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Cross-mended ceramic sherds as a proxy for depositional processes at two Late Archaic shell rings in coastal Georgia

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ABSTRACT

Characterizing the depositional and temporal nature of sediments lends insight into the construction of monuments and midden accumulation. Identifying discrete deposits at Late Archaic shell rings can be challenging due to the seemingly homogenous nature of shell deposits. Data from cross-mended artifacts can help identify surfaces and determine whether deposits are contemporaneous. We present cross-mend results from the St. Catherines Shell Ring and the Sapelo Island Shell Ring complex. In both cases, we observed vertical distance between cross-mends suggesting that detailed spatial control of artifacts and cross-mend analysis can be used to understand the nature of anthropogenic deposition and postdepositional processes.

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Introduction

Sediments, whether deposited by natural or anthropogenic means, can lend insight into depositional processes related to the formation of archaeological sites, including shell-bearing sites (see Thomas 2011). Archaeologists refer to shell-bearing sites variously as shell middens, shell mounds, shell heaps, among others, and each of these names has specific behavioral implications regarding the formation processes at these places (see Claassen 1991). Here, we utilize a "sediment-oriented approach" (see Marquardt 2010): considering shell first as a sediment to understand the nature of deposition without necessarily starting with specific assumptions with regard to human behavior. Archaeologically deposited shell often has complex strata that are affected by both initial deposition and postdepositional effects (Stein 1992). Capturing variation in shell deposits using diverse datasets is key in understanding these sites.

Reassembled cultural materials within shell deposits can serve as a proxy for the deposition of these sediments. In this manner, the context of cultural materials, such as pottery, which people deposited along with shell and other midden materials, is examined similarly to a sediment. Artifact reassembly, also known as "cross-mending" and "refitting," has the potential to identify site formation processes (Schiffer 1987:258) including postdepositional processes. This technique is based on the assumption that each artifact that mends to another was deposited at the same time. Contextual information from cross-mended artifacts can clarify associations between features and stratigraphic layers. Archaeologists have used this method productively in other parts of the world; for example, Bollong (1994) uses this method at foraging sites in South Africa to provide information regarding formation processes.

Although underutilized in research on the shell rings of the Southeastern US, cross-mend data can provide specific information about the postdepositional integrity of sites and discard practices: whether people deposited shell layers gradually, all at once, and whether they deposited certain shell layers contemporaneously. We argue that this technique provides yet another perspective into the actions of Native Americans along the coast and how they formed shell rings.

Shell rings are large, circular, arcuate, or crescent-shaped deposits composed of shell and midden deposits and are found along the southern coasts of the United States. Most of the shell rings along the coasts of Georgia and South Carolina date between 5000 and 3100 BP, or what researchers commonly refer to as the Late Archaic period While most archaeologists consider shell rings to represent sedentary villages where people formed shell deposits through a variety of processes (Thompson 2018), others view them as intentional monumental constructions. Some researchers suggest that people constructed these sites rapidly during large feasting events (Saunders 2002, 2004), and others believe they

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were residential spaces that were constructed gradually from domestic refuse (Trinkley 1985). Others think there are a greater diversity of behaviors responsible for the creation of shell ring deposits, including domestic refuse deposition and shell piling from ceremonial feasts and gatherings (Russo 2004; Sanger 2015a; Thompson 2007). Researchers have approached assessing these views (e.g., habitation, monumental constructions sites) from a wide variety of methodological perspectives, including vertebrate and invertebrate faunal analyses (Cannarozzi and Kowalewski 2019; Colaninno 2012a, 2022; Marrinan 1975, 2010; Russo 2002), isotopic analysis of oysters and clams (Andrus et al. 2012; Garland et al. 2022; Thompson and Andrus 2011), geophysical surveys (Mahar 2013; Sanger and Thomas 2010; Thompson et al. 2004), environmental data (Turck and Thompson 2016), and detailed analyses of the intrasite distribution of artifacts and features (Sanger 2017a; Sanger and Ogden 2018; Thompson 2007; Trinkley 1985). The vast majority of these studies have been used to assess how people built and used these structures. Most now currently point to an interpretation of shell rings as villages with some variation in rates of depositions (i.e., feasting deposits). This research demonstrates how ceramic cross-mend data from the St. Catherines Shell Ring (911231) and Sapelo Island Shell Ring complex (9MC23) can be used to characterize the depositional nature of the stratigraphy of shell rings and further lend insight into the nature of activities that worked to create these unique features on the landscape.

Artifact reassembly

Artifact reassembly methodologies vary according to material type and project goals. In some studies, data from conjoined artifacts have been used to associate discrete archaeological deposits and suggest temporal connections. For example, direct ceramic and lithic refits helped link clusters of Neolithic pits found at Kilverstone in Norfolk (Garrow 2006; Garrow et al. 2005). At Broken K Pueblo in Arizona, ceramic cross-mend data were used to test hypotheses about the clustering of ceramic design elements across sites that were originally based on individual sherd data alone (Hill 1970; Skibo et al.1989). Probable cross-mends from alowland artifact scatter in Arizona identified two activity areas that were in use at different times (Sullivan 1983). Refit studies can identify dispersion surfaces, which can be inferred from the three-dimensional position of sherds from the same vessel (Bollong 1994). This information can also be used to test for postdepositional disturbances (Villa 1982). Other refitting studies examine animal bone and lithics to understand depositional processes, as well as artifact manufacture (Hofman 1981; Morrow 1996; Todd and Frison 1992; Todd and Stanford 1992; Vaquero 2008; Villa 1982; Waguespack 2002).

Perhaps the most directly relevant artifact reassembly study was conducted on ceramic sherds from Bead Maker's Midden (9CH199), an Irene period shell midden on Ossabaw Island (Pearson and Cook 2012). Distributions of matching sherds were used to examine patterns of vessel discard and shell midden accumulation. Similar to the current study, this analysis was limited to sherds recovered from a **1** m x 3 mexcavation area. Mended sherds from five vessels were documented with their three-dimensional coordinates, allowing researchers to compare vertical and horizontal distributions of sherds from the same vessel to the midden stratigraphy and slope (Pearson and Cook 2010). From these distributions, two patterns of dumping practice were observed: one in which refuse was deposited in a single area at the top of the midden, and another involving scattering material over a wider area, across the flank of the midden. Lack of erosional surfaces and rain-washed deposits suggest intentional wide-spread deposition rather than downslope movement due to natural processes. This suggests that midden deposits accumulated too quickly to develop erosional surfaces. Discarded materials, including ceramics, were buried relatively rapidly.

Study area: St. Catherines and Sapelo Island shell rings

Our study focuses on two shell rings located on neighboring barrier islands (Figure **1**), both of which were built roughly 4400-4000 cal BP. The Sapelo Shell Ring complex includes three rings, all located within about 300 m of one another (Thompson 2006, 2007; Thompson et al. 2004; Waring and Larson 1968). We include Ring II, the northernmost of the three rings, as one of our sample areas along with the St. Catherines Shell Ring (Sanger 2015a; Sanger 2017b; Sanger and Thomas 2010). Both rings are generally the same size, with the St. Catherines Shell Ring measuring roughly 70 m across with midden deposits ranging from 0.5-1.5 m tall, while Ring II measures approximately 90 m in diameter, with little topographic relief and primarily composed of subsurface shell deposits (Thompson and Andrus 2011).

Applying this method to the St. Catherines Shell Ring and Sapelo Island Shell Ring complex, we examine two models of ring formation: a gradual accumulation model and a feasting model. If either of the shell rings

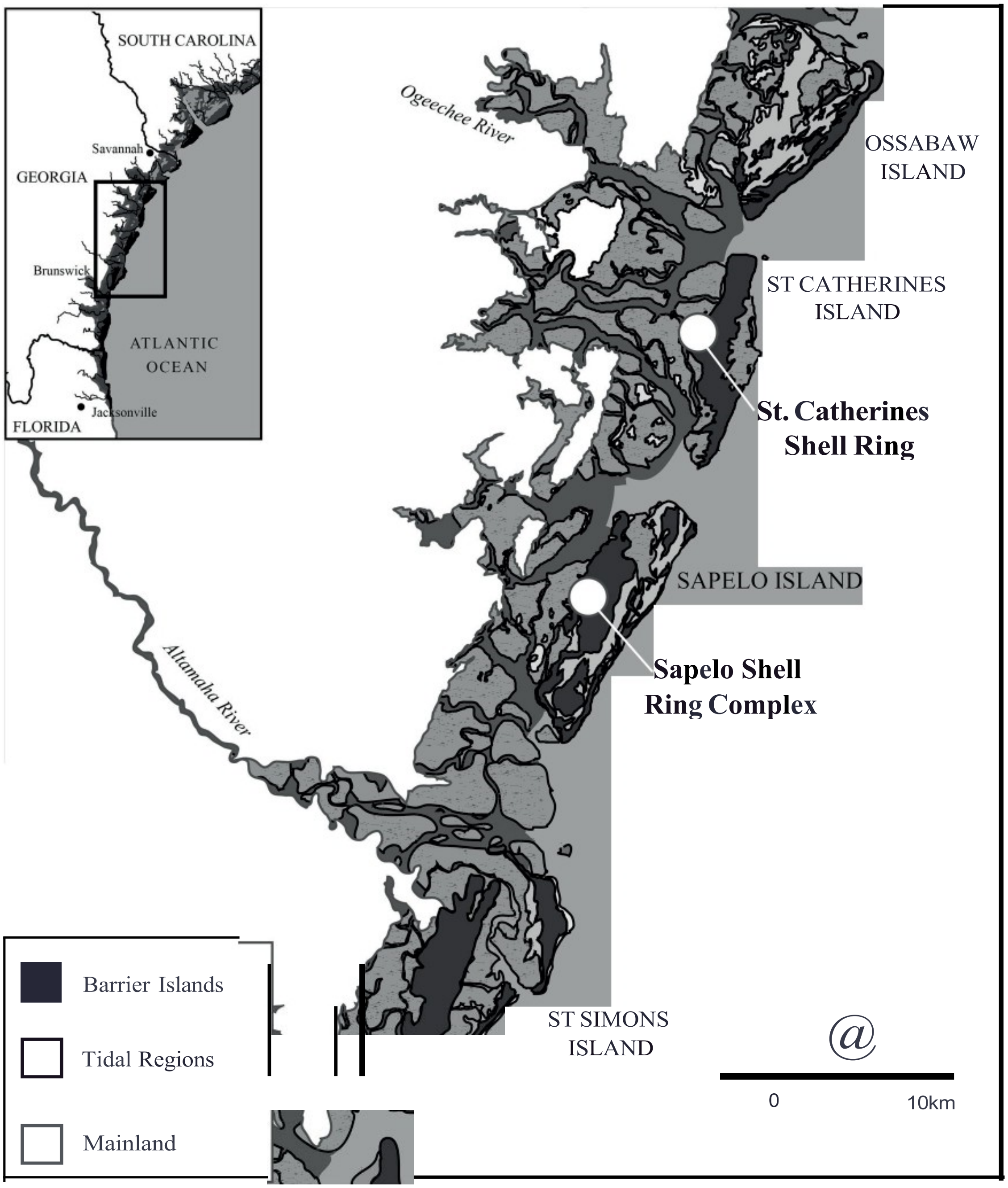

Figure 1. Locations of St. Catherines Island and Sapelo Island on the Georgia coast.

formed through the daily discard of food consumed in a domestic context (e.g., Trinkley 1985), we would expect to see most of the cross-mended sherds from within the same unit and level. In this scenario, our assumption is that people were discarding limited amounts of material at a time on the midden deposit. If Native Americans constructed the shell ring quickly, perhaps through the consumption oflarge amounts of food during feasting events (e.g., Russo 2004; Saunders 2002, 2004), we might expect sherds that mend with others from contexts that are farther apart. In this scenario, our assumption is that people discarded relatively larger amounts of shell and cultural material onto the shell deposit as secondary discard. In other words, feasting debris and broken pottery would accumulate in primary use areas and then be gathered up and deposited along the circumference of the ring. Thus, if this is the case, then it would be more likely that ceramic sherds would be deposited larger distances apart stratigraphically as the gathering of the primary debris would mix the assemblage. There are of course circumstances where this might not be the case and vessels were broken directly on the shell ring; however, we argue that if this were the case then we would find many reconstructable vessels, not just cross-mends, in close proximity to one another in the rings. This, as we demonstrate, is not the case. While no single line of data definitively points to one interpretation, this study, and previous studies on Late Archaic shell rings concatenate with the same interpretive model: the gradual accumulation of debris that is largely related to village life, but then at times hosted ceremonies and feasts.

Although many refitting studies rely on information from direct artifact refits, ceramic cross-mend studies commonly use various attributes to identify fragments that are likely from the same vessel. Using criteria such as color, texture, thickness, paste, temper, and decoration, formalized scoring systems have been developed to quantify likelihood of sherd relationships (Blanco-Gonzalez and Chapman 2014; Bollong 1994; Chapman and Gaydarska 2007). Due to the lack of variability of the small body sherds from the St. Catherines sample, we were not able to devise such a system. The ceramics from Sapelo Island Shell Ring complex that had similarities due to curvature, oxidation, width, and surface appearance were documented, but not considered as definitive evidence of belonging to the same vessel or depositional event.

Methods

Sample selection

All the ceramics considered for this study were fiber tempered. Eight sherds from the St Catherines ceramic assemblage were decorated, usually with punctates, but the rest of the sample was undecorated fiber-tempered sherds. Although there is some variability in sherd thickness, the assemblage is fairly homogenous due to lack of variability of other attributes, such as decoration, temper, and paste. Recent research using radiographic imaging and computed tomography on pottery from St. Catherines Shell Ring and McQueen Shell Ring (9LI648) have successfully identified patterns and groupings of production techniques by revealing patterns in internal structures (Sanger 2016, 2017b), but incorporating these experimental data was beyond the scope of this project. For this reason, we did not utilize similarity indices to identify potential cross-mends. This study relies on data from direct cross-mends only.

At St. Catherines Shell Ring, ceramics from three contiguous 1 m x 1 m units were selected for cross-mend analysis. These units, N782 £801, N783 £801, and N784 £801, are located in the northern area of the shell ring (Figure 2). The northern unit, N784 E801, is situated on the thickest shell deposit at the shell ring. The southern unit, N782 £801, is in the interior arc of the shell ring. This trench was excavated to reveal how the shell ring and interior plaza deposits relate (Sanger 2015a).

A total of 563 Late Archaic fiber-tempered ceramic sherds were recovered from these units. The majority (*n* = 405) were located in the southern unit, N782 E801, which was also the unit that contained the least amount of shell. The center unit, N783 E801, contained 90 sherds. The northern unit, N784 E801, contained only 68 ceramic sherds and contained the densest shell deposit in the trench.

The ceramics from Sapelo Island Shell Ring complex come from a Ring II excavation designated as Unit 1-2006, which was located in the southern arc of the ring (Figure 3). Excavators dug this 2 m x 2 m unit in quadrants (1 m x 1 m) in 10 cm levels. When possible, excavators piece plotted the exact location of ceramics in each of the quadrants.

For all collections, undecorated body sherds that were severely eroded or smaller than 1 cm on each side were excluded from study. These sherds did not have edges suitable for mending, nor did they have other unique attributes that would allow them to be organized into groups oflikely cross-mends.

Mending procedure

A total of 331 sherds were examined for direct mends from St Catherines Shell Ring(Table 1). Unique catalog numbers were applied to each sherd and organized according to unit and level. Each sherd was systematically compared for mends against every sherd, beginning with sherds from the same unit and level, then sherds from the same unit, and finally with the other two units. In the 2 x 2 m unit at the Sapelo Shell Ring complex, 148 ceramics were inspected for cross-mends in the same fashion: within the unit level context and then between unit levels.

Results

St. Catherines Shell Ring cross-mend results

The majority of sherds in each cross-mend at the St. Catherines Shell Ring were from the same unit and 10 cm level (Table 2). Few cross-mends spanned large vertical distances and they were usually associated within a single stratigraphic unit.

Sixty-seven individual sherds (~20% of the sample) were mended (Table 1). These cross-mends represent

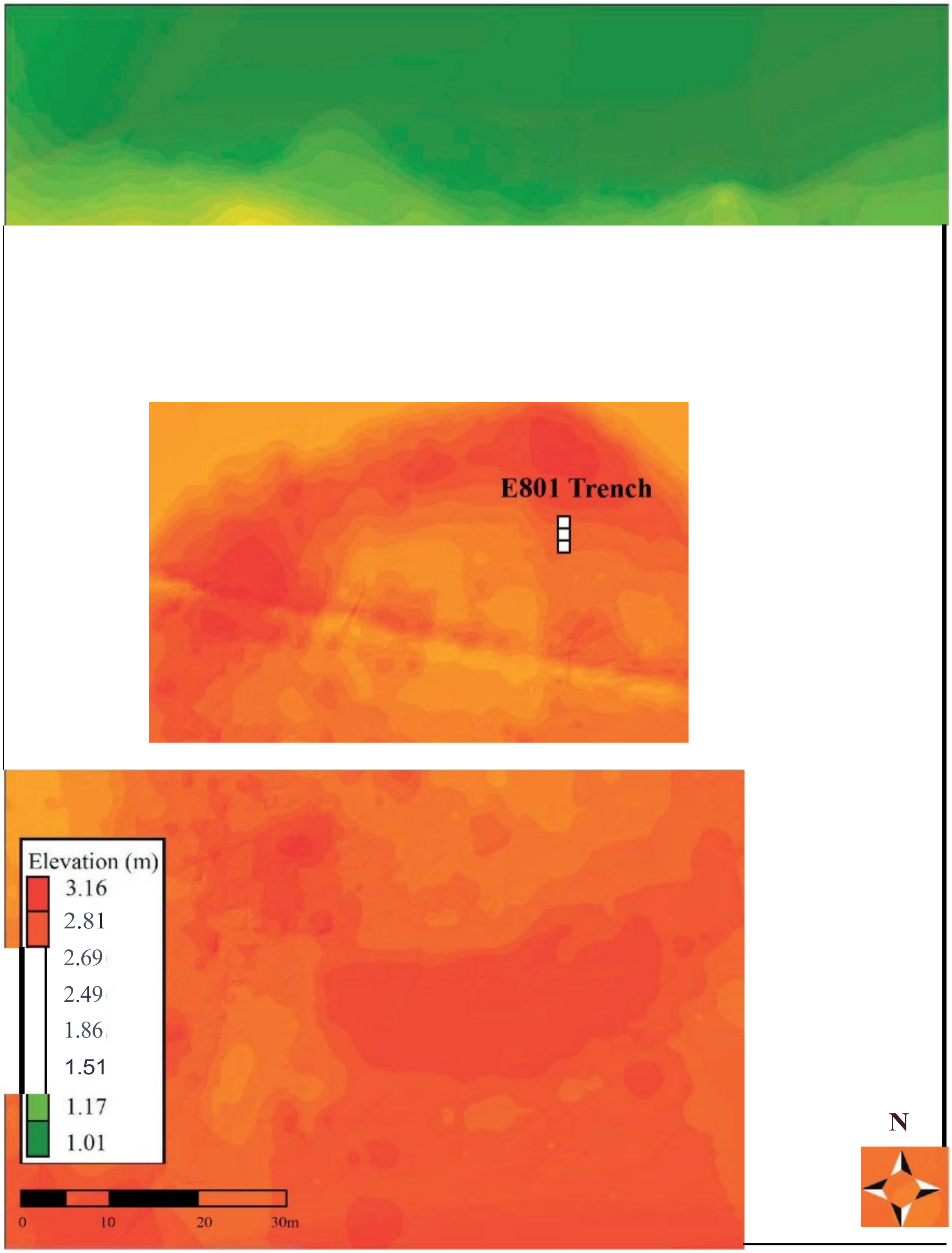

Figure 2. Topographic map of St. Catherines Shell Ring with the location of the E801 Trench used for the cross-mend study (Figure after Sanger 2015a:Figure 3.4).

a maximum of 27 vessels. A minimum number of vessels cannot be calculated using the cross-mend data. Without unique sherd characteristics that relate a particular sherd with a specific vessel, it is technically possible that all the sherds in the sample belong to the same vessel.

Horizontal distribution. Most of the cross-mends were between sherds recovered from the same 1 m x 1 m unit Only cross-mends 26 and 27 contained sherds from more than one unit. The majority (*n* = 45) of the cross-mended sherds were from the southern unit, N782 E801. This is not surprising as this unit was

Table 1. Summary Cross-mend Results at St. Catherines Shell Ring and Sapelo Island Shell Ring Complex.

St. Cathf!f'ines Cross-mend Results:
563 total sherds
331 used in cross-mend analysis
67 individual sherds that mend to another
Cross-mends consisted of between 2-9 individual sherds
27 cross-mends spanning 1-5 10 cm levels
2 cross-mends from different (adjacent) units
Sape/o Island Shell Ring Complex Cross-mend Results:
Direct aoss-mends:
148 used in cross-mend analysis
43 individual sherds that mend to another
17 cross-mended sherds spanning 1-2 10 cm levels
Cross-mends consisted of between 2-4 individual sherds
2 cross-mends from different (adjacent) units
5 mapped cross-mends spanning 1 cm-30 cm in cakulated distance
Possible aoss-mends (No direct mend):
16 possible cross-mends spanning 1-2 10 cm levels
5 possible cross-mends from different quadrants
4 mapped possible cross-mends spanning 1-81 cm in cakulated distance

where most of the sherds were recovered. These are listed as cross-mends 1-17 in Table 2. The center unit, N783 E801, contained four sherds that were mended, representing a maximum of two vessels. These are cross-mends **18** and 19. N784 E801, the northern unit, contained 13 mended sherds that represented a maximum of six vessels. These are cross-mends 20-25.

Vertical distribution. Most *(n* = 16) cross-mends contained sherds that were recovered from the same 10 cm level. Cross-mend 26 was composed of three sherds from a single 11.5 cm level. Cross-mends 22 and 27 contained sherds from a wall scrape and thus did not have a secure depth. The remaining eight cross-mends contained sherds from different levels. The greatest difference in depth between levels that contained cross-mends was 51 cm, in cross-mend 23. Sherds from cross-mends 1 and 21 spanned 40 and 41 cm in depth, respectively (Figure 4). Two cross-mends, 18 and 19, spanned 25-30 cm in depth. The three remaining instances, cross-mends 8, 10, and 15, spanned only two 10 cm levels (Figure 5).

Sapelo Shell Ring II cross-mend results

Similar to the results from St. Catherines, most of the cross-mends from Sapelo Shell Ring II were from the same level and same 1 x 1 m quadrant within the 2 x 2 m unit (Table 3). Forty-three of 148 sherds were cross-mended, accounting for a maximum of 17 ceramic vessels.

Horizontal distribution. Only cross-mend 14 (Table 3) spanned more than one 1 x **1** m unit quadrant. The remaining cross-mends contained sherds that were located within the same **1** x 1 m unit quadrant. Cross-mends were well distributed across the 2 x 2 m unit: five cross-mends from the southeast quadrant. five from the southwest quadrant, three from the northeast quadrant. and two from the northwest quadrant.

Vertical distribution. All but one cross-mend (cross-mend **11,** Table 3) were composed of sherds from within the same 10 cm level (Figure 5). Cross-mend 11 consisted of two sherds, one of which was collected from 40-50 cmbd and the other mapped at 34 cmbd Therefore, these sherds were separated by a possible depth ranging only between 6-16 cm. Sherds with similarities in curvature, oxidation, width, and surface appearance were documented, but not considered as definitive evidence of belonging to the same vessel or depositional event However, when we consider this probable cross-mend data set. the pattern is similar in that there are significantly more cross-mends from within the same 10 cm level (Figure 5).

Discussion

The low number of cross-mends with sherds from different units (Table 2) suggests that people discarded sherds within a limited horizontal area and significant postdepositional movement did not occur. This also suggests periodic and limited deposition of shell ring construction material. However, this interpretation should be used with caution. Because most sherds used in this analysis were from general unit-level contexts, there was low horizontal control of artifacts. Individual sherds from adjacent 1 m x 1 m units can be anywhere from 1 cm in distance (if located at the unit boundary) to 2 m in distance from one another (if located in opposite unit corners).

Vertical control is more precise as units at both sites were excavated in 10 cm levels. Most cross-mends were from sherds recovered from the same 10 cm level. The small depth difference of cross-mended sherds indicate that discarded sherds were deposited relatively close to one another. This can be further extrapolated to suggest that the surrounding matrix of the deposit accumulated periodically and gradually. Again, however, this interpretation should be used with caution. It is uncertain whether sherds were broken prior to deposition. It is likely that some sherds broke postdepositionally or during excavation and recovery, which would easily explain why they were recovered from the same level. The freshness of the break between cross-mends was usually noted, but not considered as definitive evidence of postdepositional breakage in this study. Only three of the cross-mended sherds were noted as possibly being a recent break.

Based on the generally small vertical distance between sherds that were cross-mended, there was likely not much postdepositional disturbance. According to

Table 2. St. Catherines Shell Ring Ceramic Cross-mend Data Table.

Cross- mend number	Catalog number	Unit	Elevation	Coordinates	Layer	Difference between levels (cm)
	28.4/5422	N782 E801	2.33-2.23		S7 or SB	41
	28.4/5605	N782 E801	2.525-2.43	N75 W50 D144.75-146	S7	
	28.4/5671	N782 E801	2.525-2.43	S7		
	28.4/5690	N782 E801	2.64-2.525	S7		
	28.4/5699	N782 E801	2.64-2.525	S7		
	28.4/5701	N782 E801	2.64-2.525	S7		
	28.4/5713	N782 E801	2.64-2.525	S7		
	28.4/5793	N782 E801	2.525-2.43	N76.5 W50.5 D145-145.5	S7	
	28.4/5847	N782 E801	2.43-2.33		S7	
2	28.4/5424	N782 E801	2.33-2.23		SB, S17, or S18	Same level
	28.4/5426	N782 E801	2.33-2.23		SB, S17, or S18	
3	28.4/5469	N782 E801	213-2.13		SB, S17, or S18	Same level
	28.4/5496	N782 E801	213-2.13		SB, S17, or S18	
4	28.4/5490	N782 E801	213-2.13		SB, S17, or S18	Same level
	28.4/5493	N782 E801	213-2.13		SB, S17, or S18	
5	28.4/5562	N782 E801	2.13-2.03		SB or S18	Same level
	28.4/5581	N782 E801	2.13-2.03		SB or S18	
6	28.4/5567	N782 E801	2.13-2.03		SB or S18	Same level
	28.4/5573	N782 E801	2.13-2.03		SB or S18	
7	28.4/5603	N782 E801	213-2.13	N54 W93 D168-170.5	SB	Same level
	28.4/5869	N782 E801	213-2.13		SB, S17, or S18	
8	28.4/5640	N782 E801	2.525-2.43	S7	19.5	
	28.4/5828	N782 E801	2.43-2.33		S7	
9	28.4/5692	N782 E801	2.64-2.525	S7	Same level	
	28.4/5694	N782 E801	2.64-2.525	S7		
	28.4/5722	N782 E801	2.64-2.525	S7		
10	28.4/5697	N782 E801	2.64-2.525	S7	21.5	
	28.4/5798	N782 E801	2.74-2.64		S1 or S7	
	28.4/5807	N782 E801	2.74-2.64		SI or S7	
11	28.4/5737	N782 E801	1.93-1.83		S13, S18, or S9	Same level
	28.4/5770	N782 E801	1.93-1.83		S13, S18, or S9	
	28.4/5778	N782 E801	1.93-1.83		S13, S18, or S9	
12	28.4/5739	N782 E801	1.93-1.83		S13, S18, or S9	Same level
	28.4/5768	N782 E801	1.93-1.83		S13, S18, or S9	
	28.4/5771	N782 E801	1.93-1.83		S13, S18, or S9	
13	28.4/5769	N782 E801	1.93-1.83		S13, S18, or S9	Same level
	28.4/5774	N782 E801	1.93-1.83		S13, S18, or S9	
14	28.4/5773	N782 E801	1.93-1.83		S13, S18, or S9	Same level
	28.4/5783	N782 E801	1.93-1.83		S13, S18, or S9	
15	28.4/5820	N782 E801	2.43-2.33		S7	20
	28.4/5421	N782 E801	2.33-2.23		S7 or SB	
16	28.4/5822	N782 E801	2.43-2.33		S7	Same level
	28.4/5853	N782 E801	2.43-2.33		S7	
17	28.4/5836	N782 E801	2.43-2.33		S7	Same level
	28.4/5849	N782 E801	2.43-2.33		S7	
18	28.4/6220	N783 E801 C2	2.65-2.61	N49 W28 D80-81.5	S7	26.3
	28.4/6376	N783 E801 C1	2.873-2.77	S1		
19	28.4/6427	N783 E801 C2	2.5-2.46	N32 W40 D93.5-96	S7, SB, SI 7, or S6B	29
	28.4/6493	N783 E801 C3	2.75-2.67		SI or S7	
20	28.4/6080	N784 E801	2.73-2.63		S7, S15, or S16	Same level
	28.4/6087	N784 E801	2.73-2.63		S7, S15, or S16	
21	28.4/6086	N784 E801	2.73-2.63		S7, S15, or S16	40
	28.4/6113	N784 E801	3.03-2.93		S1	
22	28.4/6095	N784 E801	2.52-2.43	N2.5 W62.5 D144-144.5	S16 or S6B	N/A
	28.4/6120	N784 E801	2.73-2.43	WALL CLEAN	S7, S15, S16, or S6B	
	28.4/6122	N784 E801	2.73-2.43	WALL CLEAN	S7, SI 5, SI 6, or S6B	
23	28.4/6103	N784 E801	3.03-2.93		S1	51
	28.4/6128	N784 E801	2.63-2.52	N41 WO D136.5-139.5	S16 or S6B	
24	28.4/6104	N784 E801	3.03-2.93		S1	Same level
	28.4/6107	N784 E801	3.03-2.93		S1	
25	28.4/6173	N784 E801	2.93-2.83		SI or S15	Same level
	28.4/6174	N784 E801	2.93-2.83		SI or S15	
26	28.4/5401	N782 E801	2.43-2.33	N98 W23 D154-155	S7	11.5
	28.4/5429	N782 E801	2.43-2.33	N96 W29 D145-151	S7	
	28.4/6339	N783 E801 C3	2.44-2.325	S7, SB, SI 7, or S6B		
27	28.4/5628	N782 E801	2.96-2.84		S1	N/A
	28.4/6441	N783 E801 C2		WALL CLEAN		

excavators' notes, there was no evidence of significant bioturbation. There was also no evidence of downslope movement by colluvial processes. The primary shell deposit at St Catherines Shell Ring has an approximate 7-degree angle of slope, which can account for up to a 12 cm difference in depth within a I m unit Because

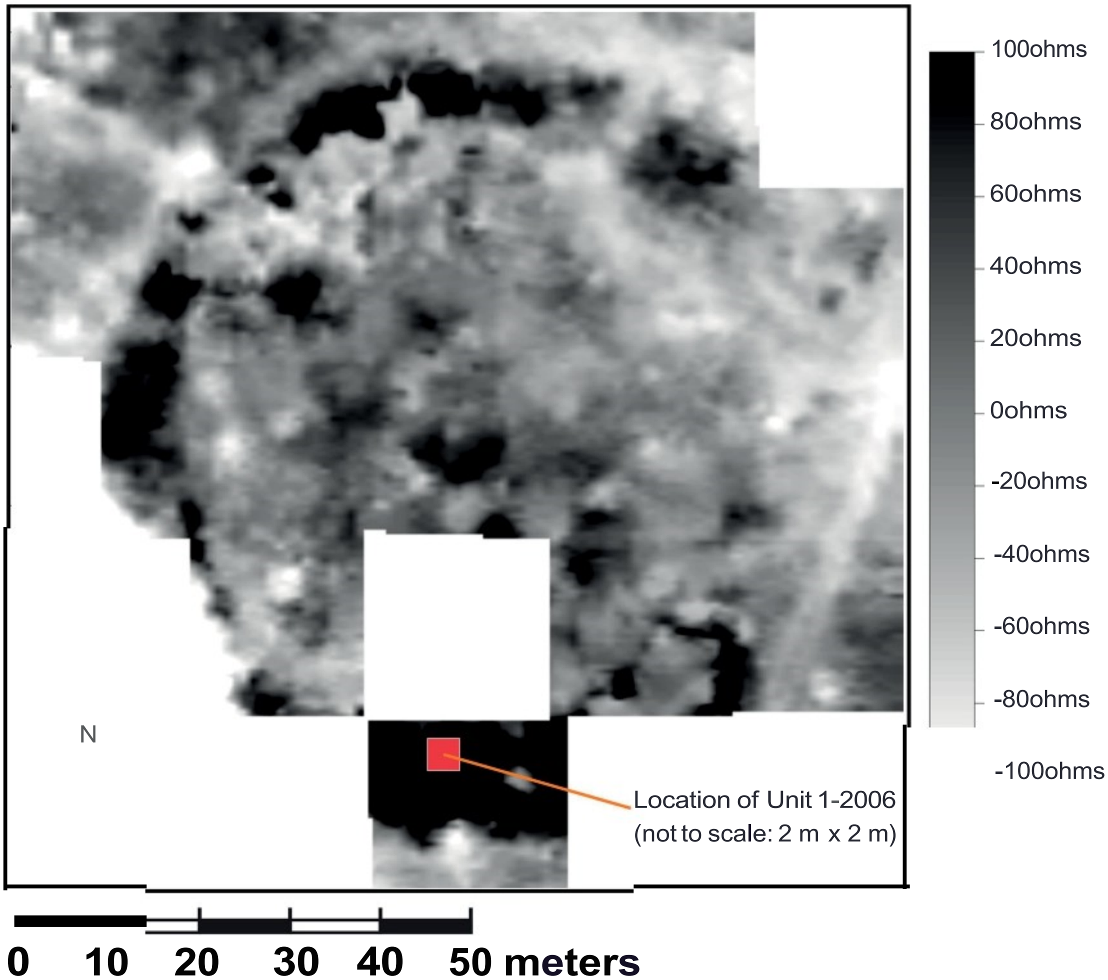

Figure 3. Soil resistance survey of Ring II at the Sapelo Shell Ring complex showing the location of Unit 1-2006 along the southern side of the ring.

Figure 4. Cross-mended sherds from St. Catherines Shell Ring. Photograph on left shows a mend consisting of nine sherds, spanning five 10 cm levels. Photographs courtesy of the American Museum of Natural History.

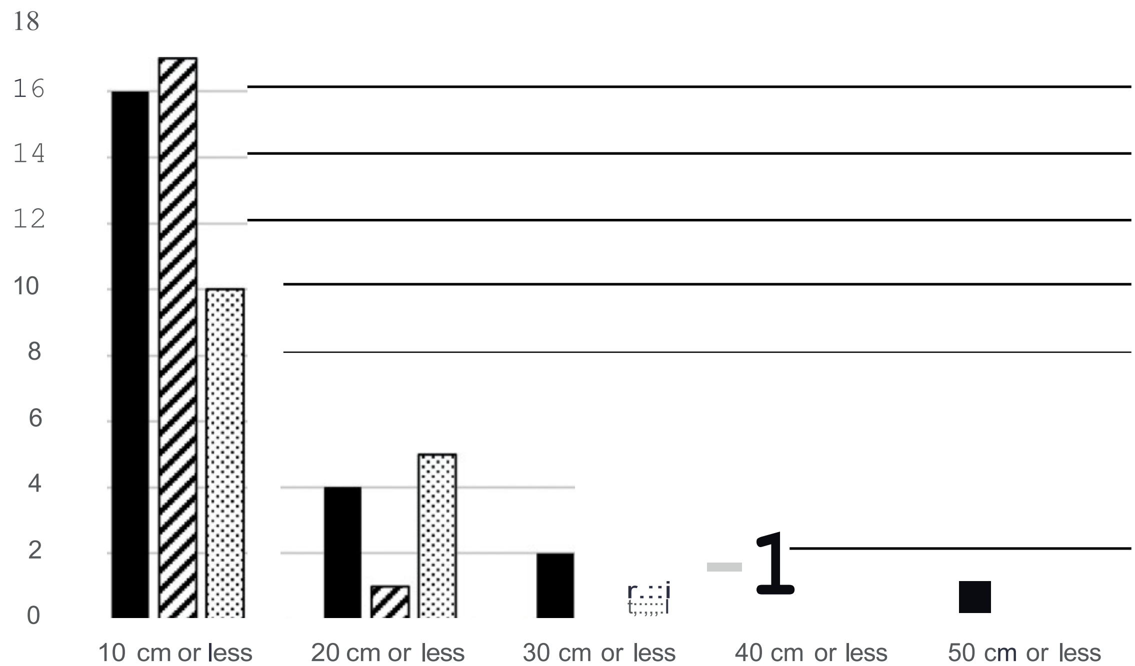

Figure 5. Frequency of cross-mend depth difference at St. Catherines Island Shell Ring (in solid black) and Sapelo Island Shell Ring complex (in diagonal stripes). Possible cross-mends from Sapelo Island Shell Ring complex that do not have direct mends, but are likely from the same vessel, are represented in stipple pattern.

the mapping data suggest that people deposited shell in a relatively contained area rather than strewn across a large area, postdepositional vertical effects due to slope are probably somewhat minimal.

The mapped data, although limited, further support the hypothesis that material was deposited within a relatively small area. Cross-mends 1 and 26 from St. Catherines Shell Ring each contained two mapped sherds. The distance between these mapped cross-mended sherds were 1.6 and 9.07 cm, respectively. This is comparable to mapped cross-mend data from Sapelo Island Shell Ring complex. Five cross-mends were composed of two or more mapped sherds. The calculated distance between sherds from these five cross-mends ranged from 1-30 cm. Although all the sherds from cross-mend 17 were from the same 10 cm level, they spanned a horizontal distance of 30 cm. The remaining cross-mends were usually within about 10 cm (Figure 6).

At the Bead Maker's Midden, cross-mends that were considered strewn, rather than deposited in a single area, had a spatial distribution of less than one and a half meters (Pearson and Cook 2010). Using only the 1 m horizontal designations in this study does not allow for precise differentiation of these depositional practices. In addition to examining more cross-mended material with mapped coordinates, extending the study to include excavation units farther awaywould generate a more accurate representation of deposition across the site. However, the limited mapping data and the dominance of inter-unit cross-mends indicate that sherds were likely not strewn across large areas.

Identifying discrete deposits in shell rings is challenging due to the seemingly homogenous nature of shell deposits. Following excavations, Sanger (2015b) used high-resolution photographs and various image processing programs to digitize excavation profiles and identify individual shell deposits at St. Catherines Shell Ring. Several stratigraphic layers and shell lenses were identified in the E801 trenches (Figures 7 and 8).

Using depth information from excavated sherds, cross-mends were assigned to the natural stratigraphic layers from where they were likely associated. Because most sherds did not have precise mapping coordinates, in a few cases, a sherd may be associated with one of three or four possible stratigraphic layers (Table 2).

The majority of sherds were located in the interior portion of the shell arc, within unit N782 E801, rather than the thick shell deposit (Layer S6b) associated with the large shell mound. This makes sense as shell sediments likely accumulate faster and in greater quantities than the breakage of pots through everyday use, even when shellfish is just being consumed on a daily basis. Such processes would be even further exaggerated if shellfish is being deposited rapidly from feasting events. Therefore, pottery has a lower chance of being included in uniform rates throughout the midden. Other factors, too, may be influencing the distribution

Table 3. Sapelo Island Shell Ring Complex Ring II CeramicCross-mend Data Table.

Cross-mend number	Catalog number	Unit Quadrant	Level	Coordinates	Difference between levels
	9MQ3.2				Same level
	9MQ3.2				
2	9MQ3.23	SE	2		Same level
	9MQ3.23	SE	2		
3	9MQ3.28	SW	3		Same level
	9MQ3.28	SW	3		
4	9MQ3.28	SW	3		Same level
	9MQ3.28	SW	3		
	9MQ3.28	SW	3		
S	9MQ3.29	SE	3	101N IOOW 33cmbd	Same level
	9MQ3.29	SE	3	101N 100W 33cmbd	
6	9MQ3.33	**NW**	4		Same level
	9MQ3.33	**NW**	4		
7	9MQ3.52	NE	S	131N 89W 50-- 57cmbd	Same level
	9MQ3.52	NE	S	131N 89W 50-- 57cmbd	
	9MQ3.52	NE	S	131N 89W 50-- 57cmbd	
8	9MQ3.54	SW	S	75N 122W SScmbd	Same level
	9MQ3.54	SW	S	75N 122W SScmbd	
9	9MQ3.65	SW	7		Same level
	9MQ3.65	SW	7		
10	9MQ3.47	NE	S	125N SSW 53cmbd	Same level
	9MQ3.S0	NE	S	120N 84W 53cmbd	
11	9MQ3.30	SE	3	36N 36W 34cmbd	up to 16 cm
	9MQ3.41	SE	4		
12	9MQ3.20	SE	2	38N 40W 27cmbd	Same level
	9MQ3.23	SE	2		
13	9MQ3.27	SW	3	45N 120W 34cmbd	Same level
	9MQ3.28	SW	3		
14	9MQ3.44	**NW**	S		Same level
	9MQ3.48	NE	S	123N 83W 53cmbd	
	9MQ3.52	NE	S	131N 89W 50-- 57cmbd	
15	9MQ3.45	NE	S	135N BOW 52cmbd	Same level
	9MQ3.46	NE	S	135N BOW 51cmbd	
	9MQ3.SI	NE	S	137N 84W SScmbd	
16	9MQ3.19	SE	2	30N 37W 22.Scmbd	Same level
	9MQ3.21	SE	2	29N 41.SW 24.Scmbd	
	9MQ3.23	SE	2		
	9MQ3.23	SE	2		
17	9MQ3.8	NW	2	118N 186W 32cmbd	Same level
	9MQ3.9	NW	2	137N 19SW 29cmbd	
	9MQ3.11	NW	2	114N 184W 32cmbd	
	9MQ3.12	NW	2	117N 172W 31cmbd	

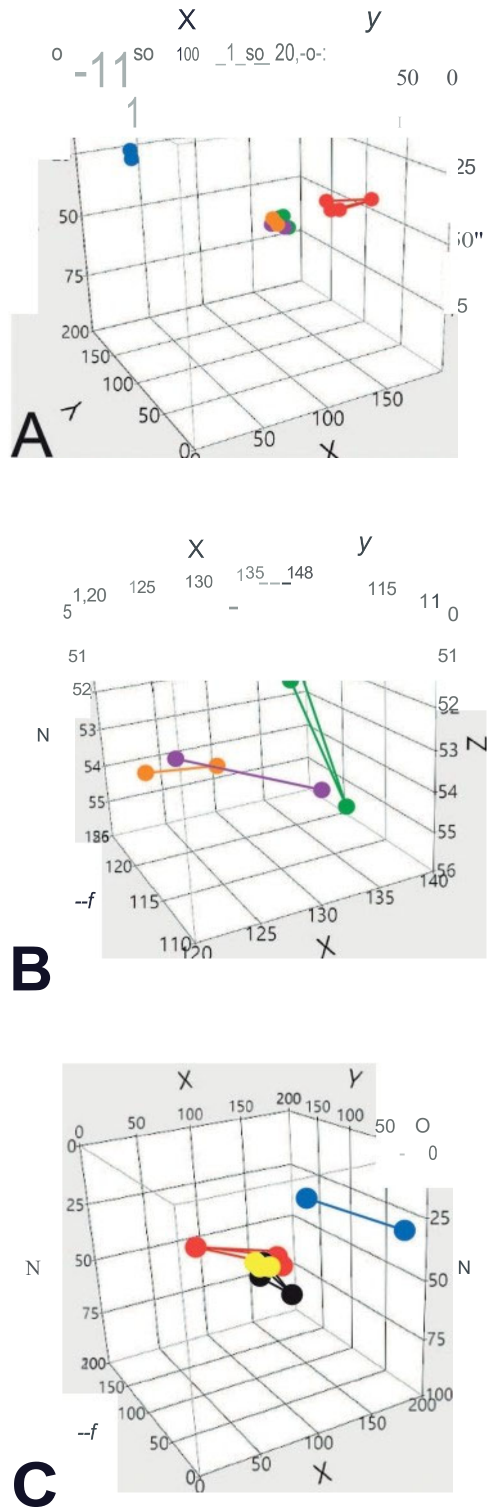

Figure 6. A: Three-dimensional plots of the mapped cross-mends from Sapelo Island. All axes are represented in centimeters. There are five cross-mends plotted in the 2 m x 2 m excavation unit. Each cross-mend is a different color. B: Zoomed in to thethree mendsclustered in thenortheast quadrant of the excavation unit. C: Possible cross-mends. These are sherds that do not directly mend, but have similar attributes and likely belong to the same vessel.

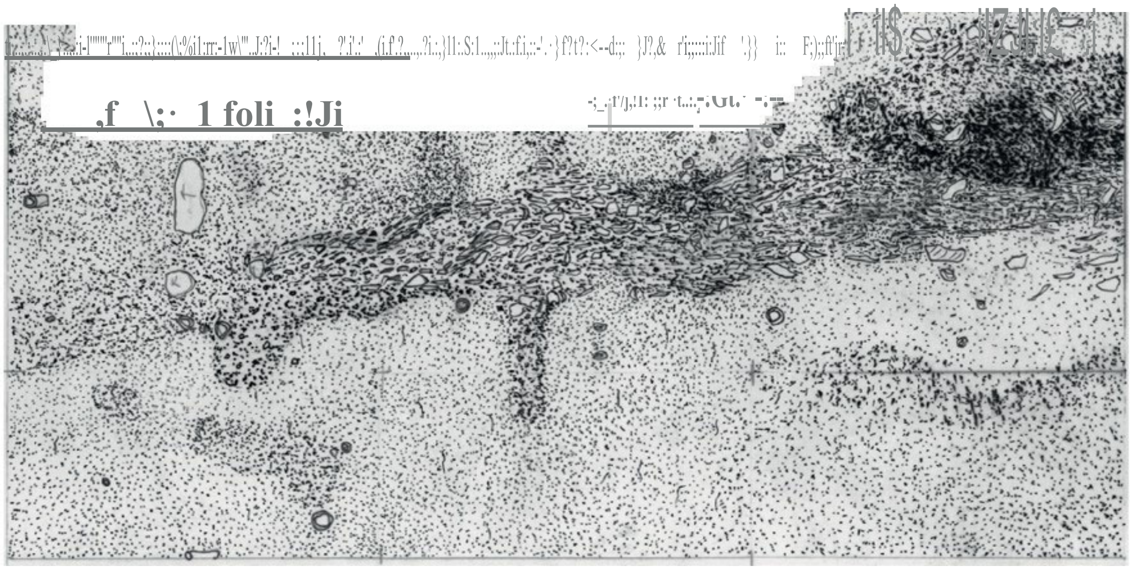

Figure 7. West profile of E801 trench. Drawing by David Hurst Thomas.

of pottery along the ring. For example, the St. Catherines Shell Ring has evidence of periodic plaza cleanings (Sanger 2015a:433}. Perhaps discarded ceramic sherds are more commonly swept from the interior plaza, accumulating near the interior of the shell arc, rather than deposited on the top of the shell deposit. Or perhaps large-scale deaning of the plaza results in deposition of ceramics and anthrosols differentially around the ring, as evidenced by lower elevations of the plaza from the surrounding area (see Thompson 2006, 2018). Further studies of ceramic cross-mends would need to be extended to larger areas of the site to explore these possibilities.

Two of the cross-mends with the greatest difference in depth, cross-mend 23 (51 cm) and cross-mend 21 (40 cm) from St. Catherines Shell Ring, were both from N784 E801. The only two cross-mends from N783 E801 (18 and 19) *also* had a difference in depth greater than 10 cm (26.3 and 29, respectively). These were the only four cross-mends in the assemblage that contained sherds from different stratigraphic layers identified by Sanger (2015a}. It is not dear what would cause these sherds to be in different, overlying, stratigraphic layers from other sherds they mend with. Postdepositional disturbance may account for this. All four cross-mends contained one sherd from the SI layer and another sherd from an underlying shell layer. The SI layer is the modern ground surface, which is covered in grasses, small palmettos, and has root and pig disturbances (Sanger 2015a). Perhaps postdepositional disturbances from pigs and palmetto root activity caused some sherds to migrate into the overlying, modern stratigraphic layer.

The remaining cross-mends from St. Catherines Shell Ring, 23 in total, were all likely from the same stratigraphic layer. For example, cross-mend 1, although spanning 41 cm in depth, contained sherds that were likely all from layer S7, a layer of light brown sand that overlays the primary shell deposit This layer seems to postdate the shell ring but contains many Late Archaic materials (Sanger 2015a). Three cross-mends span approximately 20 cm in depth (cross-mends 8, 10, and 15} but are likely from the same stratigraphic layer, S7. This is evidence that may support the hypothesis that S7, a sandy layer that likely postdates the shell ring, was deposited all at once.

The remaining 18 cross-mends (with the exception of cross-mend 22 and 27, which contained sherds without depth information) all contained sherds from the same excavated 10 cm level and stratigraphic layer. These cross-mends are associated with stratigraphic layers that compose the primary shell ring deposit and may be evidence that these layers were deposited gradually.

These findings strengthen existing interpretations of the formation of the St. Catherines Shell Ring. Archaeological evidence suggests the St. Catherines Shell Ring mayhave been a village occupied during *all* four seasons and that inhabitants likely held periodic ceremonies (Sanger 2015a}. Vertebrate fauna has also been used to explicitly test shell ring formation models (Colaninno 2012a}. Seasonality data from fishes indicate fishing occurred during four seasons and are consistent with

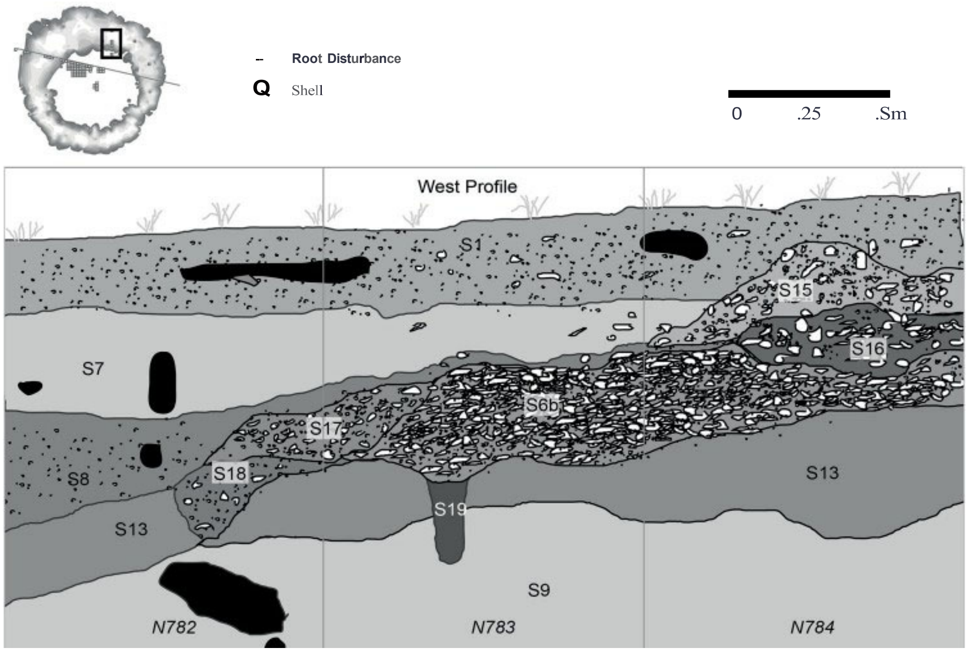

Figure 8. E801 trench stratigraphy (Image from Sanger 201Sa:Figure 3.18).

the gradual accumulation model (Colaninno 2012b; Reitz et al. 2012). Seasonality data from oysters (*Crassostrea virginica)* are also consistent with this interpretation (Cannarozzi 2012), whereas high-resolution sclerochronology of incremental shell growth in hard clams *(Mercenaria mercenaria)* indicate intensive harvests specifically during the winter/spring season (Quitmyer et al. 1997; Quitmyer and Jones 2012). Combined with data from archaeobotanical remains, the multi-proxy seasonality indicators suggest continuous or near-continuous presence of people throughout the year (Sanger et al. 2020).

Similarly, the low dispersion rates at Ring II of the Sapelo Island Shell Ring complex also support prior interpretations. Like St Catherines, Thompson (2006, 2018) interprets the entire complex as being the result of village habitation, also occupied during all four seasons, with some possible ceremonial mounding of feasting debris along different parts of the ring. The area of the ring that was the subject of the cross-mend study also has high-resolution oxygen isotope data from both oysters and clams. Unlike zooarchaeological species identification, which provides season of capture and seasonal animal procurement strategies (Colaninno 2011; Colaninno et al. 2015; Colaninno and Matthew Compton 2018; Reitz et al. 2022), high-resolution isotopic data allow for researchers to assess if singular deposits (e.g., a 10 cm level) evidence collection during multiple or opposing seasons (e.g., summer and winter), possibly suggesting mounding of shellfish, which studies in other areas of the Southeast demonstrate (see Thompson et al. 2015). The results of the isotopic analysis of this portion of the ring do not indicate rapid deposition (see Garland et al. 2022; Thompson and Andrus 2011). In multiple levels there appears to be mollusks collected during opposing seasons of the year, thus indicating more gradual accumulation of the deposits.

Summary

Excavation notes and the lack of significant distances between cross-mends suggest that there is not much evidence for postdepositional movement, either due to bioturbation or downslope movement This may indicate rapid burial of materials before exposure to subaerial postdepositional processes. The cross-mend data from the surface layer at St. Catherines, however, showed some evidence of disturbance from pigs and palmetto roots.

Although horizontal controls are limited in this study, the dominance of cross-mends containing sherds recovered from the same unit indicates that sherds were probably not strewn across large areas, but deposited in discrete areas. This hypothesis is supported by data from the mapped cross-mends. The concentration of sherds in the interior arc at St. Catherines may have further implications for discard practices, perhaps suggesting deposition by plaza cleaning.

Despite limitations, cross-mend data from undecorated body sherds from general unit-level contexts offer insight into the nature of formation processes. Most cross-mends contained sherds from a single 10 cm level, lending support to the interpretation that shell ring deposits likely accumulated gradually through daily activities, with minimal postdepositional disturbances. The locations of cross-mends support the stratigraphic interpretations at St. Catherines Shell Ring by Sanger (2015b) at St. Catherines and the isotopic data from Sapelo Shell Ring complex Ring IL In a single case in our study, there were several cross-mends that spanned a relatively large range of depths. This was in a layer that Sanger (2015a) identified as a more rapid, possible large single event, thus indicating some variation in deposition. However, this is to be expected at villages that also host feasts and ceremonies and some deposits may be more rapidly accumulating as a result of these behaviors (Thompson 2018; Thompson and Andrus 2011). That said, although some areas experienced more rapid deposition, the cross-mend evidence overwhelmingly suggests gradual, periodic deposition at both shell rings, which concatenates with other data sets that researchers have used to assess the nature of depositions at these sites.

Recommendations for future testing include analysis of assemblages with more mapped artifacts. This will more clearly relate these artifacts to the site stratigraphy and provide an accurate measure of the horizontal and vertical distances between cross-mended sherds. Larger assemblages may contain a greater variety of sherd attributes that can be analyzed and incorporated into groups of possible cross-mends based on similarity indices. Additional data about the breakage planes may help to assess whether breaks were relatively recent and possibly postdepositional. Ceramic assemblages from larger excavation areas across the shell ring would be useful in testing hypotheses generated from this relatively small area about the limited horizontal extents of cross-mends. In sum, further cross-mend study may reveal a greater diversity of depositional practices and postdepositional effects.

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Data availability statement

The data generated from this cross-mend analysis are provided within the text and tables. The artifacts studied are curated at the Laboratory of Archaeology at the University of Georgia.

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