already exists within curated collections. Archaeology is, by its nature, an iterative science, and can only benefit from further vigilance in regard to the interrogation of older frameworks and the exploration of alternative models.

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Data availability statement

All data needed to evaluate the conclusions are presented in the paper, and all raw data are available and curated at the University of Georgia Laboratory of Archaeology.

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