Routledge
Taylor & Francis Group

The Journal of Island and Coastal Archaeology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/uica20

Sourcing Mississippian pottery among the complex maritime cultures of Florida's peninsular Gulf coast

Neill J. Wallis, C. Trevor Duke, George M. Luer & Michael D. Glascock

To cite this article: Neill J. Wallis, C. Trevor Duke, George M. Luer & Michael D. Glascock (04 Oct 2023): Sourcing Mississippian pottery among the complex maritime cultures of Florida's peninsular Gulf coast, The Journal of Island and Coastal Archaeology, DOI: 10.1080/15564894.2023.2251911

To link to this article: https://doi.org/10.1080/15564894.2023.2251911

THE JOURNAL OF ISLAND AND COASTAL ARCHAEOLOGY
https://doi.org/10.1080/15564894.2023.2251911

Routledge
Taylor & Francis Group

Sourcing Mississippian pottery among the complex maritime cultures of Florida's peninsular Gulf coast

Neill J. Wallis[a], C. Trevor Duke[b], George M. Luer[c], and Michael D. Glascock[d]

[a]Florida Museum of Natural History, University of Florida, Gainesville, FL, USA; [b]University Museums, University of Alabama, Tuscaloosa, AL, USA; [c]Independent Researcher, Boynton Beach, FL, USA; [d]University of Missouri Research Reactor, University of Missouri, Columbia, MO, USA

ABSTRACT

In eastern North America after ca. AD 1050, the spread of Mississippian cultures sparked widespread transformations to economy, material culture, political structure, and ideology. "Mississippianization" influenced the politically complex maritime polities of Florida's peninsular Gulf coast, but the lack of maize agriculture indicates changes played out differently than among many inland polities. Mississippian-style pottery sherds deposited widely in mounds and in middens at the largest administrative centers are perhaps the clearest evidence of connections to the Mississippian world. We conducted a provenance study using neutron activation analysis of 303 Mississippi Period pottery vessels from 18 sites on Florida's peninsular Gulf coast to investigate how and from where coastal communities acquired Mississippian vessel forms, paste recipes, and iconography. The sample includes numerous Mississippian-related pottery types as well as Pinellas Plain, one of the local utilitarian wares. Four chemical groups are defined, three of which are local to the peninsular Gulf coast and one that is associated with the "Deep South," defined here as the inland Florida panhandle and Chattahoochee River area of southern Georgia. Our results indicate that most Mississippian-style vessels were locally made but used clay sources different from some utilitarian wares such as Pinellas Plain. Using distinctive clays and paste recipes, local production of Mississippian vessels may have been controlled by competing kin-based corporate groups affiliated with each mound center. The widespread low frequency of nonlocal Mississippian sherds from the Deep South shows persistent connections to inland Fort Walton and Rood Phase polities, possibly in relation to training of coastal potters. A greater prevalence of pottery from the Deep South at Shell Creek (8LL8) at the southern edge of the sampling region may reflect a polity with greater success in acquiring prestige goods, perhaps associated with the strong and expansive political power of the Calusa.

ARTICLE HISTORY
Received 9 June 2023;
Accepted 18 August 2023

KEYWORDS
Ceramics; neutron activation analysis; interregional; social interactions; culture contact

CONTACT Neill J. Wallis nwallis@flmnh.ufl.edu Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

Supplemental data for this article can be accessed online at https://doi.org/10.1080/15564894.2023.2251911.

Introduction

Beginning in the eleventh century AD, major transformations swept across the social landscape of midwestern and southeastern North America. Emerging in large part through multicultural encounters of diverse groups of people, the process of "Mississippianization" led to new economies, political structures, material culture, and ideologies. Unlike their forebears, Mississippians typically relied on large scale maize agriculture, had a ranked or stratified form of social organization, exhibited settlement size hierarchies that featured sizable towns containing plazas and elevated earthen platforms for chiefly residences, temples, and mortuary activities, made and used shell tempered pottery, and adopted a new pan-regional suite of important politico-religious symbols (e.g., Anderson 1994; Feathers 2006; Griffin 1967; Knight 2006; Smith 1978). Despite these apparent commonalities, much local variability characterizes Mississippian manifestations, and recent research has been directed toward elucidating the many intersecting histories that resulted in Mississippian transformations, including the contributions of various hinterland communities (e.g., Wilson et al. 2020; Wilson and Sullivan 2017).

Yet there were populations that participated in the Mississippian world still rarely considered by most archaeologists to have been Mississippian societies. Prominent among them are the communities associated with the late pre-contact Safety Harbor and Caloosahatchee archaeological cultures (ca. AD 1000–AD 1725) located on the Gulf coast of west-central and southwest Florida (Figure 1) (Luer 2014; Milanich 1994, 389; Mitchem 1989, 557–67). Safety Harbor and Caloosahatchee sites were home to the ancestors of the colonial era Tocobaga and Calusa, respectively, both of which were politically complex societies with a maritime economic foundation and a distinctively coastal way of life, as opposed to an inland agricultural one (Goggin and Sturtevant 1964; Hann 2003, 104–38; Lewis 1978; Widmer 1988). Rather than maize agriculture, they were sustained by maritime resources, supplemented by wild plant foods and limited horticulture (e.g., Marquardt 2014; Newsom and Scarry 2013). Rather than shell tempered Mississippian pottery, most pottery was tempered with sand, and some was grog (crushed potsherds) or sponge-spicule (silicate remains of sponges) tempered (Cordell 2005a, 2005b, 2005c, 2013; Duke 2022).

Despite these differences, late pre-contact peninsular Florida Gulf coast societies and their descendants were analogous to Mississippians in important ways. They constructed village-mound complexes that included large platform mounds of shell and sand (e.g., Luer and Almy 1981). They had a hierarchical political structure with a tripartite leadership that included a paramount leader, a war captain, and a head priest (Hann 1991). The paramount leader exacted tribute from outlying towns and distant polities (Marquardt et al. 2022). They acquired, made, and used Mississippian iconography of the Southeastern Ceremonial Complex (e.g., Allerton, Luer, and Carr 1984; Luer 2014, 86; Mitchem 2012; Wheeler 1997). While peninsular Florida Gulf coast societies were not "Mississippian" in all respects, their connections and contributions to the Mississippian world often have been overlooked and underestimated.

In this chemical characterization study, we seek to explain peninsular Florida Gulf coast societies' widespread appropriation of Mississippian pottery and its iconography that was tied to the cosmology of floodplain agriculturalists for whom life "in large part

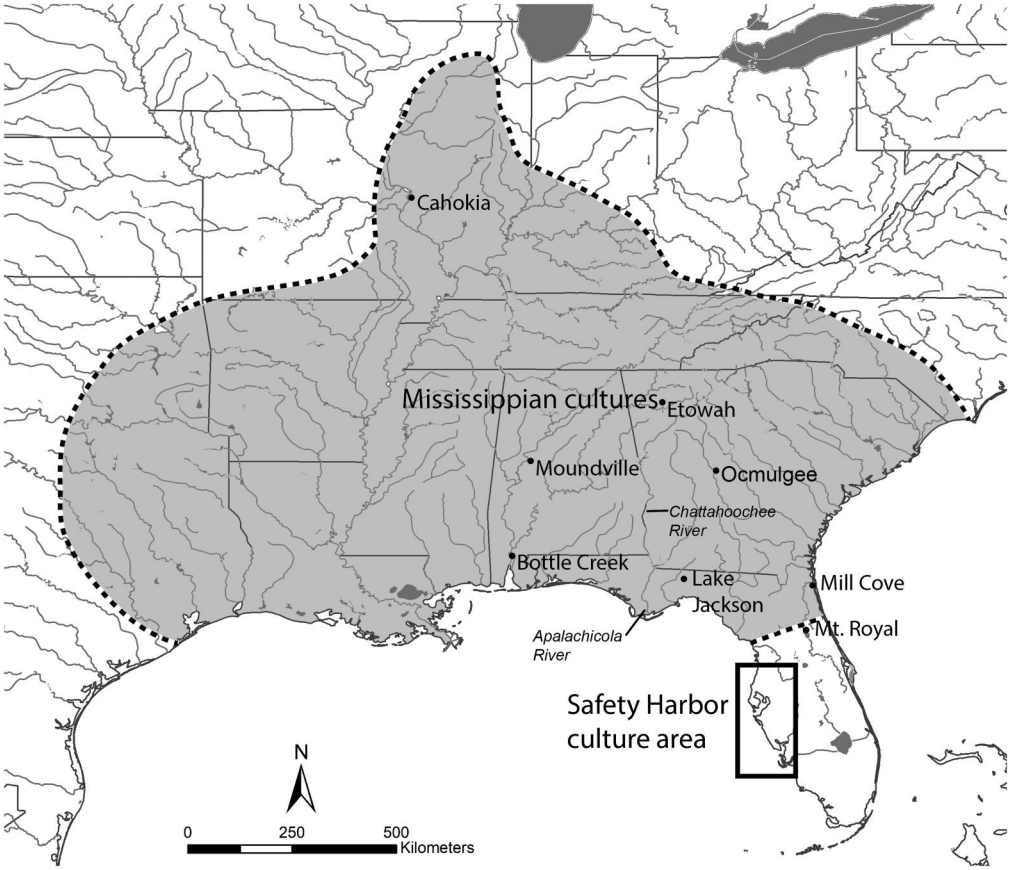

Figure 1. Extent of Mississippian cultures (shaded), the Safety Harbor culture area, and locations of major Mississippian polities mentioned in the text.

was predicated on the symbolic and practical rhythms of the harvest" (Cobb 2022, 386). How and why did coastal fisherfolk incorporate this highly visible and recognizable manifestation of inland Mississippian cultures? Many peninsular Florida Gulf coast pottery assemblages include sherds with Mississippian iconography and vessel forms as minority components, especially within mounds across the region and in both middens and mounds at the largest coastal centers (e.g., Luer 1996, 2002b, 2022). This region represents the southernmost occurrence of Mississippian-related pottery, at its furthest extent nearly 500 km removed from the nearest agricultural Mississippian polity at Lake Jackson (e.g., Griffin 1950; Payne 1994). Many of the vessel forms and their surface treatments at peninsular Florida Gulf coast sites appear so closely related to coeval Middle Mississippi Valley pottery (e.g., Holmes 1903, 80–101) as to suggest some vessels might have derived directly from inland areas to the north and northwest (e.g., Luer 1991, 1992, 2002b).

Through neutron activation analysis (NAA) of 303 pottery samples from 18 sites on Florida's peninsular Gulf coast, we identify the production origins of Mississippi Period sherds and infer how the objects, paste recipes, vessel forms, and iconography were acquired, made, and used. We define four chemical groups, three local to the Gulf coast

("Gulf 1," "Gulf 2," and "Tampa Bay") and one ("Panhandle") associated with the "Deep South" inland Florida panhandle and Chattahoochee River area of southern Georgia. We find that many sites contained a low frequency (approximately 10% or less) of Panhandle chemical group members, showing pervasive contacts between peninsular Gulf coast communities and distant inland Mississippian polities of the Fort Walton culture and Rood phase. A higher frequency (more than 20%) of pottery from the Deep South at Shell Creek, a site on the southern edge of the sampling region, may reflect more success in acquiring exotic prestige goods due to greater regional political power. However, most sherds from Mississippian vessels in our sample were locally made. Mississippian sherds were mostly deposited in mounds and reflect selection of clays and paste recipes distinct from those of local domestic pottery production. This pattern demonstrates local adoption and production of Mississippian iconography in contexts associated with ritual on the peninsular Gulf coast and is consistent with recent interpretations of pottery production for mound ceremonies as closely controlled by competing kin-based corporate groups affiliated with local mound centers (Duke et al. 2023).

Safety Harbor and Caloosahatchee archaeology and the distribution of Mississippian pottery

In Florida, Mississippian agricultural societies were confined to the panhandle and are represented by the Pensacola and Fort Walton archaeological cultures (Milanich 1994, 355–87). Each archaeological culture area contains a preeminent mound center with unmistakable ties to Mississippian polities further north: Bottle Creek to Moundville and Lake Jackson to Etowah (Brown 2003; Jones 1982). Further east, the fisher-hunter-gatherer communities in the St. Johns River area were not Mississippians and relied little on maize, constructed locally distinctive mounds and earthworks, and made connections to the Early Mississippian (ca. AD 1000–1250) world mainly by way of smaller scale groups of foragers with closer proximity to inland polities (Ashley, Wallis, and Glascock 2015). Major St. Johns centers at Mill Cove and Mount Royal garnered exotic raw materials and craft items from inland Mississippians, including from Cahokia in southern Illinois (Ashley 2012; Moore 1894a, 1894b, 1900). These Cahokian items possibly were exchanged with Florida groups for the marine shell, yaupon holly (for black drink), and bird feathers highly valued by interior farming chiefdoms (Ashley 2002, 167; Ashley and Thunen 2022). Mississippian-related artifacts also might have been indispensable for social reproduction and promoting community identity in the context of mortuary and other mound rituals in the St. Johns River area (Ashley and Rolland 2014).

How communities of west-central and southwest Florida were connected to the greater Mississippian world has remained unresolved. Occasional Mississippian-style prestige goods of copper and stone were brought south into the region and are represented most prominently at Tatham Mound on the northern edge of the Safety Harbor culture area (Mitchem 2012; see also Wheeler 1997). But these contacts were not accompanied by changes in subsistence practices (Ashley and White 2012, 15). No archaeological evidence of maize has been documented, including from stable isotope

analysis of human bone (Hutchinson 2004; Hutchinson et al. 1998). The early sixteenth-century de Soto expedition did not encounter maize until after marching inland some 50 km from Uzita on Tampa Bay (Hann 2003, 111; Milanich and Hudson 1993, 128). By all accounts, late pre-Columbian inhabitants of the Florida peninsular Gulf coast continued a long-standing subsistence pattern that was focused on marine and freshwater resources.

Platform mounds may show some Mississippian influence, but they also have clear Middle Woodland (ca. AD 100–600) precedents on the Florida Gulf coast and beyond (e.g., Kassabaum 2021; Pluckhahn and Thompson 2018; Pluckhahn, Jackson, and Rogers 2022). Regardless, the rate of platform mound construction seems to have increased during the Mississippi Period, and around the greater Tampa Bay area this resulted in what may have been the highest density of such structures anywhere in Florida. At least 15 platform mounds of shell, or shell and earth, are recorded near the shores of Tampa Bay, and at least seven more existed across a broader area encompassing nearby Pasco and Sarasota counties. Steep-sided, oblong, or rectangular in plan, and with ramps facilitating access to summits, documented mounds range from 1.5 m to more than 6 m high and include from 650 to 7700 m^3 of estimated volume (Luer and Almy 1981). Ethnohistoric accounts suggest that structures serving as temples or leaders' houses possibly stood atop platform mounds, although supporting archaeological evidence is limited (Griffin and Bullen 1950, 17; Milanich 1994, 397; Milanich and Hudson 1993, 61, 70). Mounds with the broadest summits may also have provided spaces for ceremonies with large numbers of participants (Luer and Almy 1981). Mounds further south around Charlotte Harbor often were of grand scale too, with at least one up to 10 m high, and some with summits reportedly supporting structures that accommodated many people (Marquardt and Walker 2013, 852–4).

At least 66 burial mounds, mostly near Tampa Bay, Sarasota Bay, and to the east and south, are reported in the Florida Master Site File to have contained Safety Harbor pottery sherds. Some of these mounds are components of complexes that include platforms, plazas, and other built features. But most burial mounds are isolated from other built features or villages, a placement that appears particularly common in interior areas away from the shoreline where communities were smaller and more mobile than their coastal counterparts (Luer 2002a; Mitchem 1988).

At some sites the built landscape also included embankments, linear ridges, and causeways of shell, or sand and shell, that connected mounds to one another and to other features (Luer 2014, 85). For example, at Maximo Point, an intricate series of major causeways, up to 2 m high, 20 m wide, and 200 m long were connected to one another and to the platform mound (Moore 1900, 353–4). At Snead Island, a massive platform mound is fringed by shell and sand mounds that enclose a plaza that opens toward the Manatee River. Mounds and middens of other shapes and sizes were also associated with ramps and causeways to facilitate easier access. Even at smaller sites, elevated walkways connected living areas, as at the Old Oak site on Sarasota Bay (Luer 1977).

If each platform mound, or cluster of mounds, was the symbolic center of a polity or corporate group, as has been argued for some southern Mississippian sites (e.g., Blitz and Lorenz 2006; Knight 2016), then around Tampa Bay there may have been more political units in closer proximity to each other than anywhere else in Florida. The

proximity of centers may be consistent with a heterarchical political landscape in which corporate groups strived to control territory and rights to estuarine resources (Pluckhahn, Jackson, and Rogers 2022). Indeed, early Spanish accounts of the Tampa Bay region describe polities with small territories, shifting boundaries, and frequent conflict among them (Hudson 1998, 69–85; Milanich 1998, 72–3; Mitchem 1989, 594).

Whether one or more mound-affiliated communities surrounding Tampa Bay were ever politically dominant is uncertain, but if there were a ranked structure then Snead Island, the largest mound complex, likely would have occupied the apex position on the south side of Tampa Bay. The Safety Harbor site likely had an apex position on the northwest side of Tampa Bay. Perhaps the Fort Brooke site at the mouth of the Hillsborough River and/or Mill Point at the mouth of the Alafia had an apex position on the northeast side of Tampa Bay. At the southern edge of our study area, the situation among the Calusa and their predecessors was definitively hierarchical, with large scale food harvesting, leaders enjoying preferential access to goods, and a political capital at Mound Key that was able at some times to extend influence across much of southern Florida (e.g., Goggin and Sturtevant 1964; Marquardt et al. 2022).

Safety Harbor pottery

Perhaps the most convincing evidence of Mississippian connections at sites on the Gulf coast of peninsular Florida is pottery that recalls Mississippian surface treatments, vessel forms, and themes. These are minority wares in the overall assemblages, which are dominated by sand tempered plain and, depending on the locality, Pasco Plain, Belle Glade Plain, and Pinellas Plain (Mitchem 1989; Sears 1958). Certain minority Safety Harbor pottery types have long been noted to be related to those of the Mississippian Southeast (Schnell, Knight, and Schnell 1981, 159–71; Stirling 1936, 354; Willey 1949, 475–88; Willey and Woodbury 1942, 245), and are found in numerous burial mounds, and occasionally in other contexts, from the Withlacoochee River to the northwestern Everglades. In burial mounds, most vessels are represented by fragmentary sherds that were deposited in various parts of the mounds not associated with individual graves (e.g., Hutchinson 2006, tables 4.2, 4.5, 4.9; Willey 1949, 471, 478).

The earliest Mississippian pottery on the peninsular Gulf coast includes Englewood Incised, Sarasota Incised, Lemon Bay Incised, and St. Petersburg Incised, the latter two with Late Woodland Weeden Island affinities, and constitute parts of Willey's (1949, 131–5) Englewood ceramic complex. These types occur mostly in burial mounds and are presumed to occur as early as AD 900 (Austin, Mitchem, and Weisman 2014). Other Mississippian-influenced types are directly dated to as early as ca. AD 1100 and as late as ca. AD 1400, as demonstrated by AMS assays on soot taken from the rims of several vessels (Table 1).

Luer (1996, 2002b, 2014, 2022; Luer and Almy 1987) has documented the distribution of Mississippian vessel fragments at mounds on the peninsular Gulf coast. At most sites, these sherds are found in small numbers compared to associated local plain wares (Luer 1991, 70; Luer and Almy 1987, 315; Mitchem et al. 1985, 200). Sand mounds at a few of the largest coastal centers, such as Tierra Verde near St. Petersburg and Shell Creek near Fort Myers, contain the greatest numbers of Mississippian-related pottery sherds

Table 1. New AMS assays from soot on Mississippian-related vessels in the Safety Harbor culture area.

Sample ID	Site no.	Site name	Pottery type	Radiocarbon age	Error	12/13 ratio	Calibrated date (2σ)
Beta-523498	8HI3	Picnic Mound	Safety Harbor Incised	590	30	−25.4	AD 1302–1412
Beta-524813	8LL8	Shell Creek	Lake Jackson Plain	800	30	−21.9	AD 1180–1279
Beta-524812	8LL8	Shell Creek	Fort Walton Incised	570	30	−23.9	AD 1306–1424
Beta-524814	8MA31	Pillsbury	St. Johns Check Stamped	910	30	−24.2	AD 1040–1214
Beta-528370	8PI51	Tierra Verde	Cool Branch Incised	600	30	−24.4	AD 1301–1408
Beta-523497	8PI51	Tierra Verde	Lake Jackson Plain	900	30	−22.5	AD 1042–1219
Beta-523496	8PI51	Tierra Verde	Lake Jackson Plain	870	30	−23.7	AD 1047–1261

(estimated in the low hundreds), and thereby may associate authority and power with possession of these objects. Luer (2002a) proposed a tiered model of prestige goods exchange, whereby the most powerful chiefs obtained Mississippian vessels from afar or through sponsored local production and then exchanged them with lesser chiefs in smaller quantities.

Florida-specific Safety Harbor pottery type names tend to obscure similarities with Mississippian types. Vessel forms and surface treatments in some cases are analogous to counterparts further north, but with different tempers. Lake Jackson Plain and Lake Jackson Incised sherds are mostly from short-collared jars or bowls with loop handles or lugs on the rim (Luer 2022) and are grog or sand tempered versions of the classic shell tempered Mississippian vessels used for preparing hominy, a staple food of boiled maize (Briggs 2016). Likewise, the type Cool Branch Incised is essentially a sand, grit, or grog tempered version of shell tempered Moundville Incised (White, Du Vernay, and Yuellig 2012, 237–8). Sarasota Incised beakers and bottles are equivalent to Andrews Decorated beakers and Safety Harbor Incised bottles are equivalent to Nunnally Incised bottles from the Chattahoochee River area (Luer 2002b, 157–8). Furthermore, Mississippian-style effigies are recorded at many sites, including Sarasota Bay Mound (human; Luer 2005, 28), Parrish Mound 2 (owl; Stirling 1935, 380; Willey 1949, 149), Picnic Mound (frog; Bullen 1952, 67), Shell Creek (human), and Aqui Esta (human or other mammal; Luer 2002b, 129). Point Washington Incised sherds often come from open bowls with bird head and tail adornos (Luer 2014; Willey 1949, 463) and are equivalent to the Mississippi Valley type Mound Place Incised (Phillips 1970, 135–6), and broadly similar to many others across the Mississippian Southeast such as Moundville Engraved bird effigy bowls (e.g., Brown 2004, 583). Still other Safety Harbor types (or the idea for them) apparently came directly from the Florida panhandle, such as Fort Walton Incised.

The common occurrence of grog temper in Mississippian-related pottery on the peninsular Gulf coast is unlike the composition of most midden assemblages, which are dominated by plain sherds with sand temper. Prominent among the latter is Pinellas Plain, a type that occurs first around AD 900 and becomes pervasive by AD 1200 (Austin, Mitchem, and Weisman 2014). Pinellas Plain occurs mostly in open bowl forms and the paste contains frequent ferric and phosphatic nodules and exhibits a distinctive laminated or contorted character in cross-section. Some vessel forms and cross-sections suggest mold-made vessels that could have been produced by a wide swath of the population, including novices (Duke 2022; contra Sears 1958, 3), unlike coil-made Mississippian-related vessels that require more skill to make. The near exclusive

association of grog with Mississippian-related pottery from mounds is suggestive of a local ritual technology (Duke et al. 2023). Because grog tempering was common in some southern parts of the Mississippian world, like in the Chattahoochee River Valley, Tallahassee Red Hills, and Lower Mississippi Valley (e.g., Blitz and Lorenz 2006; Livingood 2010; Scarry 2007), some grog tempered vessels might also have been made in inland Mississippian communities and delivered to Safety Harbor sites through exchange.

The production origins of Mississippian-related vessels on the Florida peninsular Gulf coast have been the focus of empirical study only recently. Using a combination of NAA, Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS), and petrographic analysis of pottery assemblages from seven sites, 94 samples of which were from Mississippi Period contexts, Duke et al. (2023) found that most Safety Harbor pottery was locally made at all investigated locations. Moreover, stark compositional differences were observed between the Mississippian-related assemblages from mounds and coeval midden pottery (i.e., Pinellas Plain). Not only were different tempers used—sand for midden pottery and grog for mound pottery—but also mound pottery grog particles often incorporated the fragments of micaceous nonlocal and possibly heirloomed Late Woodland (ca. AD 600–1000) vessels. In addition, they found that the clay sources used for production of mound versus Pinellas Plain midden pottery were different. These results suggested that Safety Harbor potters "increasingly invested in securing clay resources and the esoteric knowledge behind ritual practice" and probably controlled access through kin-based corporate group membership (Duke et al. 2023, 12).

An emphasis on local production of ceremonial pottery assemblages was a significant departure from that of preceding Late Woodland Weeden Island pottery (ca. AD 600–1000) in which vessels were often made in locations hundreds of kilometers from their places of final deposition. In some mounds, the majority of analyzed Late Woodland decorated sherds were from nonlocally made vessels (Duke et al. 2023; Wallis et al. 2017; Wallis, Pluckhahn, and Glascock 2016). Duke (2022) also collected metric measures of consistency, evenness, and symmetry of vessel form and surface treatment corresponding with potting skill. Based on the premise that bodily habits acquired through many years of experience are revealed in the work of skilled potters, even among vessels that were expediently made (see Budden and Sofaer 2009; Sofaer and Budden 2013), Duke (2022) demonstrated that while Late Woodland Weeden Island vessels were mostly crafted by highly skilled potters, Safety Harbor potters were significantly less skilled on average and exhibited a wider range of skill levels. A similar organization of ritual vessel production may have been present in the Mississippian Deep South as well, such as at Cemochechobee on the Chattahoochee River, where products of less-skilled potters also were documented (Schnell, Knight, and Schnell 1981). Taken together, results support the idea that much Mississippian-style pottery was produced on the peninsular Gulf coast by local members of kin-based corporate groups rather than by a dispersed network of specialists centered in the Deep South, as seems to have been the case for earlier Weeden Island pottery.

Here we use NAA of a much-expanded sample of Mississippian-related pottery vessels to further investigate how peninsular Florida coastal communities acquired and made Mississippian objects and iconography.

Materials and methods

Sampling

We sampled 303 Mississippi Period pottery sherds from 18 sites within the Safety Harbor culture area across a linear distance of approximately 250 km (Figure 2 and Table 2). Each sample was derived from a sherd of a unique vessel, distinguished by vessel form, rim shape, surface treatment, and paste attributes. The samples include representatives of a diverse assortment of Mississippian types, as defined by Willey (1949), Sears (1967), and Luer (2022) (Figure 3). The attributes of form and style of Lake Jackson Plain, Lake Jackson Incised, Fort Walton Incised, Marsh Island Incised, Point Washington Incised, Cool Branch Incised, and Lemon Bay Incised have origins in the Florida Panhandle and Chattahoochee River Valley. In contrast, the attributes of form and style of Englewood Incised, Sarasota Incised, Safety Harbor Incised, and Pinellas Incised are recognized as local to the peninsular Gulf coast region and also have analogs at inland Mississippian sites, as discussed above. We took a conservative approach to type assignation and designated any unrecognized variants of Mississippian types as unidentified incised, unidentified incised and punctated, and unidentified punctated. Other types with known Mississippi Period associations at sites were also included, as was the contemporaneous domestic ware Pinellas Plain. We also included a few samples of Mission Period Jefferson ware (Smith 1951), primarily from Big Mound Key.

Vessel forms were often undetermined due to the small size of sherds. However, most sherds appeared to represent bowls. Pinellas Plain sherds primarily came from (open) unrestricted bowls. Most Lake Jackson and Cool Branch Incised sherds came from collared bowls or jars. Lemon Bay Incised, Point Washington Incised, Fort Walton Incised, and Englewood Incised sherds appeared to be from bowls. Sarasota Incised samples represent beakers and bowls, and at least one St. Petersburg Incised vessel is a fluted funnel. Most Safety Harbor Incised sherds came from bottles. One sample was from a hunchback effigy bottle. No dippers were in our samples.

The strategy for sampling was opportunistic and the number of existing Mississippian-related sherds from each site was small enough that all, or nearly all, were selected for sampling. This unavoidable circumstance resulted in uneven sampling across the three temporal phases of the Safety Harbor Period: Englewood (ca. AD 1000–1200), Pinellas (ca. AD 1200–1500), and Bayview (ca. 1567–1725). The Bayview phase is virtually unrepresented except at Big Mound Key.

The investigated assemblages come from Mississippi Period mounds and associated villages. These sites are conceptually divided into a two-tiered classification scheme, consisting of primary mound centers and villages and secondary mound centers and villages (Table 2). These classifications generally conform to a two-tiered settlement pattern based on the overall size of constructed monuments, the quantity and quality of materials found at the site, and the size of associated villages. Mounds considered part of primary centers include Safety Harbor (8PI2), Tierra Verde (8PI51), and Shell Creek (8LL8). Primary village sites include Safety Harbor (8PI2), Maximo Point (8PI19), Portavant Mound (8MA17; part of Snead Island Complex), and Big Mound Key (8CH10). Among primary mound sites, Tierra Verde and Shell Creek contributed the most Mississippian-related sherds to the sample. Among the primary village sites, Snead

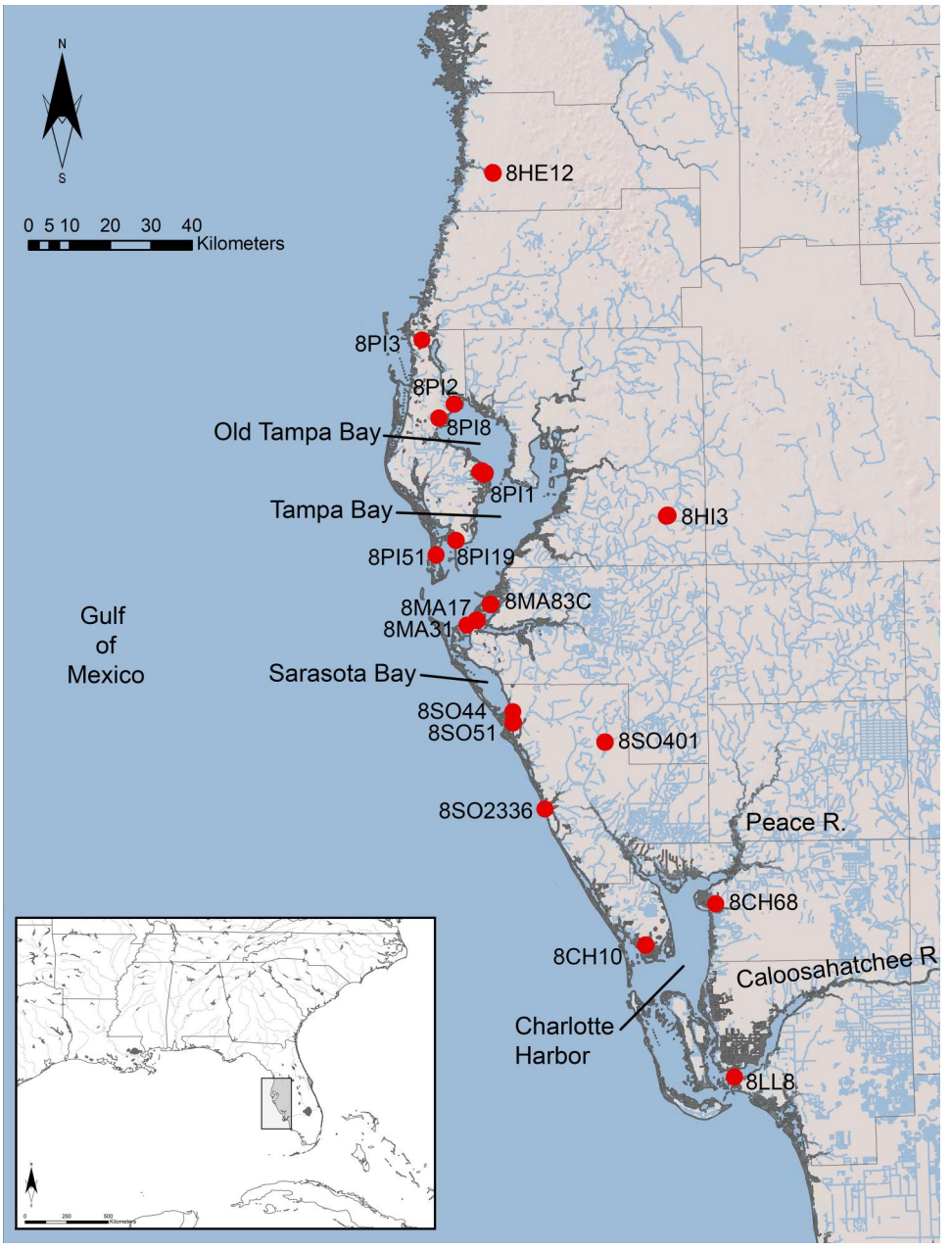

Figure 2. Locations of sample sites.

Island is preeminent, with the highest frequency of Mississippian-related artifacts associated with massive shell monuments.

Mounds that are considered part of secondary centers include Weeki Wachee Mound (8HE12), Weedon Island (8PI1), Safford Mound (8PI3), Picnic Mound (8HI3), Prine Mound (8MA83C), Sarasota Bay Mound (8SO44), Myakka Valley Ranches Mound (8SO401), and Aqui Esta Mound (8CH68). For this study, we also consider Seven Oaks

Table 2. Site and type distribution of NAA samples.

Site no.	Site name	Site type	Lake Jackson Plain	Lake Jackson Incised	Fort Walton Incised	Marsh Island Incised	Point Washington Incised	Cool Branch Incised	Englewood Incised	Sarasota Incised	Safety Harbor Incised	Pinellas Incised	UID Incised	UID Incised and Punctated	UID Punctated	Pinellas Plain	Sand tempered plain	Other	Total
8CH10	Big Mound Key	Primary	1							1	1		3	4		6	1	12[a]	**29**
8CH68	Aqui Esta	Secondary	2		1	1	1			5	4		1				3	2[b]	**20**
8HE12	Weeki Wachee	Secondary			2		3						3						**8**
8HI3	Picnic Mound	Secondary	1		1		2				3	1		4					**12**
8LL8	Shell Creek	Primary	1	3	7			2	2	3	8	1	3	2				6[c]	**38**
8MA17	Portavant Mound	Primary	2	1	3		1							2	1	1			**11**
8MA30	Pillsbury Mound	Secondary							2				1	1					**4**
8MA83C	Prine Mound	Secondary	1	1			1			1				2					**6**
8PI1	Weedon Island	Secondary														1			**1**
8PI19	Maximo Point	Primary														20			**20**
8PI2	Safety Harbor	Primary	1	1	2		2						4	5	1	16	4		**36**
8PI3	Safford Mound	Secondary	5		5	2	1			1	3		1	4	1				**23**
8PI51	Tierra Verde	Primary	9	3	6		4	5	5		19	2	4	1	2				**60**
8PI8	Seven Oaks Mound	Secondary										4	2	4					**10**
8SO2336	Snake Island	Secondary														4			**4**
8SO401	Myakka Valley Ranches	Secondary	5	1						2				1	1		3	2[d]	**15**
8SO44	Sarasota Bay Mound	Secondary	1	1							1							1[e]	**4**
8SO51	Old Oak	Secondary															1	1[f]	**2**
Total			**29**	**11**	**27**	**3**	**15**	**7**	**9**	**13**	**39**	**8**	**22**	**30**	**6**	**48**	**12**	**24**	**303**

[a] Includes: one Glades Tooled, nine Jefferson Ware, one Mission Period Complicated Stamped, and one Leon Check Stamped.
[b] Includes: one Pasco Red and one Pineland Plain.
[c] Includes: one Jefferson Ware, two Lemon Bay Incised, two St. Petersburg Incised, and one Fortune Noded.
[d] Includes: one sand tempered red slipped and one Pineland Plain.
[e] Noded human effigy.
[f] UID cordmarked.

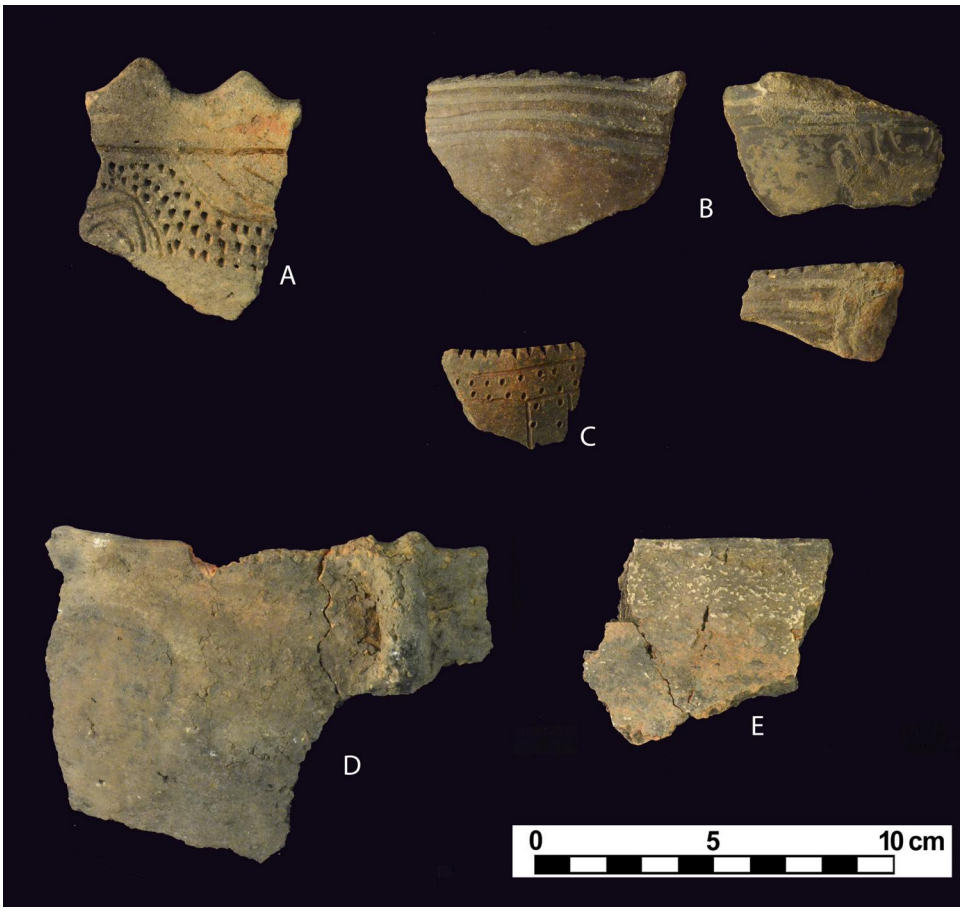

Figure 3. Examples of pottery samples from middens and mounds without burials: (A) Fort Walton Incised (8MA17); (B) Point Washington Incised (8PI2); (C) Englewood Incised (8PI2); (D) Lake Jackson Plain (8CH10); (E) Pinellas Plain (8MA17).

Mound (8PI8) and Pillsbury Burial Mound (8MA30) to be secondary centers, but they did have associations with nearby primary centers, the former with Safety Harbor and the latter with Shaws Point (8MA1233) and Snead Island. Secondary habitation sites include the Old Oak site (8SO51) and Snake Island (8SO2336).

Methods

NAA is an analytical technique used for determining the bulk elemental composition of a sample (Glascock 1992). NAA is based on properties of the nucleus. When nuclei are bombarded with neutrons, a portion of them will become unstable radioactive isotopes. These isotopes decay with characteristic half-lives and emit gamma radiation characteristic of each element. The resulting gamma rays can be measured to determine quantities of each element.

The term "bulk composition" refers to the fact that all constituents of the sample are measured at once during NAA. In the case of pottery, this means that the total

combined composition of clay(s), aplastic inclusions, added temper(s), and elements added or subtracted through post-depositional diagenesis or leaching are measured and cannot be differentiated without complementary analytical methods. While there are many potential sources of chemical variation among pottery samples (e.g., see Neff et al. 2006), prior research in Florida and adjacent areas demonstrates that the geographic location of a clay deposit tends to be most significant (e.g., Ashley, Wallis, and Glascock 2015; Gilmore 2016; Jenkins, Wallis, and Glascock 2023; Wallis et al. 2010, 2015, 2017; Wallis, Pluckhahn, and Glascock 2016). Despite sharing an ultimate origin in the southern Appalachian Mountains, near-surface clayey deposits in this region exhibit variation in chemistry and mineral inclusions "due to differences in the timing, conditions, and mechanisms of deposition, as well as their frequently divergent post-depositional histories" (Wallis et al. 2015, 31).

Samples were first carefully removed from a sherd of each vessel lot in the Florida Museum Ceramic Technology Lab using a rock saw so that vessel form and iconography remained intact wherever possible. The removed portions were then prepared at the University of Missouri Research Reactor (MURR) Archaeometry Laboratory according to their standard procedures, which are described elsewhere (Glascock 1992; Neff 2002).

NAA resulted in quantification of 33 elements; however, three of these elements—nickel (Ni), calcium (Ca), and strontium (Sr)—were removed from consideration prior to statistical analysis and interpretation. Ni was below detection limits for most samples and therefore was not further considered. Ca and Sr showed enrichment in some samples that might have been due to diagenesis related to association with shell midden rather than original pottery fabric constituents (e.g., Wallis 2011, 95–6). Therefore, both Ca and Sr were removed from the statistical analyses and a calcium correction procedure for marine shell was applied to compensate for the diluting effect of calcium enrichment on the other elements (Cogswell, Neff, and Glascock 1998). The remaining 30 elements were converted to base-10 logarithms to compensate for differences in magnitude between major and trace elements. The data were then reduced to principal components (PC) and plotted on PC axes to explore chemical group affinities among samples. Core chemical group members were identified in plots and assigned accordingly, then potential additional members were evaluated by plot coordinates and Mahalanobis Distance (MD). In an iterative process, members were individually added or subtracted from chemical groups according to their individual MDs and the effect of their membership on other member MDs. Finally, using the resulting chemical groups as references, the data were reduced to canonical discriminant functions (CDF) and membership was refined using the same iterative process described above. Chemical group members were defined as having a minimum of 1% probability of group membership and at least twice the membership probability for any other group. Occasionally the concentration of an element was below its detection limit and yielded missing data. In such cases each missing value was substituted with a value that minimized the MD for the specimen from the group centroid (Glascock 1992).

Data from prior NAA of 130 clay samples from across Florida and Georgia (Wallis et al. 2015) and more than 1500 pottery samples from contemporaneous and earlier time periods (e.g., Ashley, Wallis, and Glascock 2015; Duke et al. 2023; Jenkins, Wallis,

and Glascock 2023; Wallis et al. 2010, 2017; Wallis, Pluckhahn, and Glascock 2016) were similarly analyzed and compared for reference.

Results

Chemical groups

The pottery samples are assigned to four chemical groups—Panhandle, Tampa Bay, Gulf 1, and Gulf 2—each of which corresponds to a region of provenance (Table 3, Figures 4 and 5, and Supplementary Table S2).

The Panhandle chemical group is defined by enrichment in potassium (K), scandium (Sc), titanium (Ti), cobalt (Co), rubidium (Rb), and barium (Ba), and by depletion of antimony (Sb). A total of 17 samples is assigned to the Panhandle group, including Fort Walton Incised ($n = 3$), Safety Harbor Incised ($n = 3$), Lemon Bay Incised ($n = 2$), Pinellas Incised ($n = 2$), St. Petersburg Incised ($n = 2$), Lake Jackson Plain ($n = 1$), sand tempered plain ($n = 1$), unidentified punctated and incised ($n = 1$), unidentified incised ("Englewood-like;" $n = 1$), and an incised "hunchback" human effigy bottle much like those found across the Mississippian world (see Luer 2005, 28). Supporting the group's geographic association are three clay samples (NJW357, NJW826, NJW827) from the Apalachicola River in the Florida panhandle with strong probabilities of group membership (Supplementary Table S1) and similar chemical signatures of pottery from earlier time periods in this region (Wallis et al. 2015; Wallis, Pluckhahn, and Glascock 2016).

The Tampa Bay chemical group ($n = 53$) is characterized by enrichment of vanadium (V), zinc (Zn), Rb, Sb, and especially chromium (Cr), and depletion of Co. Notably, the group mean Cr concentration of 437 ± 70 ppm is approximately five times greater than that of the other three groups. More than three-quarters of Tampa Bay group members are Pinellas Plain ($n = 41$), four are sand tempered plain, and the remaining eight include an assortment of other types. All but two Tampa Bay chemical group members from sites outside the vicinity of Tampa Bay are Pinellas Plain. In contrast, a few other

Table 3. NAA group assignments by site.

Site no.	Name	Tampa Bay	Gulf 1	Gulf 2	Panhandle	Unassigned	Total
8HE12	Weeki Watchee Mound	1	6			1	**8**
8PI3	Safford Mound	2	12	1	1	7	**23**
8PI8	Seven Oaks Mound		8	1		1	**10**
8PI2	Safety Harbor	22	1	10		3	**36**
8PI1	Weedon Island					1	**1**
8HI3	Picnic Mound		9		2	1	**12**
8PI19	Maximo Point	18				2	**20**
8PI51	Tierra Verde		51	3	2	4	**60**
8MA83C	Terra Ceia		1	3		2	**6**
8MA17	Portavant Mound			7	1	3	**11**
8MA30	Pillsbury Mound		2			2	**4**
8SO44	Sarasota Bay Mound		3		1		**4**
8SO51	Old Oak			1		1	**2**
8SO401	Myakka Valley Ranches Mound		7	1		7	**15**
8SO2336	Snake Island	3				1	**4**
8CH10	Big Mound Key	7	1	14		7	**29**
8CH68	Aqui Esta		6	8	1	5	**20**
8LL8	Shell Creek		2	18	9	9	**38**
Total		**53**	**109**	**67**	**17**	**57**	**303**

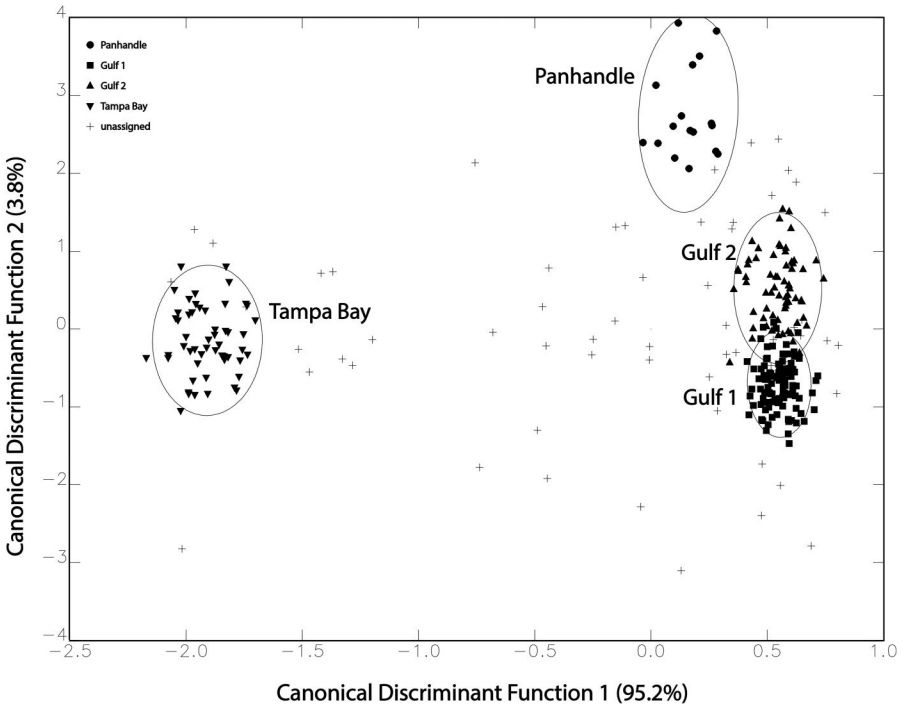

Figure 4. Plot of CDF1 and CDF2 showing compositional group members and unassigned samples. Ellipses represent 90% probability of membership.

types from the Safety Harbor and Safford Mound sites in the northern Tampa Bay area are Tampa Bay chemical group members, including Lake Jackson Plain, Marsh Island Incised, sand tempered plain, UID incised, and UID incised and punctated. While no clay samples analyzed so far by NAA are convincing matches for the Tampa Bay chemical group, two sources from northern Tampa Bay have Cr enrichment approaching the high levels of the local pottery (Figure 6). These correlations are suggestive of a distinctive group of clay resources local to the northern Tampa Bay region.

Gulf 1 ($n = 109$) and Gulf 2 ($n = 67$) are two chemical groups local to the Florida Gulf coast and similar to each other. The northern and southern extents of these groups is unknown, but they are clearly confined to the Gulf coast (Jenkins, Wallis, and Glascock 2023; Wallis, Pluckhahn, and Glascock 2016). Both are enriched in Sb and depleted in K, Cr, and Rb. The groups differ mainly in terms of sodium (Na), with the Gulf 1 group depleted in this element compared to the Gulf 2 group (Figure 7). While not usually a significant element for distinguishing provenance groups, in this case Na enrichment may relate to an association of utilized clays with salt water. Regardless, Gulf 1 and Gulf 2 are considered marginally different variations of a chemical signature "local" to the peninsular Gulf coast. Pottery type is not correlated with Gulf 1 or Gulf 2 membership. All pottery types well represented in the study are present in both groups with the notable exception of Pinellas Plain.

A total of 57 pottery samples (18.8%) remained unassigned following the statistical analysis. These samples mostly exhibit chemical compositions between those of the defined groups but do not form any cohesive group(s) themselves. A high proportion of

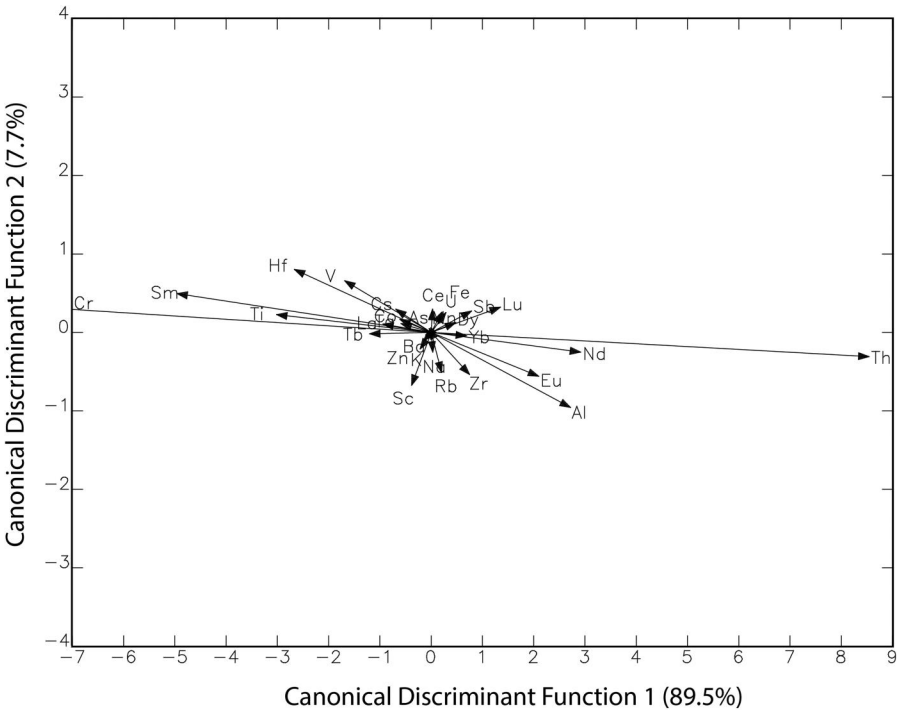

Figure 5. Plot of CDF1 and CDF2 with vectors showing relative influence of each elemental variable.

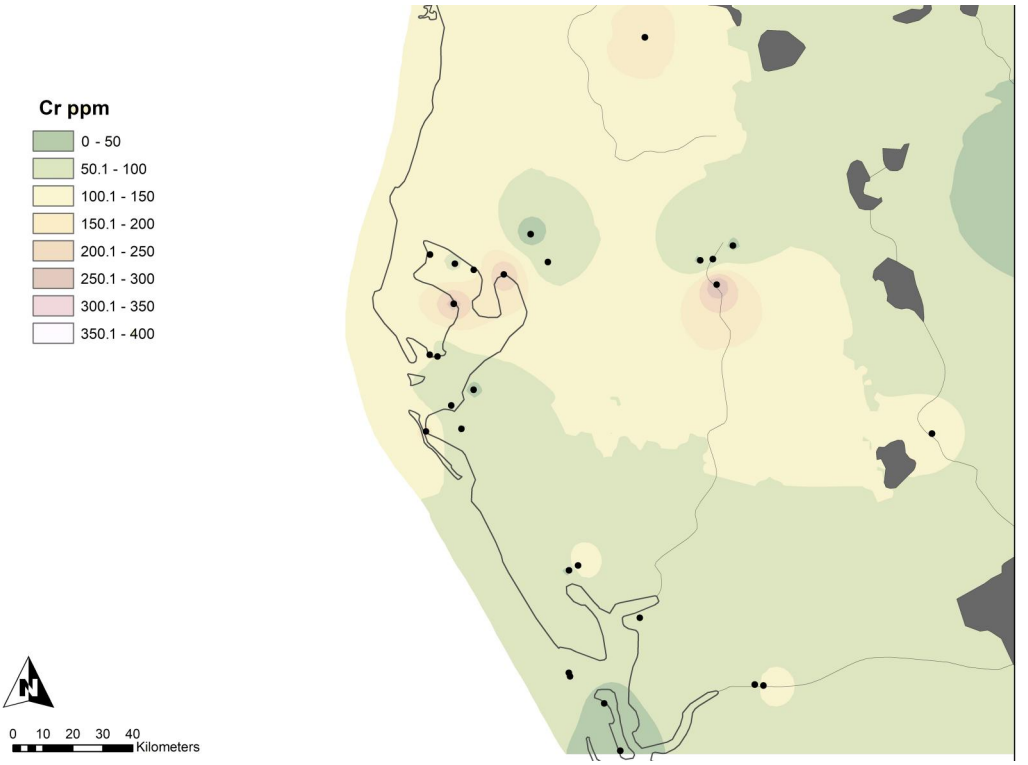

Figure 6. Interpolation of Cr concentration in clay samples in west peninsular Florida.

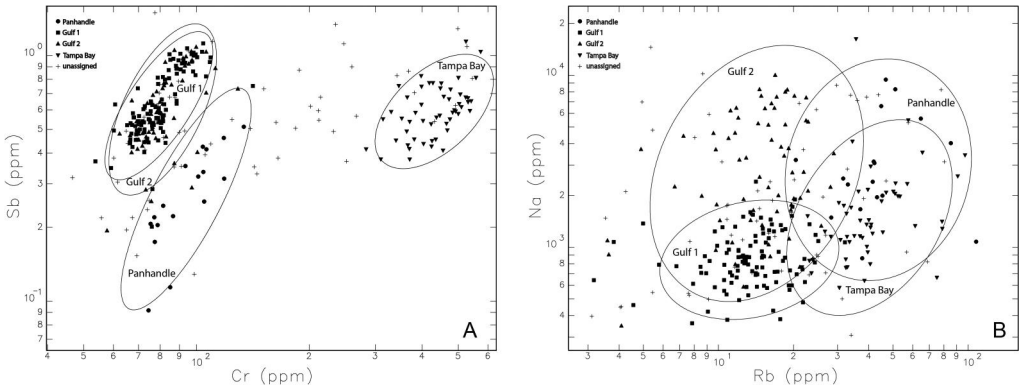

Figure 7. (A) Bivariate plot of Cr and Sb. (B) Bivariate plot of Rb and Na. Both plots are logarithmic scale. Ellipses represent 90% probability of membership.

unassigned samples in a site assemblage, such as that of Myakka Valley Ranches (8SO401), may indicate that multiple clay resources from the site vicinity were utilized but are poorly represented in our current clay and pottery sample.

Site distributions of chemical group members

As noted, pottery samples of the Tampa Bay chemical group are most common in assemblages from northern Tampa Bay sites. The few samples of the Tampa Bay chemical group from sites outside Tampa Bay may have been produced near the northern portions of Tampa Bay. In contrast, both Gulf 1 and Gulf 2 chemical group members are distributed throughout the study sample region. Both chemical groups are currently believed to reflect clayey resources exploited throughout the study area, but clays associated with the Na-enriched Group 2 may only be from along the coast.

The subtle chemical difference between Gulf 1 and Gulf 2 chemical groups may have geographic significance pertaining to site or clay source distance from salt water. Inland sites (8HE12, 8HI3, 8SO401) and sites located at least a few hundred meters back from the estuary shoreline (8PI3, 8PI8) overwhelmingly contain Na-depleted Gulf 1 group members. In contrast, sites proximate to the shorelines of bays and sounds (8PI2, 8MA17, 8CH10, 8LL8) are dominated by Na-enriched Gulf 2 members. An important exception is Tierra Verde (8P51), which is located at the mouth of Tampa Bay on Cabbage Key but has a pottery assemblage dominated by Na-depleted Group 1 members. Another anomaly in this regard is Aqui Esta (8CH68), which is located near mangroves on Alligator Creek North Fork, but nearly one-third of its assemblage is assigned to the Na-depleted Gulf 1 group. These exceptions could indicate that differences in Na concentrations among samples are not due to post-depositional diagenesis. Instead, the differences in Na could have originated in the clay sources utilized for pottery manufacture (but see pottery type discussion below). The clay sample with the highest probability of Gulf 1 membership (sample ZIG331; Supplementary Table S1) is located approximately 50 km inland on the Caloosahatchee River (Wallis et al. 2015). No clays in our current sample have statistical affinity to the Gulf 2 chemical group, possibly

indicating that clays representing this group are located in subtidal deposits that have yet to be sampled by archaeologists.

Panhandle chemical group members have a low frequency (mostly less than 10%) in several assemblages from throughout the study area and are represented at nearly 40% ($n = 7$) of the sampled sites. No apparent correlation exists between presence of Panhandle chemical group members and site classification or geography. Small numbers of Panhandle group members are represented at primary and secondary mound centers and primary villages. A lone exception to this uniformly low frequency of Panhandle chemical group members is Shell Creek, where nearly 24% ($n = 9$) of the analyzed sherds are assigned to this group. Shell Creek is the southernmost site in the study area, is associated with a major mound center, and contains an abundance of Mississippian-related sherds. In contrast, its counterpart to the north—the major mound center of Tierra Verde—contains only 3% ($n = 2$) Panhandle chemical group members, despite having one of the largest Mississippian pottery assemblages.

Samples left unassigned to any group occur in low frequencies (approximately 10%) at sites in much of the study area. Higher frequencies (roughly 30%) of unassigned samples are disproportionately represented in assemblages from sites in the southern half of the project area, most notably at Myakka Valley Ranches Mound (8SO401), Big Mound Key (8CH10), Aqui Esta (8CH68), and Shell Creek (8LL8). The unassigned samples from each of these sites have diverse chemical signatures and do not show any affinities among sites, perhaps indicating that they represent multiple clay resources near each locality that are so far poorly characterized.

Type distribution of chemical group members

Pinellas Plain is the only pottery type that exhibits a significant association with a chemical group, in this case the Tampa Bay group (Table 4). A few types such as Safety Harbor Incised and Pinellas Incised show a majority membership in the Gulf 1 chemical group, and this pattern holds at sites where these samples were obtained. For example, nearly three-quarters of Safety Harbor Incised vessels are Gulf 1 vessels, but most come from sites—especially Tierra Verde—where Gulf 1 members dominate or are well represented in the entire assemblage.

It is tempting to suggest that nonlocal pottery of the Panhandle chemical group is more prevalent among Mississippian-related incised and punctated vessels than among plain vessels. Panhandle chemical group samples constitute 16 of 195 (8.2%) punctated and incised vessels, and two of 54 (3.7%) plain vessels, the latter composed of Lake Jackson Plain, sand tempered plain, and Pineland Plain. But this difference in proportions is not statistically significant ($X^2 = 1.277$, $P = 0.258$). Thus, vessels of all styles and types (aside from Pinellas Plain) appear equally likely to have been acquired from the Deep South.

While chemical group membership is variable among samples in each pottery type, certain groups of vessels of the same type appear to derive from the same production origin. This is the case, for example, with three Sarasota Incised beakers from three different sites: 8SO401, 8LL8, 8MA83C. The beakers share a distinctive small triangle motif outlined through incision and filled with punctations (Luer 2023, 38). Two of the vessels

Table 4. NAA group assignments by major named types.

Pottery type	Tampa	Gulf 1	Gulf 2	Panhandle	Unassigned	Total
Lake Jackson Plain	1	17	8	1	2	**29**
Lake Jackson Incised		9	4		2	**15**
Sarasota Incised		3	6		4	**13**
Safety Harbor Incised		29	4	3	3	**39**
Point Washington Incised	1	10	3		2	**16**
Pinellas Incised		6	1	2		**9**
Jefferson Ware	1	1	7		1	**10**
Fort Walton Incised		9	9	3	3	**24**
Pinellas Plain	41				7	**48**
Englewood Incised		5	1		3	**9**
Cool Branch Incised		5	3			**8**
Lemon Bay Incised				2		**2**
St. Petersburg Incised				2		**2**
Total	**44**	**94**	**46**	**13**	**27**	**224**

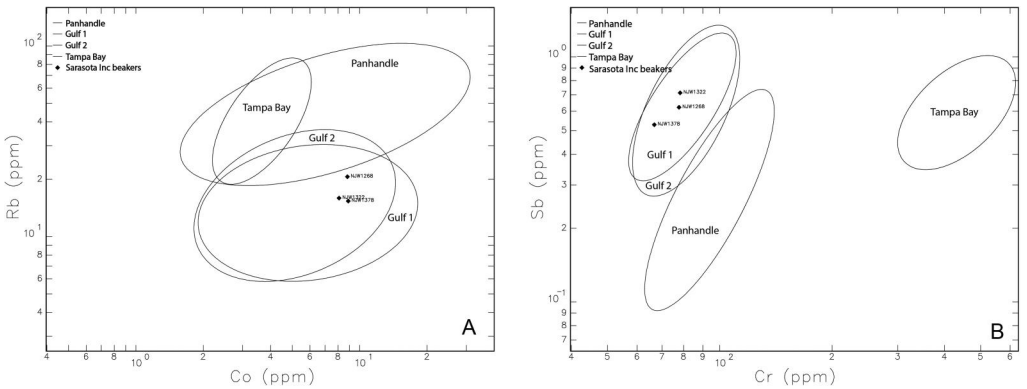

Figure 8. Three Sarasota Incised Beakers plotted by (A) Co and Rb, and (B) Cr and Sb. Ellipses represent 90% probability of group membership.

are Gulf 2 members while the third, from the inland site of 8SO401, is a Gulf 1 member. As noted above, the distinction between the Gulf 1 and Gulf 2 chemical groups is primarily in terms of Na concentrations, and this is indeed the case with these three individual members of the two groups. In fact, many of the other elements most important for discriminating chemical groups in this study are similar among these three vessels, as assessed by *z*-scores that compare each sample element concentration to the mean and standard deviation for the Gulf 1 group (Figure 8 and Table 5). If these chemical similarities indicate a common clay source for the three vessels, then disparities in Na could be the result of post-depositional diagenesis. Assessing compositional variation among specific sets of vessels with similar forms and motifs is a focus of ongoing work, and results may help resolve the source of Na variation in the wider sample.

Discussion

Most Mississippian pottery on the Florida peninsular Gulf coast was produced in the region. However, the NAA data indicate that, at some sites, only one or two vessels

Table 5. Concentrations of select elements and corresponding percentiles based on Gulf 1 group *z*-scores for three Sarasota Incised beakers.

Sample	Vessel lot	Co (ppm)	Co %	Cr (ppm)	Cr %	Rb (ppm)	Rb %	Sb (ppm)	Sb %	Na (ppm)	Na %	Ti (ppm)	Ti %
NJW1268	8SO401-3	8.7683	75	77.3569	41	20.486	91	0.619	42	698.5208	28	5901.711	75
NJW1322	8MA83C-2	7.9539	80	76.989	40	15.644	62	0.7014	58	1040.732	66	5676.494	62
NJW1378	8LL8-3	8.8228	88	66.211	14	15.237	59	0.525	26	6357.393	100	5609.073	58

originated from inland Deep South localities hundreds of kilometers to the north, most likely from the Chattahoochee/Apalachicola River area, and possibly further east in the Tallahassee Red Hills region where the Lake Jackson site is located. Thus, chemical signatures of these nonlocal vessels support previous hypotheses that Mississippian influences apparent in the decoration and vessel forms of Englewood and Safety Harbor pottery types were derived from Rood phase and Fort Walton cultures in these respective areas (Austin, Mitchem, and Weisman 2014, 108–9; Luer 2002a, 2002b).

These data also help characterize the interactions that led to nonlocal vessels being brought south to sites on the peninsular Gulf coast. The 17 nonlocal Panhandle chemical group vessels distributed across the study area evidently came into the region over the course of several centuries and demonstrate sustained interregional connections. The earliest of these connections is represented by two St. Petersburg Incised sherds and two Lemon Bay Incised sherds (Willey 1949, 442, 474–5). All four sherds are from Shell Creek and likely date to the Englewood Phase (ca. AD 1000–1200). A fourteenth-century age on soot from a Panhandle chemical group Fort Walton Incised bowl (Table 1), also from Shell Creek, shows that nonlocal vessels continued to be brought into the region generations later. The other pottery sherds in the Panhandle chemical group are likely to date to the Pinellas Phase (ca. AD 1200–1500), such as a Fort Walton Incised carinated bowl fragment from Picnic Mound, a Lake Jackson Plain sherd from Portavant Mound, and the hunchback sherd from Sarasota Bay Mound. Types with Panhandle group examples, such as Lake Jackson Plain, Safety Harbor Incised, Pinellas Incised, and Fort Walton Incised also include many Gulf 1 and Gulf 2 members. Rather than a time-limited incursion of Mississippian pottery that had long-lasting effects on local vessel form and iconography, "outside" influences recurred throughout much of the Mississippi Period and Mississippian pottery was also locally made. Early sherds of St. Petersburg Incised and Sarasota Incised include Gulf 1 and Gulf 2 chemical group members, as do sherds of apparent later types, such as Pinellas Incised.

Centuries of close interactions between communities of the Florida peninsular Gulf coast and those in the Deep South preceded these Mississippi Period connections. The widespread distribution of several distinctive Deptford Check Stamped vessels is suggestive of connections established during the Middle Woodland Period (ca. AD 100–600) (Luer 2020). Middle and Late Woodland (ca. AD 100–1000) relationships are evident in the form of matching wooden paddle stamps on Swift Creek Complicated Stamped pottery, which are unique maker's marks that can be traced across multiple sites (Wallis and Pluckhahn 2023; Wallis, Pluckhahn, and Glascock 2016). Though no paddle matches have been documented south of the Cedar Keys, which are north of our study area, results of petrographic analysis and NAA show that much of this Swift Creek pottery, as well as Late Woodland Weeden Island pottery, was brought from

Deep South production locations to middens and mounds on the peninsular Gulf coast, including southwest Florida (Duke 2022; Wallis et al. 2017). Close affinities between the two regions also are apparent in commonalities of Woodland site positioning, layout, and orientation (Wallis 2018), and probable migration events inferred through modeling of radiocarbon assays (Pluckhahn et al. 2020).

A dramatic drop in the frequency of pottery from the Deep South by ca. AD 1000 on the peninsular Gulf coast implies that the intensity of interregional ties diminished from the Late Woodland Period to the Mississippi Period (Duke 2022; Wallis et al. 2017). The downward trend in nonlocal Deep South pottery may be related more to changes in the organization of ritual pottery production than to the overall strength of social ties between regions. The consistently high level of crafting skill evident in various attributes of Weeden Island vessels (ca. AD 600–1000) and the great frequency with which they were transported long distances suggest a regional network of potters, perhaps constituting a sodality, may have drawn members from numerous dispersed villages while organizing training in a limited number of central locations, especially near the lower Chattahoochee River (Duke 2022; Wallis et al. 2017, 140). The sodality network would have ensured that Weeden Island ritual potters obtained privileged sacred knowledge and the requisite skill to produce the vessels needed for mound ceremonies. But variability in paste recipes and the prevalence of unique versions of form and decoration seem to indicate that individual expressions of the initiated were valued within the network (Wallis 2013).

In contrast to Weeden Island ritual pottery, vessels made by Safety Harbor potters during the Mississippi Period exhibited a significantly wider range of skill that included the work of novices while also utilizing a distinctive grog temper and different clay sources than Pinellas Plain for ritual vessels that were broken and deposited in mounds. Duke (2022) argues that these patterns indicate peninsular Florida Gulf coast Mississippian pottery production was learned from common sources and likely controlled by kin groups that enabled experts to work alongside and train related potters of all skill levels. If these kin-based corporate groups were in competition for resources and located very near one another, the clays, tempers, crafting, and iconographic knowledge, as well as the final products themselves, may have been proprietary and important to constituting group identities (Duke et al. 2023; see also e.g., Beck 2007; Gillespie 2000).

Importantly, the local adoption of grog temper in Mississippian vessels intended for special uses may reveal that nonlocal vessels were not used simply as templates for emulating Mississippian forms and iconography but also signify relationships that facilitated the training of Safety Harbor potters by Rood phase and Fort Walton potters. The important difference between Weeden Island and Safety Harbor training networks is that while the former seems to have integrated initiates across village communities through closely guarded knowledge, the latter was the basis for a trainee to disseminate knowledge within a kin group back home. Sustaining faithful reproduction of vessel fabric, form, and iconography through periodic contact with a Deep South Mississippian source was evidently important, and local peninsular Gulf coast idiosyncratic interpretations are much less common than among Weeden Island vessels of the Late Woodland Period. Still, local Mississippian variations of motifs and vessel forms do exist, and are likely emblematic of localized meanings (e.g., Friberg 2018).

An anomaly is apparent at Shell Creek, where more than a quarter of Mississippian vessels had likely Fort Walton or Rood phase origins. This comparatively high frequency may be due in part to temporal disparities in sampling across sites. In addition, some sites were used longer than others. Perhaps Shell Creek was a hub of activity during times when many nonlocal Mississippian vessels were brought into the region, while the other sites in our sample were inactive during those intervals. Alternatively, the polity associated with Shell Creek might have been consistently more politically powerful than others in the region and thus more successful in exchanging exotic goods and forging relationships with distant elites over time. It may be no coincidence that the highest frequency of nonlocal Mississippian vessels in our sample is to the south of the Safety Harbor culture area and near what was the sixteenth-century capital of the Calusa domain.

Control of economic resources has long been considered the basis for Mississippian hierarchical power and authority. Though not agriculturalists, peninsular Gulf coast societies developed common property regimes for managing fisheries, some of which became territorial and exclusive (Widmer 1988). Drawing on archaeological and historical evidence, Pluckhahn, Jackson, and Rogers (2022, 1) argue that exclusive property rights in the Tocobaga area emerged from public ritual and competition between groups that resulted in "societies of relatively small scale and limited authoritarian government." In contrast, property rights among the Calusa were more closely tied to lineage, which resulted in more exclusive control of resources and more authoritarian governance. If this interpretation is correct, perhaps the relative abundance of nonlocal pottery in the Shell Creek assemblage is reflective of the greater political power of Calusa lineages.

Much research also emphasizes the importance of Mississippian elite control over ideology (e.g., Brown 2007; Cobb and King 2005; Dye 2004; Luer 1996; Pauketat 2005). Mississippian iconography was closely associated with "charter myths that positioned elites as the arbiters of powerful cosmological forces" (Blitz 2010, 22). Motifs emphasizing themes of warfare and fertility were distributed on finely crafted objects of copper and shell of the Southeastern Ceremonial Complex (SECC), many of which had "international styles" (Blanton et al. 1996) associated with limited production and circulation (King 2007). A few of these items were brought south to the peninsular Gulf coast (Mitchem 2012), and others were made locally and circulated around southern Florida. Examples of the latter are metal tablets with the cross in circle motif (Allerton, Luer, and Carr 1984) and metal crested bird ornaments with similarities to a tortoiseshell ornament from Etowah in northern Georgia (Wheeler 1997, 77). Pottery gourd effigies that emphasized fertility themes are widespread on the peninsular Gulf coast and are potentially Mississippian-influenced (e.g., Luer 1996), but also have local precedents in Late Woodland (ca. AD 600–900) Weeden Island pottery.

Occurrence of rare materials bearing SECC themes mainly at the largest Mississippian mound centers across the Southeast has been the basis for inferring elite control of production for exchange with other elites (e.g., Jones 1982; Scarry 2007). Such objects also may have been valued for their associations with ritual events and gatherings. It has been suggested, for example, that copper long-nosed god maskettes distributed at select sites across the Southeast were "gifts handed out to people who

would have forever after been affiliated with Cahokia" (Pauketat 2009, 145). At the regional scale of distribution, Mississippian pottery vessels are hypothesized to have served as symbols of particular centers' history and significance (Blitz 2010, 16; Steponaitis and Knight 2004, 170). At Shell Creek, the abundance of sherds from vessels made in the Deep South might therefore reflect the greater political prominence of lineages affiliated with the site compared to those of other sites in our study sample.

In return for Mississippian vessel prestige goods, peninsular Florida native people could have provided coastal foodstuffs, yaupon holly leaves for black drink, shark teeth, feathers, salt, and marine turtle shell and mollusk shell for exchange into the interior (Ashley 2002, 167; Luer 2014; Mitchem 2012). In terms of mollusk shell, lightning whelks (*Sinistrofulgur sinistrum;* formerly *Busycon sinistrum*) were widely distributed across the Midwest and Southeast for production of cups, bowls, and beads (Marquardt and Kozuch 2016; Trubitt 2005). The peninsular Gulf coast may have been a major source for these shells, and the high proportion of nonlocal vessels at Shell Creek could reflect a relationship of alliance and intermarriage that enhanced access to shell exchange networks, analogous to the pattern observed on the Atlantic coast of northeast Florida (Ashley, Wallis, and Glascock 2015).

Conclusion

Based on the NAA results presented here, we have learned that most Mississippian pottery from the peninsular Gulf coast was made in the region. Only relatively few vessels were imported, some early in the Safety Harbor Period and a few later on. The latter included a few vessels of eccentric form such as a hunchback effigy bottle. We also learned that one local plain ware, Pinellas Plain, had a distinctive clay source. Other local wares (e.g., sand tempered plain, Belle Glade Plain, chalky plain, red painted, and check stamped) probably also had distinct clay sources, but we did not source them.

West-peninsular Florida societies did not adopt an agricultural way of life, and yet interactions entailed the flow of iconography, technology, and objects to the coast from inland agricultural polities, thereby crossing distinctive social, political, and ecological boundaries. Our data demonstrate that communities of the peninsular Florida Gulf coast were connected to the Mississippian world primarily through Rood phase and Fort Walton polities hundreds of kilometers to the north. At least two complementary relationships with Deep South Mississippian polities and their potters appear to be implicated.

First, in the study area and through time, select individuals or small groups in some Gulf coast communities or lineages likely received some training in making ritual ceramics from Deep South inland Mississippian potters. These contacts enabled local potters to emulate faithfully Mississippian paste recipes, iconography, and vessel forms. Some local grog tempered Lake Jackson Plain and incised vessels were used for cooking (as indicated by soot on vessel walls), and perhaps benefited from the technological advantages of the temper in withstanding thermal stresses. The prevalence of grog in sherds from all vessel forms from mounds indicates that Gulf coast communities also employed grog as a ritual substance in ceremonial vessels (Duke 2022, 289–93). Themes of fertility and warfare had relevance to Gulf coast communities and had local

precedents in the Late Woodland Period. In the context of competition between coastal polities, acquiring Mississippian-style vessels could have been important in establishing group identities. As Duke (2022) has argued, that potters of all skill levels (and possibly all ages) were involved in pottery production may reveal that crafting Mississippian-style ritual vessels was significant in consolidating kin-based corporate claims to history, ancestry, and spirits, and transmitting them to future generations.

Second, some Mississippian vessels were acquired from the Deep South. The most prominent example so far is at Shell Creek, which may correspond with a powerful polity able to garner prestige goods in abundance. The prevalence of nonlocal Mississippian pottery to the south of Charlotte Harbor may correlate with the rise of the powerful Calusa polity, where prestige goods may have materialized success in interregional social networks and a leader's "supernatural efficacy" (Welch 1996, 90–1).

Both patterns show that Deep South Mississippian material culture, technology, and symbols were important in ritual and political activities on the peninsular Florida Gulf coast. The potential breadth of Deep South Mississippians' influence on Florida Gulf coast settlement patterns, political structure, mound construction, and mortuary practices remains difficult to tease apart from local cultural continuities and developments. However, the acquisition and production of Mississippian vessels and iconography on the Florida Gulf coast are becoming more clear. In this case, the transfer of Mississippian ideology between distant polities involved persistent social interactions, fidelity to exotic iconographic representations, and assimilation into local Gulf coast traditions and practices. Peninsular Gulf coast societies were steadfast participants in the Mississippian world.

Supplemental data

Supplementary Table S1. Clay sample chemical group projections based on Mahalanobis distance calculations and using a Canonical Discriminant Function transformation matrix.

Supplementary Table S2. Elemental composition, group assignments, and ceramic types.

Acknowledgements

Analyzed collections come from the Florida Museum of Natural History, Florida Bureau of Archaeological Research, Charlotte Harbor Environmental Center, HistoryMiami Museum, Sarasota County History Center, the Smithsonian Institution, and several private collections, and we thank all of them for facilitating access and permitting analysis. We thank four anonymous reviewers for comments that improved the paper.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research was funded by Wenner-Gren Foundation Post-Ph.D. Research Grant No. 8337 and National Science Foundation grants 2052613 and 2208558.

References

Allerton, D., G. M. Luer, and R. S. Carr. 1984. Ceremonial tablets and related objects from Florida. *The Florida Anthropologist* 37:5–54.

Anderson, D. G. 1994. *The Savannah River chiefdoms*. Tuscaloosa: University of Alabama Press.

Ashley, K. H. 2002. On the periphery of the early Mississippian world: Looking within and beyond northeastern Florida. *Southeastern Archaeology* 21 (2):162–77.

Ashley, K. H. 2012. Early St. Johns II interaction, exchange, and politics: A view from northeastern Florida. In *Late prehistoric Florida: Archaeology at the edge of the Mississippian world*, ed. K. H. Ashley and N. M. White, 100–25. Gainesville: University Press of Florida.

Ashley, K. H., and V. Rolland. 2014. Ritual at the mill cove complex: Realms beyond the river. In *New histories of pre-Columbian Florida*, ed. N. J. Wallis and A. R. Randall, 262–82. Gainesville: University Press of Florida.

Ashley, K., and R. Thunen. 2022. St. johns river fisher-hunter-gatherers: Florida's connection to Cahokia. In *Cahokian dispersions: Diasporic connections in the Mississippian southeast*, ed. M. Baltus, S. Baires, E. Malouchos, and J. Mehta, 7-27. Singapore: Springer.

Ashley, K. H., N. J. Wallis, and M. D. Glascock. 2015. Forager interactions on the edge of the early Mississippian world: Neutron activation analysis of ocmulgee and St. Johns pottery. *American Antiquity* 80 (2):290–311. 10.7183/0002-7316.80.2.290

Ashley, K. H., and N. M. White. 2012. Late prehistoric Florida: An introduction. In *Late prehistoric Florida: Archaeology at the edge of the Mississippian world*, ed. K. H. Ashley and N. M. White, 1–28. Gainesville, FL: University Press of Florida.

Austin, R. J., J. M. Mitchem, and B. R. Weisman. 2014. Radiocarbon dates and the late prehistory of Tampa Bay. In *New histories of preColumbian Florida*, ed. N. J. Wallis and A. R. Randall, 94–120. Gainesville, FL: University Press of Florida.

Beck, R. A., ed. 2007. *The durable house: House society models in archaeology*, Occasional Paper No. 35. Carbondale, IL: Center for Archaeological Investigations.

Blanton, R. E., G. M. Feinman, S. A. Kowalewski, and P. N. Peregrine. 1996. A dual-processual theory for the evolution of Mesoamerican civilization. *Current Anthropology* 37 (1):1–14. 10.1086/204471

Blitz, J. H. 2010. New Perspectives in Mississippian Archaeology. *Journal of Archaeological Research* 18 :1–39.

Blitz, J. H., and K. G. Lorenz. 2006. *The Chattahoochee chiefdoms*. Tuscaloosa: University of Alabama Press.

Briggs, R. V. 2016. The civil cooking pot: Hominy and the Mississippian standard jar in the Black Warrior Valley, Alabama. *American Antiquity* 81 (2):316–32. 10.7183/0002-7316.81.2.316

Brown, I., ed. 2003. *Bottle Creek: A Pensacola culture site in south Alabama*. Tuscaloosa: University of Alabama Press.

Brown, I. W. 2004. Prehistory of the Gulf coastal plain after 500 B.C. In *Handbook of North American Indians, Volume 14: Southeast*, ed. R. D. Fogelson, 574–85. Washington: Smithsonian Institution.

Brown, J. A. 2007. On the Identity of the Birdman within Mississippian Period Art. In *Ancient Objects and Sacred Realms: Interpretations of Mississippian Iconography*, edited by F. K. Reilly III and J. F. Garber, 56–106. Austin: University of Texas Press.

Budden, S., and J. Sofaer. 2009. Non-discursive knowledge and the construction of identity: Potters, potting, and performance at the Bronze Age tell of Szazhalombatta, Hungary. *Cambridge Archaeological Journal* 19 (2):203–20. 10.1017/S0959774309000274

Bullen, R. P. 1952. Eleven archaeological sites in Hillsborough County, Florida. Report of Investigations 8, Florida Geological Survey, Tallahassee.

Cobb, C. R. 2022. Reassessing migration and climate change during the Mississippian period. In *Following the Mississippian spread: Climate change and migration in the Eastern US (ca. AD 1000–1600)*, ed. R. A. Cook and A.R. Comstock, 379–97. Cham: Springer International Publishing.

Cobb, C. R., and A. King. 2005. Re-inventing Mississippian tradition. *Journal of Archaeological Method and Theory* 12 (3):167–93. 10.1007/s10816-005-6927-y
Cogswell, J., H. Neff, and M. D. Glascock. 1998. Analysis of shell-tempered pottery replicates: Implications for provenance studies. *American Antiquity* 63 (1):63–72. 10.2307/2694776
Cordell, A. S. 2005a. Variability in the Sarasota Bay Mound (8SO44) pottery assemblage. *The Florida Anthropologist* 58:75–90.
Cordell, A. S. 2005b. Notes on pottery from the Myakka Valley Ranches Mound (8SO401). *The Florida Anthropologist* 58:99–104.
Cordell, A. S. 2005c. Revisiting the Aqui Esta Mound (8CH68): Paste variability in the pottery assemblage. *The Florida Anthropologist* 58:105–20.
Cordell, A. S. 2013. Technological investigation of pottery variability at the Pineland site complex. In *The archaeology of Pineland: A coastal southwest Florida site complex, A.D. 50–1710*, ed. W. H. Marquardt and K. J. Walker, 383–543. Institute of Archaeology and Paleoenvironmental Studies, Monograph 4. Gainesville, FL: University of Florida Press.
Duke, C. T. 2022. Crafting history: Personhood and potting skill in the North American southeast, PhD diss., University of Florida, Gainesville.
Duke, C. T., N. J. Wallis, L. Bloch, A. S. Cordell, and M. D. Glascock. 2023. Sourcing ritual specialists in ancient Tampa Bay (AD 650–1550): A multi-method chemical and petrographic approach. *Journal of Anthropological Archaeology* 71:101528. 10.1016/j.jaa.2023.101528
Dye, D. H. 2004. Art, ritual, and chiefly warfare in the Mississippian world. In *Hero, hawk, and open hand: American Indian art of the ancient Midwest and South*, ed. R. F. Townsend, 191–205. Chicago, IL: Art Institute of Chicago.
Feathers, J. K. 2006. Explaining shell-tempered pottery in prehistoric eastern North America. *Journal of Archaeological Method and Theory* 13 (2):89–133. 10.1007/s10816-006-9003-3
Friberg, C. M. 2018. Cosmic negotiations: Cahokian religion and Ramey Incised pottery in the northern hinterland. *Southeastern Archaeology* 37 (1):39–57. DOI:10.1080/0734578X.2017.1378986.
Gillespie, S. D. 2000. Rethinking ancient Maya social organization: Replacing "lineage" with "house". *American Anthropologist* 102 (3):467–84. 10.1525/aa.2000.102.3.467
Gilmore, Z. 2016. *Gathering at Silver Glen: Community and history in late archaic Florida*. Gainesville, FL: University Press of Florida.
Glascock, M. D. 1992. Characterization of archaeological ceramics at MURR by neutron activation analysis and multivariate statistics. In *Chemical characterization of ceramic pastes in archaeology*, ed. H. Neff, 11–26. Madison, WI: Prehistory Press.
Goggin, J. M., and W. C. Sturtevant. 1964. The Calusa: A stratified, non-agricultural society (with notes on sibling marriage). In *Explorations in cultural anthropology: Essays in honor of George Peter Murdock*, ed. W. H. Goodenough, 179–219. New York: McGraw-Hill.
Griffin, J. B. 1967. Eastern North American archaeology: A summary. *Science (New York, N.Y.)* 156 (3772):175–91. 10.1126/science.156.3772.175
Griffin, J. W. 1950. Test excavations at the Lake Jackson site. *American Antiquity* 16 (2):99–112. 10.2307/276887
Griffin, J. W., and R. P. Bullen. 1950. *The Safety Harbor site, Pinellas County, Florida*. Gainesville, FL: Florida Anthropological Society Publications.
Hann, J. H. 1991. *Missions to the Calusa*. Gainesville, FL: University Press of Florida.
Hann, J. H. 2003. *Indians of Central and South Florida, 1515–1763*. Gainesville, FL: University Press of Florida.
Holmes, W. H. 1903. Aboriginal pottery of the eastern United States. *Bureau of American Ethnology Annual Report* 20:1–237.
Hudson, C. M. 1998. *Knights of Spain, warriors of the sun: Hernando de Soto and the South's ancient chiefdoms*. Athens: University of Georgia Press.
Hutchinson, D. L. 2004. *Bioarchaeology of the Florida Gulf coast*. Gainesville, FL: University Press of Florida.
Hutchinson, D. 2006. *Tatham mound and the bioarchaeology of European contact: Disease and depopulation in central gulf coast Florida*. Gainesville, FL: University Press of Florida.

Hutchinson, D. L., C. S. Larsen, M. J. Schoeninger, and L. Norr. 1998. Regional variation in the pattern of maize adoption and use in Florida and Georgia. *American Antiquity* 63 (3):397–416. 10.2307/2694627

Jenkins, J. A., N. J. Wallis, and M. D. Glascock. 2023. Using neutron activation analysis to evaluate social connections during a period of transformative social change in the American Southeast. *Journal of Archaeological Science: Reports* 48:103859. 10.1016/j.jasrep.2023.103859

Jones, B. C. 1982. Southern cult manifestations at the Lake Jackson Site, Leon County, Florida. *Salvage Excavations of Mound 3. Midcontinental Journal of Archaeology* 7 (1):3–44.

Kassabaum, M. C. 2021. *A history of platform mound ceremonialism: Finding meaning in elevated ground*. Gainesville, FL: University Press of Florida.

King, A., ed. 2007. *Southeastern ceremonial complex: Chronology, content, contest*. Tuscaloosa: University of Alabama Press.

Knight, V. J. 2006. Farewell to the southeastern ceremonial complex. *Southeastern Archaeology* 25 (1):1–5.

Knight, V. J. 2016. Social archaeology of monumental spaces at Moundville. In *Rethinking Moundville and its hinterland*, ed. V. P. Steponaitis and C. M. Scarry, 23–43. Gainesville, FL: University Press of Florida.

Lewis, C. M. 1978. The Calusa. In *Tacachale: Essays on the Indians of Florida and southeastern Georgia during the historic period*, ed. J. T. Milanich and S. Proctor, 19–49. Gainesville, FL: University Press of Florida.

Livingood, P. C. 2010. *Mississippian polity and politics on the gulf coastal plain: A view from the Pearl River, Mississippi*. Tuscaloosa: University of Alabama Press.

Luer, G. M. 1977. Excavations at the old oak site, Sarasota, Florida: A late Weeden-Island safety harbor period site. *The Florida Anthropologist* 30:37–55.

Luer, G. M. 1991. Historic resources at the Pineland site, Lee County, Florida. *The Florida Anthropologist* 44:59–75.

Luer, G. M. 1992. Mississippian-period popeyed bird-head effigies in West-Central and Southwest Florida. *The Florida Anthropologist* 45 (1):52–62.

Luer, G. M. 1996. Mississippian ceramic jars, bottles, and gourds as compound vessels. *Southeastern Archaeology* 15 (2):181–91.

Luer, G. M. 2002a. *Ceramic bottles, globular vessels, and safety harbor culture*. Florida Anthropological Society Publication No. 15, 95–110.

Luer, G. M. 2002b. *The Aqui Esta Mound: Ceramic and shell vessels of the early Mississippian-influenced Englewood phase*. Florida Anthropological Society Publication No. 15, 111–81.

Luer, G. M. 2005. Sarasota Bay mound: A safety harbor period burial mound, with notes on additional sites in the city of Sarasota. *The Florida Anthropologist* 58 (1–2):7–56.

Luer, G. M. 2014. New Insights on the Woodland and Mississippi periods of West-Peninsular Florida. In *New histories of pre-Columbian Florida*, ed. N. J. Wallis and A. R. Randall, 74–93. Gainesville: University Press of Florida.

Luer, G. M. 2020. Comments on some tetrapodal middle Woodland vessels. *The Florida Anthropologist* 73 (4):316–27.

Luer, G. M. 2022. Some Mississippi-style ceramics from Florida's Safety Harbor and Caloosahatchee II–IV periods. *The Florida Anthropologist* 75 (1):33–83.

Luer, G. M. 2023. Featured photographs: Safety harbor period beakers. *The Florida Anthropologist* 76 (1):37–41.

Luer, G. M., and M. M. Almy. 1981. Temple mounds of the Tampa Bay Area. *The Florida Anthropologist* 34 (3):127–55.

Luer, G. M., and M. M. Almy. 1987. The Laurel mound (8SO98) and radial burials with comments on the safety harbor period. *The Florida Anthropologist* 40:301–20.

Marquardt, W. H. 2014. Tracking the Calusa: A retrospective. *Southeastern Archaeology* 33 (1):1–24. 10.1179/sea.2014.33.1.001

Marquardt, W. H., and L. Kozuch. 2016. The lightning whelk: An enduring icon of southeastern north American spirituality. *Journal of Anthropological Archaeology* 42:1–26. 10.1016/j.jaa.2016.01.005

Marquardt, W. H., and K. J. Walker. 2013. The Pineland site complex: An environmental and cultural history. In *The archaeology of Pineland: A coastal southwest Florida site complex*, ed. W. H. Marquardt and K. J. Walker, 793–920. Institute of Archaeology and Paleoenvironmental Studies, Monograph 4. Gainesville, FL: University of Florida.

Marquardt, W. H., K. J. Walker, V. D. Thompson, M. Savarese, A. D. Roberts Thompson, and L. A. Newsom. 2022. Episodic complexity and the emergence of a coastal kingdom: Climate, cooperation, and coercion in Southwest Florida. *Journal of Anthropological Archaeology* 65: 101364. 10.1016/j.jaa.2021.101364

Milanich, J. T. 1994. *Archaeology of Precolumbian Florida*. Gainesville, FL: University Press of Florida.

Milanich, J. T. 1998. *Florida Indians and the invasion from Europe*. Gainesville, FL: University Press of Florida.

Milanich, J. T., and C. M. Hudson. 1993. *Hernando de Soto and the Indians of Florida*. University Press of Florida, Gainesville.

Mitchem, J. M. 1988. Some alternative interpretations of safety harbor burial mounds. *Florida Scientist* 51:100–7.

Mitchem, J. M. 1989. Redefining Safety Harbor: Late Prehistoric/Protohistoric Archaeology in West Peninsular Florida., PhD diss., Department of Anthropology. University of Florida, Gainesville.

Mitchem, J. M. 2012. Safety harbor: Mississippian influence in the circum-Tampa Bay Region. In *Late prehistoric Florida: Archaeology at the edge of the Mississippian world*, ed. K. Ashley and N. M. White, 172–85. Gainesville, FL: University Press of Florida.

Mitchem, J. M., M. T. Smith, A. C. Goodyear, and R. R. Allen. 1985. Early Spanish Contact on the Florida Gulf Coast: The Weeki Wachee and Ruth Smith Mounds. In *Indians, Colonists, and Slaves: Essays in Memory of Charles H. Fairbanks*, edited by K.W. Johnson, J.M. Leader, and R.C. Wilson, pp. 179–219. Florida Journal of Anthropology, Special Publication Number 4, Gainesville.

Moore, C. B. 1894a. Certain sand mounds of the St. John's River, Florida. Part II. *Journal of the Academy of Natural Sciences of Philadelphia* 10:129–246.

Moore, C. B. 1894b. Certain sand mounds of the St. John's River, Florida. Part I. *Journal of the Academy of Natural Sciences of Philadelphia* 10:4–128.

Moore, C. B. 1900. *Certain antiquities of the Florida west-coast*. *Journal of the Academy of Natural Sciences of Philadelphia* 11:351–94.

Neff, H. 2002. Quantitative techniques for analyzing ceramic compositional data. In *Ceramic source determination in the greater southwest, Monograph 44*, ed. D. M. Glowacki and H. Neff, 15–36. Los Angeles: Cotsen Institute of Archaeology, UCLA.

Neff, H., J. Blomster, M. Glascock, R. Bishop, M. Blackman, M. Coe, G. Cowgill, A. Cyphers, R. Diehl, S. Houston, et al. 2006. Smokescreens in the provenance investigation of early formative mesoamerican ceramics. *Latin American Antiquity* 17 (1):104–18. 10.2307/25063039

Newsom, L. A., and C. M. Scarry. 2013. Homegardens and mangrove swamps: Pineland archaeobotanical research. In *The archaeology of Pineland: A coastal southwest Florida site complex, A.D. 50–1710*, ed. W. H. Marquardt and K. J. Walker, Monograph 4, 253–304. Gainesville, FL: Institute of Archaeology and Paleoenvironmental Studies.

Pauketat, T. R. 2005. The forgotten history of the Mississippians. In *North American archaeology*, ed. T. R. Pauketat and D. D. Loren, 186–211. Malden, MA: Blackwell.

Pauketat, T. R. 2009. *Cahokia: Ancient America's great city of the Mississippi*. New York: Penguin Books.

Payne, C. 1994. Mississippian capitals: An archaeological investigation of preColumbian political structure., PhD diss., Department of Anthropology, University of Florida, Gainesville.

Phillips, P. 1970. *Archaeological Survey in the Lower Yazoo Basin, Mississippi, 1949–1955* Papers of the Peabody Museum of Archaeology and Ethnology No. 60. Harvard University, Cambridge.

Pluckhahn, T. J., K. Jackson, and J. A. Rogers. 2022. "Let Us All Enjoy the Fish": Alternative Pathways and Contingent Histories of Collective Action and Governance Among Maritime

Societies of the Western Peninsular Coast of Florida, USA, 100–1600 CE. *Frontiers in Political Science* 4:804084. doi: 10.3389/fpos.2022.804084.

Pluckhahn, T. J., N. J. Wallis, and V. D. Thompson. 2020. The History and Future of Migrationist Explanations in the Archaeology of the Eastern Woodlands with a Synthetic Model of Woodland Period Migrations on the Gulf Coast. *Journal of Archaeological Research* 28:443–502.

Pluckhahn, T. J., and V. D. Thompson. 2018. *New histories of village life at crystal river*. Gainesville, FL: University of Florida Press.

Scarry, J. F. 2007. Connections between the Etowah and Lake Jackson chiefdoms: Patterns in the iconographic and material evidence. In *Southeastern ceremonial complex: Chronology, content, contest*, ed. A. King, 134–50. Tuscaloosa: University of Alabama Press.

Schnell, F. T., V. J. Knight, and G. S. Schnell. 1981. *Cemochechobee: Archaeology of a Mississippian Ceremonial Center on the Chattahoochee river*. Gainesville, FL: University Press of Florida.

Sears, W. H. 1958. The maximo point site. *The Florida Anthropologist* 11 (1):1–10.

Sears, W. H. 1967. The Tierra Verde burial mound. *The Florida Anthropologist* 20:25–74.

Smith, B. D. 1978. Variations in Mississippian settlement patterns. In *Mississippian settlement patterns*, ed. B. D. Smith, 479–503. New York: Academic Press.

Smith, H. G. 1951. Appendix: Leon-Jefferson ceramic types. In *Here they once stood: The tragic end of the Apalachee missions*, ed. M. F. Boyd, H. G. Smith, and J. W. Griffin, 163–74. Gainesville, FL: University Press of Florida.

Sofaer, J., and S. Budden. 2013. Many hands make light work: Potting and embodied knowledge at the bronze age tell at Szazhalombatta, Hungary. In *Embodied knowledge: Historical perspectives on belief and technology*, ed. M. L. S. Sorensen and K. Rebay-Salisbury, 118–24. Oxford: Oxbow Books.

Steponaitis, V. P., and V. J. Knight. 2004. Moundville art in historical and social context. In *Hero, hawk, and open hand: American Indian art of the ancient midwest and south*, ed. R. F. Townsend, 167–82. Chicago, IL: Art Institute of Chicago.

Stirling, M. W. 1935. Smithsonian archaeological projects conducted under the federal emergency relief administration, 1933–1934. In *Smithsonian institution annual report for 1934*, 371–400. Washington DC: Smithsonian Institution.

Stirling, M. W. 1936. Florida cultural affiliations in relation to adjacent areas. In *Essays in anthropology in honor of Alfred Louis Kroeber*, 351–7. Berkeley: University of California Press.

Trubitt, M. B. 2005. Crafting marine shell prestige goods at Cahokia. *North American Archaeologist* 26 (3):249–66. 10.2190/4NR2-8C4H-AWXB-JVPE

Wallis, N. J. 2011. *The swift creek gift: Vessel exchange on the Atlantic coast*. Tuscaloosa: University of Alabama Press.

Wallis, N. J. 2013. Swift creek and Weeden Island mortuary landscapes of interaction. In *Early and middle woodland landscapes of the southeast*, ed. A. P. Wright and E. R. Henry, 204–18. Gainesville: University Press of Florida,.

Wallis, N. J. 2018. Powers of place in the predestined middle Woodland village. In *The archaeology of villages in eastern North America*, ed. J. Birch and V. D. Thompson, 36–53. Gainesville: University Press of Florida.

Wallis, N. J., M. Boulanger, J. R. Ferguson, and M. D. Glascock. 2010. Woodland period ceramic provenance and the exchange of swift creek complicated stamped pottery in the southeastern United States. *Journal of Archaeological Science* 37 (10):2598–611. 10.1016/j.jas.2010.05.020

Wallis, N. J., A. S. Cordell, E. Harris-Parks, M. C. Donop, and K. C. D. Hall. 2017. Specialization and the politics of Weeden Island "sacred" and "prestige" vessel production. *Southeastern Archaeology* 36 (2):131–43. 10.1080/0734578X.2016.1237229

Wallis, N. J., Z. I. Gilmore, A. S. Cordell, T. J. Pluckhahn, K. H. Ashley, and M. D. Glascock. 2015. The ceramic ecology of Florida: Compositional baselines for pottery provenance studies. *Science and Technology of Archaeological Research* 1 (2):29–48.

Wallis, N. J., and T. J. Pluckhahn. 2023. Understanding multi-sited early village communities of the American southeast through categorical identities and relational connections. *Journal of Anthropological Archaeology Tbd* 71:101527. 10.1016/j.jaa.2023.101527

Wallis, N. J., T. J. Pluckhahn, and M. D. Glascock. 2016. Sourcing interaction networks of the American southeast: NAA of swift creek complicated stamped pottery. *American Antiquity* 81 (4):717–36. 10.7183/0002-7316.81.4.717

Welch, P. D. 1996. Control over goods and the political stability of the Moundville chiefdom. In *Political structure and change in the prehistoric southeastern United States*, ed. J. F. Scarry, 69–91. Gainesville: University Press of Florida.

Wheeler, R. J. 1997. Metal crested woodpeckers, artifacts of the terminal glades complex. *The Florida Anthropologist* 50 (2):67–82.

White, N. M., J. P. Du Vernay, and A. J. Yuellig. 2012. Fort Walton culture in the Apalachicola Valley, Northwest Florida. In *Late prehistoric Florida: Archaeology at the edge of the Mississippian world*, ed. K. H. Ashley and N. M. White, 231–74. Gainesville: University Press of Florida.

Widmer, R. J. 1988. *The evolution of the Calusa: A nonagricultural Chiefdom on the southwest Florida coast*. Tuscaloosa: University of Alabama Press.

Willey, G. R. 1949. *Archeology of the Florida Gulf Coast. Vol. Smithsonian miscellaneous collections*, vol. 113. Washington DC: Smithsonian Institution.

Willey, G. R., and R. B. Woodbury. 1942. A chronological outline for the northwest Florida coast. *American Antiquity* 7 (3):232–54. 10.2307/275482

Wilson, G. D., D. N. Bardolph, D. Esarey, and J. J. Wilson. 2020. Transregional social fields of the early Mississippian midcontinent. *Journal of Archaeological Method and Theory* 27 (1):90–110. 10.1007/s10816-019-09440-y

Wilson, G. D., and L. P. Sullivan. 2017. Mississippian origins: From emergence to beginnings. In *Mississippian beginnings*, ed. G. D. Wilson, 1–28. Gainesville: University of Florida Press.