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Geochemical sourcing of fiber-tempered pottery and the organization of Late Archaic Stallings communities in the American Southeast

Zackary I. Gilmore^{a,*}, Kenneth E. Sassaman^b, Michael D. Glascock^c

^a Department of Anthropology, Rollins College, 1000 Holt Ave – 2761, Winter Park, FL 32789, USA

^b Department of Anthropology, 1112 Turlington Hall, University of Florida, PO Box 117305, Gainesville, FL 32611-7305, USA

^c Archaeometry Laboratory, University of Missouri Research Reactor, 1513 Research Park Drive, Columbia, MO 65211, USA

ABSTRACT

The oldest pottery technology in North America was innovated by hunter-gatherers belonging to the Late Archaic Stallings culture (ca. 5150–3200 cal B.P.) of Georgia and South Carolina. The culture history of Stallings societies is relatively well-known; however, the permanence and scale of Stallings communities, the nature of the connections among them, and the extent to which they changed over time remain poorly understood. In this study, 450 samples Stallings pottery and 24 raw clay resource samples from along the Savannah and Ogeechee Rivers were submitted for neutron activation analysis (NAA). The NAA results show a significant shift in the nature of vessel transport at the outset of the Classic Stallings phase (4100–3800 cal B.P.), an interval marked by the appearance of the region's first formalized circular villages and dedicated cemeteries. This shift involved the funneling of pots with carinated rims into a few major middle Savannah River mortuary sites, providing evidence for a novel Stallings sociality that combined relatively localized village life with periodic large-scale ritual gatherings.

1. Introduction

The oldest pottery technology in North America was innovated by hunter-gatherer communities of the Late Archaic Stallings culture of Georgia and South Carolina. The culture history of Stallings archaeology is relatively well-known, spanning a period of nearly two millennia (ca. 5150–3200 cal B.P.) and divided into three phases on the basis of changes in pottery (Sassaman, 1993, 2004). Shifts in land-use practices accompanied changes in pottery, although the permanence and scale of communities over time and the nature of connections among them remain poorly understood. The present study focuses on Stallings pottery provenance as a proxy for the movement and interaction of people and materials along the Savannah River, the main corridor of Stallings settlement, and at sites along the adjacent Ogeechee River (Fig. 1). Our ultimate goal is to better understand regional variation in Stallings communities and determine how these changed between the Early Stallings and Classic Stallings phases, a transition marked by the emergence of formalized, circular villages and dedicated cemeteries (Sassaman, 2006).

To this end, a total of 474 Stallings pottery sherds and raw clay sources from locations along the Savannah and Ogeechee rivers were sampled and subjected to neutron activation analysis (NAA). NAA has been shown to be highly effective in distinguishing among pottery from distinct geological sources across multiple contexts in the lower Southeast (e.g., Ashley et al., 2015; Gilmore, 2016; Wallis et al., 2010;

Wallis et al., 2016). This study is the first application of NAA to Stallings pottery assemblages and the first attempt within the region to systematically examine pottery movement based on compositional differences along the length of a single river valley.

Our results indicate that there is strong patterned variation in the chemical composition of both raw clay resources and Stallings pottery along the Savannah River. This variation reflects not only a distinction between local and nonlocal vessels but also the direction (i.e., upriver versus downriver) in which pottery was moved. Overall, the NAA data indicate a relatively low overall frequency of Stallings pottery movement between the Coastal Plain and Lower Piedmont/Fall Zone regions of the river valley. This pattern holds true during both Early Stallings and Classic Stallings times, perhaps suggesting some degree of continuity in the scale and structure of interacting communities, despite changes in settlement, ritual, and technology. However, one notable change in pottery was the introduction of carinated vessels, a rare form found predominately at two Classic Stallings sites, both housing large cemeteries. Compared to other vessel forms, carinated vessels involved a higher proportion of nonlocal items, and compositional data suggest that vessels deposited at mortuary locations were delivered from both upriver and downriver locations. We interpret this as evidence for a novel sociality and rituality associated with mortuary events that gathered people and artifacts from across the river valley in a few select locations during the Classic Stallings period.

* Corresponding author.

E-mail address: zgilmore@rollins.edu (Z.I. Gilmore).

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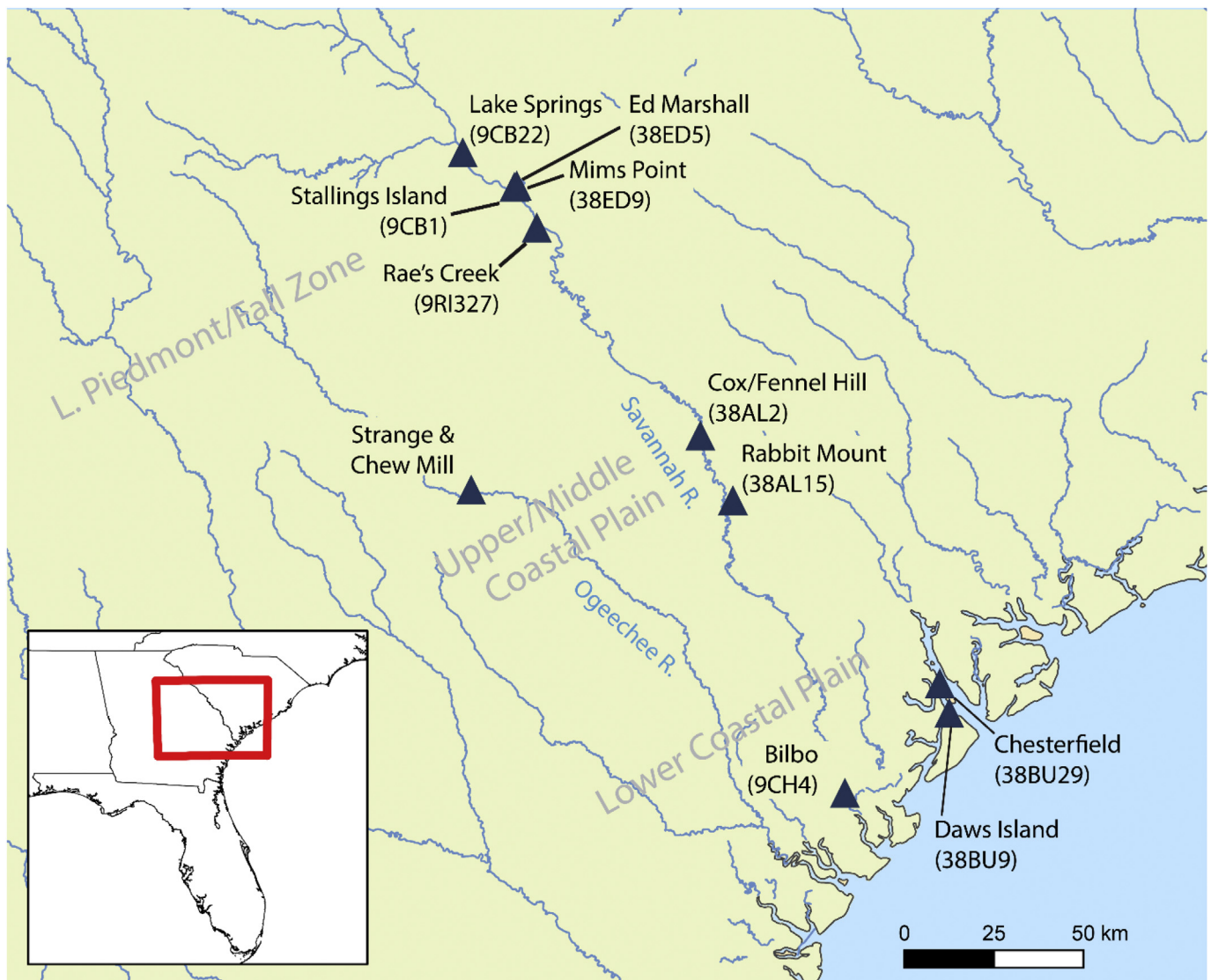


Fig. 1. Map of study area showing locations of sampled Stallings sites.

2. Incipient pottery technology in the southeastern U.S

Pottery-making has a deep history in the southeastern U.S., extending back more than 5000 years (Sassaman, 1993; Saunders and Hays, 2004). The region's earliest pottery, belonging to the Stallings tradition, is characterized by its fibrous organic temper, usually composed of Spanish moss (*Tillandsia usneoides*). Stallings pottery also frequently contains varying amounts of sand and/or grit, although the extent to which this reflects distinct tempering strategies as opposed to differences in the natural inclusions present within various clay sources is unclear. Sites with Stallings pottery extend throughout most of the Savannah River valley from the Piedmont to the coast, as well as the adjacent Ogeechee River valley, tributaries of both rivers, interriverine landforms in the Coastal Plain, and along the Atlantic coast of southern Georgia. Vessels with visible sand constituents occur most often at interior Stallings sites and their frequency seems to have increased over the course of the Stallings period (Sassaman, 1993:161). Parallel and roughly coeval fiber-tempered pottery traditions were centered along the coastline and St. Johns River valley of northeast Florida, where preexisting exchange relationships with the Stallings region may have facilitated the rapid transmission of pottery technology (Sassaman, 2004).

Stallings vessels consisted mostly of shallow, round-bottomed

bowls, and flat-bottomed basins (Sassaman, 1993:144). These were crafted using multiple different forming techniques that included coiling, molding, and slab construction (Sanger, 2017). For roughly 1000 years following their initial appearance, Stallings vessels were mostly plain. This changed at around 4100 cal BP when vessel surfaces began being adorned with various punctated and incised motifs (Fig. 2). This transition from mostly plain to mostly decorated pottery marks the boundary between the Early Stallings (~5150–4100 cal B.P.) and Classic Stallings (4100–3800 cal B.P.) phases.

Based on a variety of technofunctional and use-wear data linking early pots to cooking functions, the advent of pottery in the Southeast was undoubtedly a significant culinary innovation (Sassaman, 1993). Despite this fact, multiple regional scholars have remarked on the apparent absence of evidence for a major shift in subsistence traditions associated with early pottery (Caldwell, 1958:15; Milanich, 1994:86; Stoltman, 1972). There is, however, a great deal of evidence that pottery played an important transformative role in Late Archaic social life. The most striking instance of this comes from Florida's St. Johns River valley where pottery was initially adopted not for purposes related to domestic subsistence, but instead as an important medium of long-distance exchange and broad-scale social integration. At the Silver Glen complex, for example, highly decorated Orange pottery deposited at places of social gathering has been linked through compositional

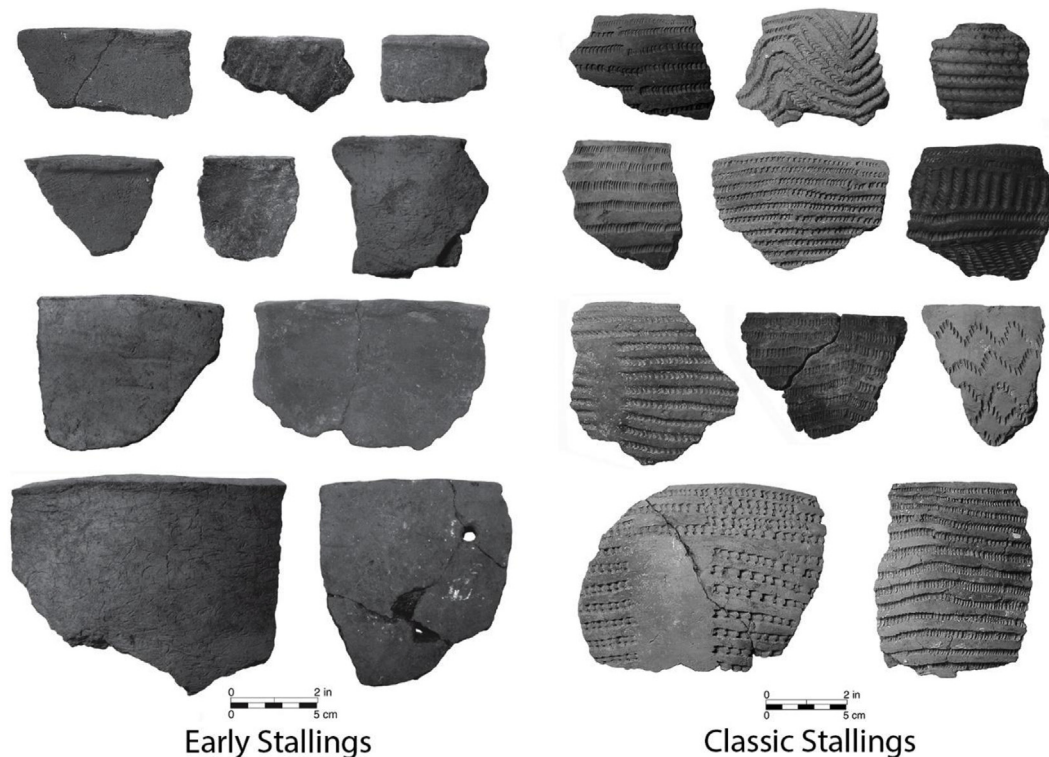


Fig. 2. Examples of sherds of Early Stallings (left) and Classic Stallings (right) pottery from assemblages sampled for this study (photos and layout by Kenneth E. Sassaman).

analyses to geological clay sources more than 200 km away (Gilmore, 2016). In this particular case, pottery quickly superseded preexisting exchange goods and helped concentrate extracommunal ritual and monument construction in a few massive mound centers. While large-scale social gathering represents but one possible mode of regional interaction, this example serves to illustrate the magnitude of the potential social ramifications associated with the addition of pottery technology to the cultural repertoires of Late Archaic societies in the Southeast.

3. Stallings communities in the Savannah River valley

The organization of Early Stallings communities is not known in great detail. A few general features suggest that communities of the Savannah River valley were small-scale, seasonally mobile, and participants in extralocal networks of interaction. Sites of this phase are relatively small, although often with substantial middens and assemblages of pits, indicative of prolonged or repeated use.¹ Various lines of evidence suggest that seasonal movements along the river—including fall forays from the Coastal Plain into the lower Piedmont to harvest mast—were more typical than year-round settlement. Burials, if present at a given site, were distributed in seemingly random fashion in midden deposits (e.g., Cook, 2015; Stoltman, 1974).

Assemblages of early, mostly plain, pottery are dominated by basins

¹ The major exception to this settlement pattern are the shell rings of the Atlantic coast (Russo, 2006). Debate on the function and permanence of shell rings continues, but most archaeologists agree that rings were formalized settlements that, in at least some cases, were occupied year-round (Russo, 1991). Debate turns on whether feasting events account for the high volume of shell at rings, and whether such events, if they occurred, were a source of social capital for aspiring elite. Burials generally do not occur at shell rings on the Atlantic coast, except at St. Catherine's Island in Georgia, where the cremated remains of persons were interred in the central area of the McQueen ring (Sanger et al., 2018).

that were used for indirect-heat cooking. Various types of rock could be drafted into use with basins (i.e., “stone boiling”), but common in the Savannah River valley was the use of soapstone from the Piedmont, where it outcrops. Soapstone cooking stones predate pottery by many centuries in locations near quarries. By Early Stallings times they were displaced downriver to sites in the Coastal Plain (Cook, 2015; Stoltman, 1974; Waring, 1968). Also derived from Piedmont sources were winged bannerstones (Sassaman and Randall, 2007). These and other media of technological and stylistic expression linked Coastal Plain and Piedmont communities in alliances of an uncertain nature. Given the lack of large gathering sites of this age in the valley, alliances were likely predicated on individual or small-scale movements of persons, and perhaps “down-the-line” exchange. Notably, over the centuries of interaction between members of these provincial groups, cultural differences between them seem to have intensified rather than diminish; pottery, for instance, was never adopted by indigenous Piedmont communities despite its common use among the nonlocal persons with whom they interacted (Sassaman, 1993).

The Classic Stallings phase of 4100–3800 cal BP is better known than the preceding phase owing largely to investigations in and around the namesake site in the middle Savannah valley, Stallings Island (Clafin, 1931; Sassaman, 2006; Sassaman et al., 2006). After an occupational hiatus of two centuries, Stallings Island was established as a residential compound of at least 8–10 households encircling an interior area dedicated to human interment. Other circular settlements are known for two other sites within one kilometer of Stallings Island, but only Lake Spring, ~25 km upriver, also involved a substantial cemetery. Like Stallings Island, Lake Spring had vessels with carinated rims (Fig. 3), the only two sites known from the valley with more than a trace of this form. Irrespective of form, fiber-tempered pottery of the Classic Stallings phase is routinely decorated, mostly with punctations, but also incised and simple-stamped surfaces (see Fig. 2 for examples). The repertoire of decoration spans the regional extent of sites of this phase, indicative of a widely shared stylistic tradition. However, comparisons of Classic Stallings pottery from three major site clusters in the

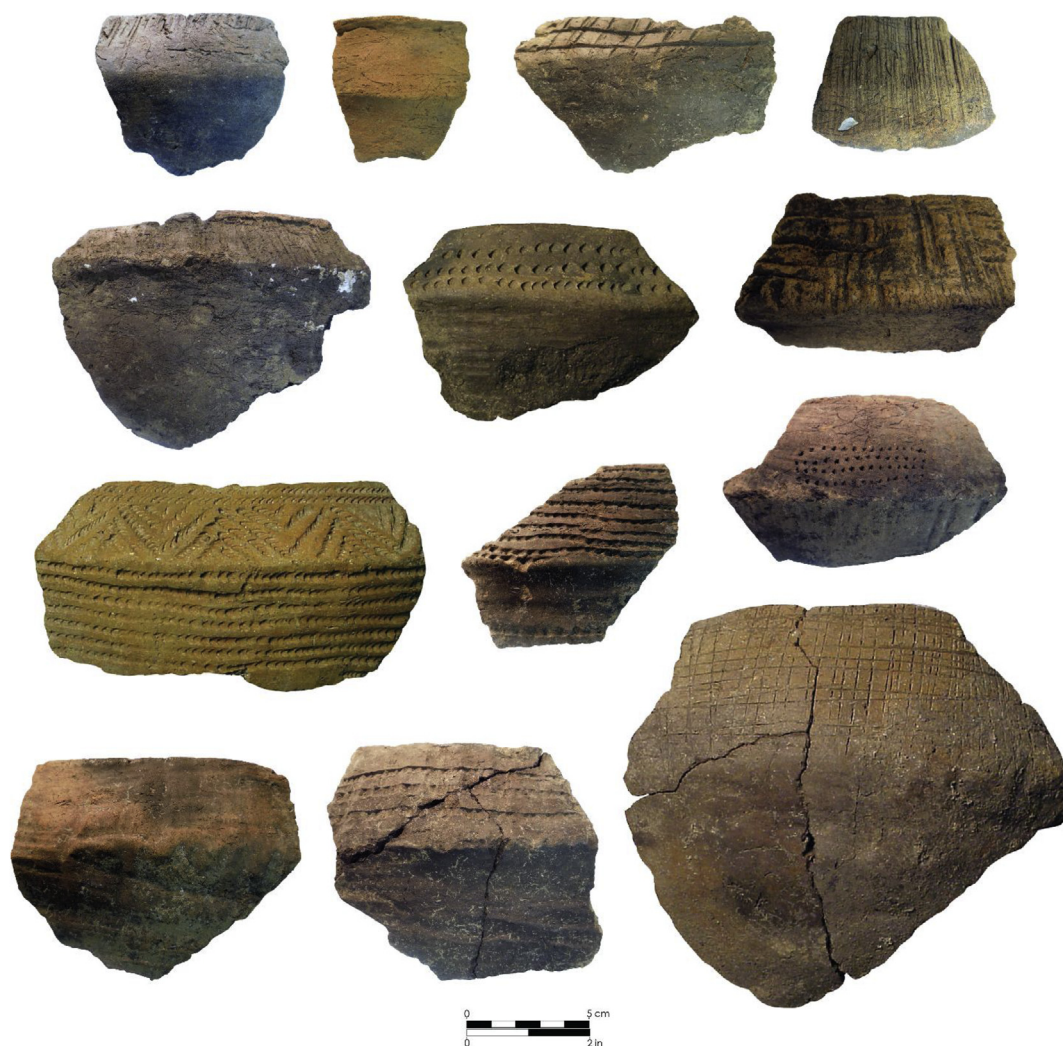


Fig. 3. Examples of rim sherds of carinated vessels from the Classic Stallings phase assemblage from Stallings Island (9CB1), Georgia (photos by Zackary I. Gilmore).

region reflect a good deal of geographic circumscription in wall thickness, the amount of sand in paste, and even the handedness of potters (Sassaman and Rudolphi, 2001). These trends suggest that members of Stallings communities continued to interact with nonlocal persons across the region, but now in ways that did not involve the seasonal relocation of entire coresidential groups. Data on the provenance of clays used to make Stallings pottery bear relevance in discriminating among the possible alternative social arrangements that would account for this shift in community organization and interaction.

4. Sampling and methods

A large inventory of Stallings pottery assemblages was available for this study. Between the late 1980s and early 2000s, technofunctional and stylistic data were collected from 36 assemblages comprising a total Minimum Number of Vessels (MNV) of more than 3000 (Sassaman, 1993; Sassaman et al., 1995, 2006). Nevertheless, as noted, prior to the present study only limited compositional analyses of Stallings pottery and related wares had ever been attempted (see Smith and Trinkley, 2006; Thompson et al., 2008).

In this case, samples were collected from assemblages spanning the temporal and spatial distributions of Stallings pottery in the greater Savannah River region (Fig. 1; Table 1). These assemblages can be divided temporally into the Early and Classic Stallings periods and geographically into four distinct spatial units, including the Lower

Piedmont/Fall Zone, Upper-Middle Coastal Plain, and Lower Coastal Plain/Coast in the Savannah River valley, as well as the adjacent Ogeechee River drainage.

Early Stallings pottery assemblages are distributed widely at sites across the region and were sampled accordingly. Classic Stallings samples were drawn from Savannah River sites with formalized site plans (e.g., circular villages) or other investments in place (e.g., Stallings Island and Lake Spring cemeteries; Mims Point storage pits), all with assemblages of ornately decorated pottery and two (Stallings Island and Lake Spring) with carinated vessels. These Classic Stallings localities occur primarily along the coast and in the middle Savannah area, essentially at opposite ends of the 200-km-long expanse encompassed by the distribution of Early Stallings vessels. Classic Stallings assemblages from two Ogeechee River sites (Chew Mill and Strange) were also sampled.

In total, 450 Stallings vessels were sampled from 13 sites.² In all but

² As Smith and Trinkley (2006) demonstrate, it can sometimes be difficult to macroscopically distinguish between fiber-tempered Stallings pottery and partially temporally overlapping Thom's Creek wares because of the widely varying amounts of fiber temper utilized by Stallings potters. And indeed, petrographic analysis of 225 of the sherds included here revealed fiber proportions ranging approximately 3% to almost 30%. Nevertheless, the ubiquitous presence of fiber temper in all analyzed samples, the position of sampled sites at or beyond the known fringes Thoms Creek distribution, and the pre-

Table 1
Pottery samples subjected to NAA by time period, subregion, and site.

	# Sampled Vessels	Total MNV	Repository	References
EARLY STALLINGS				
Lower Coastal Plain/Coast				
Bilbo	30	~ 40	UWG	Crook 2009
Daws Island	30	49	SCIAA	Michie 1973
Upper-Middle Coastal Plain				
Rabbit Mount	30	246	PM	Stoltman 1974
Cox/Fennel Hill	30	68	SCIAA	Trinkley 1975
Lower Piedmont/Fall Zone				
Victor Mills	30	~ 40	LSA	Sassaman 2006
Ed Marshall	30	~ 50	LSA	Sassaman 2006
Rae's Creek	30	32	UWG	Cook, 1990
CLASSIC STALLINGS				
Coast				
Chesterfield	30	55	CM	Flannery 1943
Lower Piedmont/Fall Zone				
Stallings Island	60 ^a	> 1000	LSA/PM	Clafin 1931; Sassaman et al., 2006
Lake Spring	30	> 200	UGA	Miller 1949
Mims Point	30	85	SCIAA	Sassaman, 1993
Ed Marshall	30	32	LSA	Sassaman 2006
Ogeechee River				
Chew Mill	30	191	LSA	Sassaman et al., 1995
Strange	30	390	LSA	Sassaman et al., 1995

UWG = University of West Georgia.

SCIAA = South Carolina Institute of Archaeology and Anthropology.

PM = Peabody Museum, Harvard University.

LSA = Laboratory of Southeastern Archaeology, University of Florida.

CM = Charleston Museum.

UGA = University of Georgia.

^a Includes 30 carinated and 30 noncarinated vessels.

two cases, 30 samples were deemed sufficient (based on considerations related to statistical significance and methodological precedent) to characterize the range of geochemical variation present in the assemblage from each site. At Ed Marshall, stratigraphically distinct Early Stallings and Classic Stallings components were sampled separately, resulting in a total of 60 sampled vessels. Similarly, the large assemblage of carinated vessels (n = 130) from Stallings Island was sampled as a subset of the entire site assemblage, raising its total sample to 60 as well. Additional carinated vessels were included in the 30 samples from Lake Spring; however, the relatively small proportion of this form (~4 percent) in the assemblage did not enable additional sampling.

In addition to the pottery, geological clay sources from the Savannah and Ogeechee River valleys were sampled to provide a reference for making provenance determinations. A total of 24 clay samples were collected, including 21 from locations along the Savannah River, three from the upland Fall Zone near Aiken, SC, and three from the Ogeechee drainage (Fig. 4). Clay samples were processed, molded into briquettes, and oven-fired at the Florida Museum of Natural History's Ceramic Technology Laboratory using the methods outlined by Cordell et al. (2017).³

(footnote continued)

Thoms Creek ages of the sampled Early Stallings assemblages make us confident in the Stallings classification of all sherds included in this study.

³ In brief, analyzed clay samples were dried, crushed, and sieved in order to remove aplastic inclusions (e.g., pebbles, shells, plant matter, etc) larger than 2 mm in diameter. Smaller aplatrics were left in the clay sample, as these

NAA analyses were carried out at the University of Missouri Research Reactor (MURR) using standard procedures (described in detail in Glascock, 1992, 1998; Neff, 1992, 2000; Neff and Glowacki, 2002). In brief, each sample was abraded with a silicon carbide burr, washed with deionized water, dried, and crushed into a powder. It was then subjected to two irradiations (one short and one long) and three gamma counts using high-purity germanium detectors, allowing for the detection of 33 elements, which were tabulated in parts per million (see supplementary data).

Raw data for 30 of the 33 elements were then subjected to quantitative analyses⁴ (see Baxter 1992; Glascock, 1992; Glascock et al. 2004; Neff 1994, 2002 for more detailed descriptions and justifications of statistical techniques). First, raw elemental concentrations for pottery and clay samples were converted to base-10 logarithms and reduced to Principal Components (PCs) based on a covariance matrix. Next, simple bivariate plots of elements and PC scores, along with PC biplots showing the relative influence of different elements, were used to form preliminary chemical composition groups. Group membership was then evaluated and refined by calculating Mahalanobis distances using all 30 PCs.

5. Results

5.1. Clay chemistry

NAA results show clearly patterned differences in the chemistry of clay resources along the length of the Savannah River (Fig. 5; Table 2). The concentrations of most measured elements are highest in upriver clays nearer the Piedmont and gradually decrease moving downriver through the Coastal Plain and farther from the ultimate source of most clays in the region, the southern Appalachian Mountains (see Wallis, 2011:101 for discussion of a similar chemical distribution along the Altamaha/Ocmulgee drainage system directly to the south). In fact, twenty-one of the 30 analyzed elements are positively correlated with distance from the coastline, including five (Manganese [Mn] and the rare earth elements Terbium [Tb], Dysprosium [Dy], Ytterbium [Yb], and Lutetium [Lu]) for which the correlations are statistically significant at the 0.10 level. Of the remaining nine elements, Chromium (Cr), Arsenic (As), and Antimony (Sb) exhibit the strongest inverse correlation, meaning that they are most enriched in clays nearer the coast and gradually decrease upriver.

The dominant upriver-downriver gradient observed here conforms to the pattern one might expect based on the gradual sorting of riverine sediments as grain size decreases and heavier minerals fall out as flow rate decreases. However, it should be noted that the winnowing of some chemically diluting (as far as NAA is concerned) elements such as quartz could actually increase the concentration of other constituent elements in downriver samples. It is also possible that sediments near the coast may include marine clay deposits derived from lithological sources distinct from those farther upriver. This situation may well account for the opposite-trending elements noted here. Regardless of their ultimate causes, though, the geochemical patterns observed in the

(footnote continued)

presumably formed a constituent of the raw materials available to ancient potters. Samples were then moistened with deionized water, air dried, and fired in an oven to a temperature of 800 °C.

⁴ Nickel (Ni) was present in lower-than-detectable concentrations in most samples and was therefore excluded from statistical analyses. Calcium (Ca) and Strontium (Sr) were also excluded because of concerns, based on previous regional studies (Ashley et al., 2015; Gilmore, 2016; Wallis et al. 2010, 2016), that levels of these elements had been impacted by varying amounts of shell present in the respective depositional environments of sampled assemblages. A mathematical correction (based on Cogswell et al., 1998) was used to remove Ca and Sr from the data and compensate for their diluting effects on other elements.

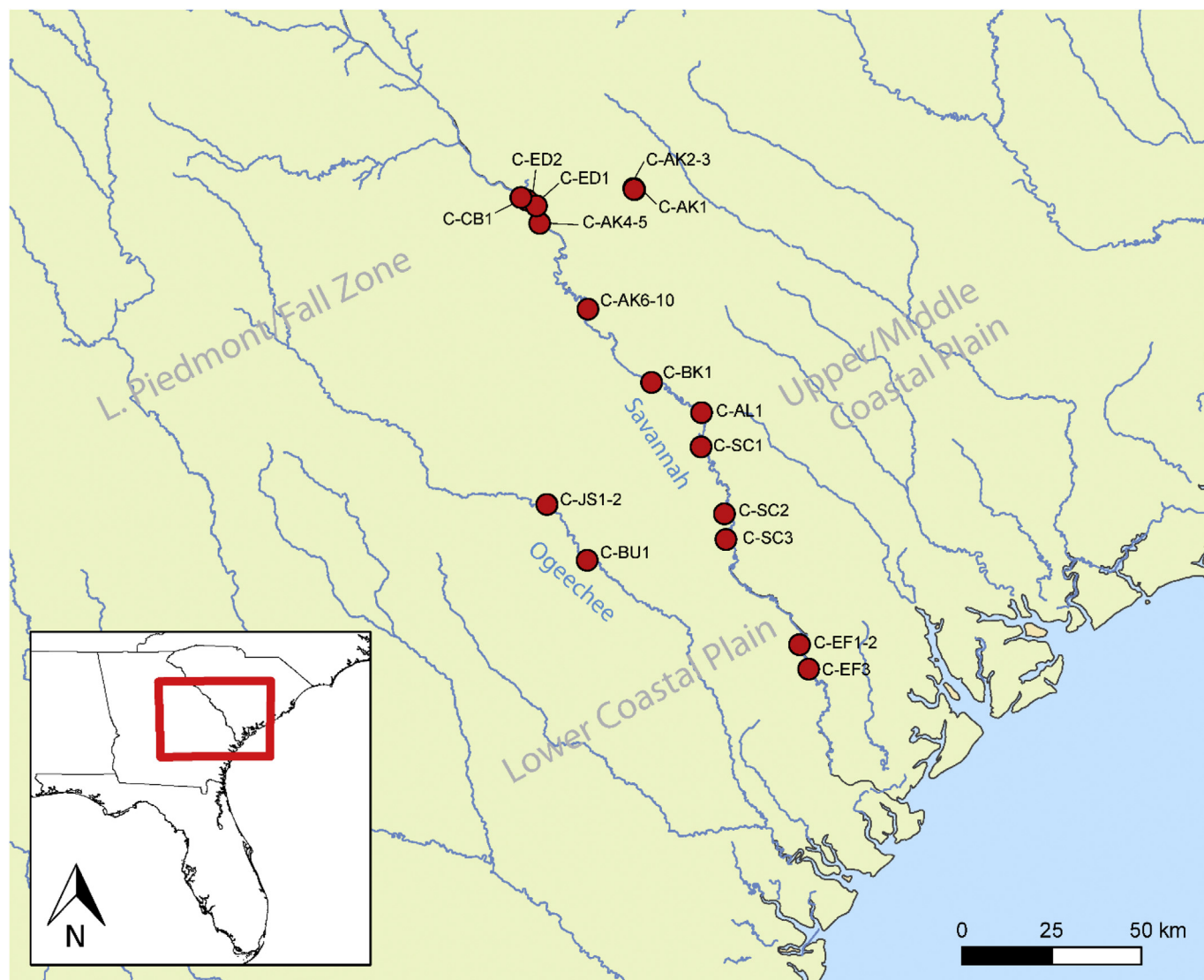


Fig. 4. Map showing locations of sampled raw clay resources.

analyzed clays provide a strong basis for not only distinguishing between local and nonlocal vessels within Savannah River sites but also for inferring the direction (i.e., upriver versus downriver) of pottery movement.

Outside the lower Savannah River valley, the Upland Fall Zone and Ogeechee samples each exhibit distinct chemical characteristics. Upland Fall Zone samples yielded widely divergent clay signatures but as a group are distinguished by relatively high levels of a few elements, including Aluminum (Al), As, and Antimony (Sb) and substantially lower concentrations of most others, especially Na, K, Manganese (Mn), and Cobalt (Co). Samples from the Ogeechee River are compositionally similar to those of the Upper/Middle Coastal Plain of the Savannah River in many respects, but with marked depletions in Na, K, Scandium (Sc), Mn, Iron (Fe), and Rubidium (Rb), likely due to the fact that the Ogeechee is a strictly Coastal Plain drainage with less direct sedimentary input from Piedmont and Appalachian lithologies.

5.2. Pottery composition groups

Among the pottery samples, three compositional groups (CG1–CG3) were identified that can be confirmed with Mahalanobis distance measurements, while a fourth (CG4) was inferred from bivariate plots of elements and PCs but is difficult to verify statistically due to small

sample size (Fig. 6; Table 3). CG1 ($n = 89$), composed entirely of pottery samples recovered from Lower Coastal Plain/Coast sites, exhibits the lowest concentrations of most measured elements, with the exceptions of As, zirconium (Zr), Sb, and Hafnium (Hf), which are highest in this group. CG2 ($n = 142$), which consists primarily of samples from the Upper-Middle Coastal Plain of the Ogeechee and Savannah Rivers, has slightly higher, yet still relatively low, concentrations of most elements, also with a few exceptions, including K, and Rb, which are significantly elevated in this group. CG3 ($n = 92$), dominated by Lower Piedmont/Fall Zone samples, exhibits substantially higher levels of most elements but is conspicuously depleted in a few major ones including Na, Mn, and Fe. And finally, CG4 ($n = 11$) composed almost entirely of carinated vessels recovered from Lower Piedmont/Fall Zone sites, contains the highest concentrations of most elements and is especially enriched in Na, Fe, Co, and zinc (Zn).

5.3. Pottery provenance and vessel movement

Well-defined trends in the spatial distribution of pottery group members, together with comparisons to clay composition data, allow for strong inferences regarding vessel provenance. As shown in Fig. 7, the distribution of the chemical composition groups in a bivariate plot of PC1 and PC3 is essentially a mirror image of the Savannah River

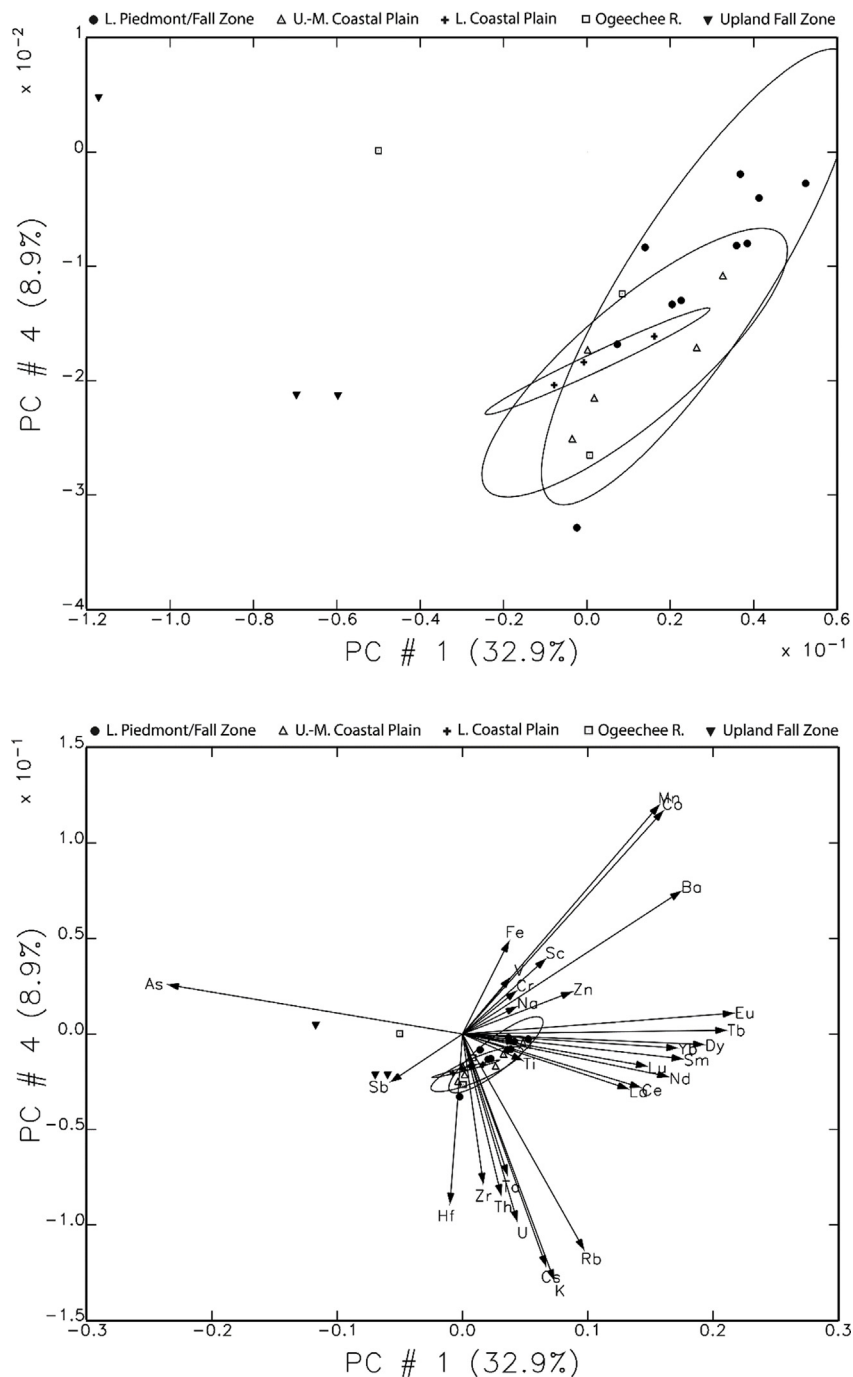


Fig. 5. Clay sample subregions plotted on Principal Component 1 and Principal Component 4 without (top) and with (bottom) element vectors (based on the complete pottery/clay dataset).

Table 2
Chemical signatures of analyzed clay samples by subregion.

Subregion	No. of Analyzed Clay Samples	Generalized Chemical Signature
Lower Coastal Plain/Coast	3	Low concentrations of most elements; highest levels of Na, K, Cr, and Rb.
Upper-Middle Coastal Plain	5	Intermediate concentrations of most elements; highest levels of Al, Ti, V, Fe, As, Sb, and Cs; lowest levels of Rb, Zr, Hf, and U.
Lower Piedmont/Fall Zone	10	Highest concentrations of most elements; lowest levels of Na, K, Cr, and Sb.
Middle Ogeechee River	3	Similar to Upper-Middle Coastal Plain clays but with marked depletions in Na, K, Sc, Mn, Fe, and Rb.
Upland Fall Zone	3	Highest levels of Al, As, and Sb; very low concentrations of most other elements, especially Na, K, Mn, and Co.

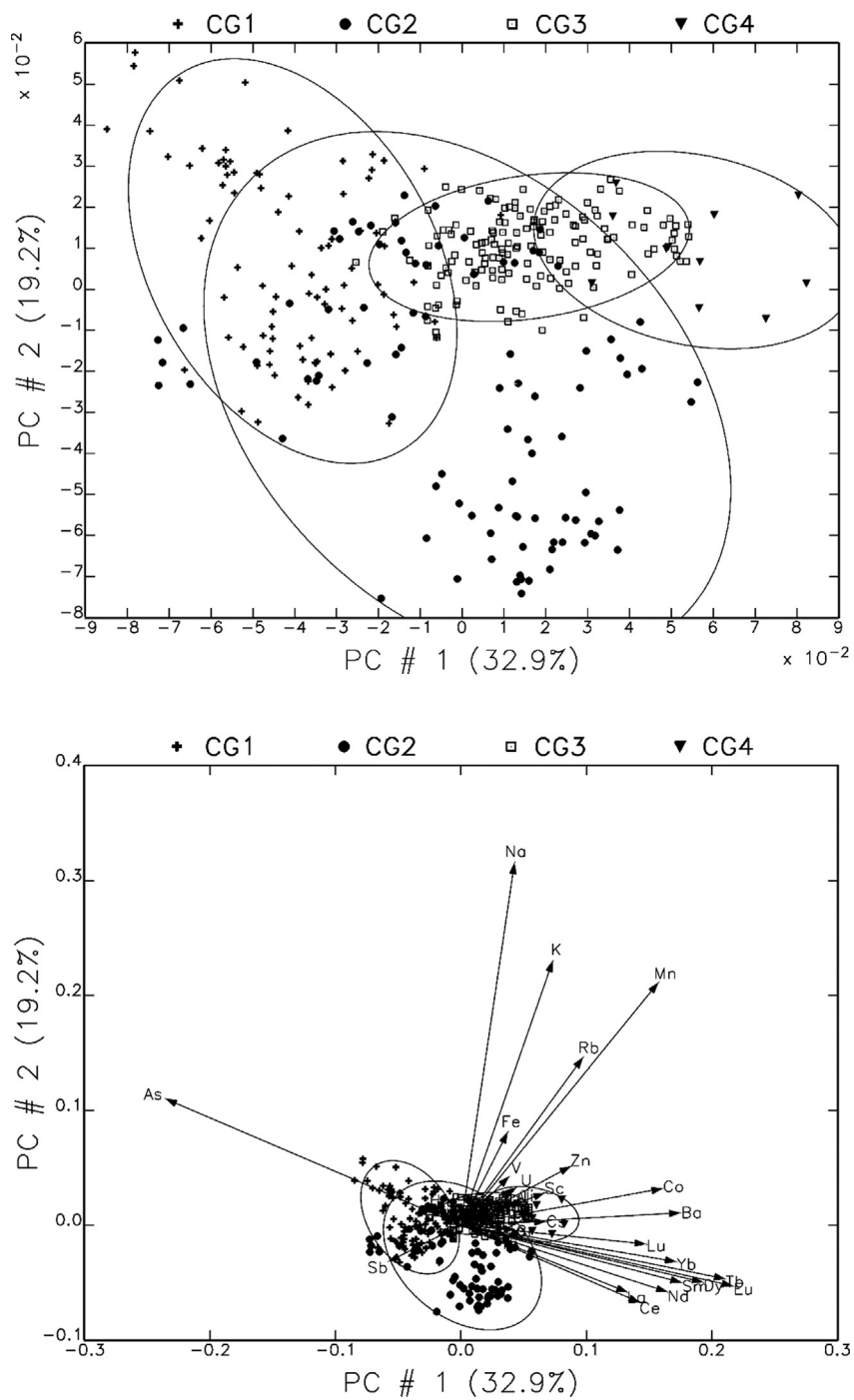


Fig. 6. Chemical composition groups plotted on Principal Component 1 and Principal Component 2 without (top) and with (bottom) element vectors.

Table 3
Chemical signatures and geographical distribution of pottery composition groups.

Composition Group	N	Chemical Signature	Primary Distribution
CG1	89	Lowest concentrations of most elements; highest levels of As, Zr, Sb, and Hf.	Lower Coastal Plain/Coast along the Savannah River
CG2	142	Relatively low concentrations of most elements; highest levels of K and Rb	Upper-Middle Coastal Plain along the Savannah and Ogeechee Rivers
CG3	92	Relatively high concentration of most elements; lowest levels of Na, Mn, and Fe.	Lower Piedmont/Fall Zone along the Savannah River
CG4 ^a	11	Highest concentrations of most elements; especially enriched in Na, Fe, Co, and Zn	Lower Piedmont/Fall Zone along the Savannah River
Unassigned	116		All areas

^a Provisional group.

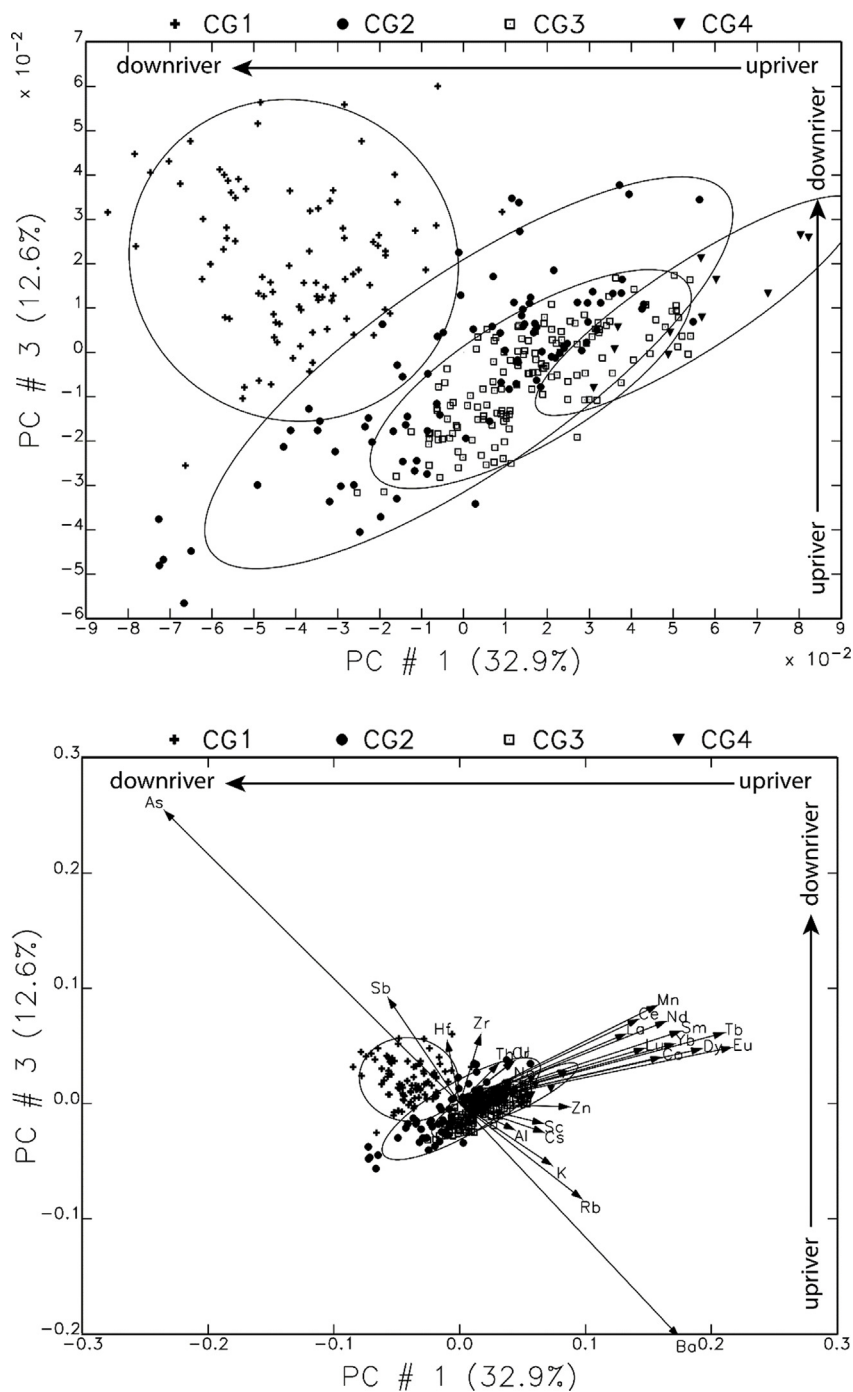


Fig. 7. Chemical composition groups plotted on Principal Component 1 and Principal Component 3 without (top) and with (bottom) element vectors.

landscape. PC1 scores are increasingly positive moving from the coast upriver toward the Piedmont, while PC3 scores are increasingly positive in the opposite (i.e., downriver) direction. And when the elements most significantly influencing these PC scores are considered, it is clear that spatial patterns in pottery composition conform closely to those observed in the corresponding raw clay data discussed above.

Vessel movement was thus inferred by identifying pottery samples assigned to a nonlocal compositional group (Table 4). Among Early Stallings samples, a total of 21 (10.0 percent) of the 210 vessels sampled were determined to have nonlocal provenances. These include nine vessels belonging to CG2 that were likely manufactured with raw materials from the Upper-Middle Coastal Plain but were deposited at Lower Piedmont/Fall Zone sites and 12 vessels from CG3 with origins in

the Lower Piedmont/Fall Zone that ended up in Upper-Middle Coastal Plain sites. These results indicate a low, yet significant, frequency of pottery movement in both upriver and downriver directions during the Early Stallings phase.

Among the 240 Classic Stallings vessels sampled, 15 (6.3 percent) are likely nonlocal. Four of these are CG2 vessels with raw material links to the Upper-Middle Coastal Plain that were eventually deposited in a Lower Piedmont/Fall Zone site. The remaining 11 are all CG4 vessels recovered from Lower Piedmont/Fall Zone sites that register an anomalous level of chemical enrichment across numerous measured elements. The unusually positive PC scores associated with CG4 samples, together with the geographical trends in clay composition discussed above, suggest an origin point for these vessels upriver and

Table 4
Inventory of pottery Composition Group membership and nonlocal vessels.

	CG1	CG2	CG3	CG4	Unass.	Nonlocal Vessels	Probable Origin(s) of Nonlocal Vessels
EARLY STALLINGS							
Lower Coastal Plain/Coast							
Bilbo	30						
Daws Island	30						
Total	60						
Upper-Middle Coastal Plain							
Rabbit Mount		15	2		13	2 (6.7%)	upriver (Lower Piedmont/Fall Zone)
Cox/Fennel Hill		6	10		14	10 (33.3%)	upriver (Lower Piedmont/Fall Zone)
Total		21	12		27	12 (20%)	
Lower Piedmont/Fall Zone							
Victor Mills		5	15		10	5 (16.7%)	downriver (Upper-Middle Coastal Plain)
Ed Marshall			13		17		
Rae's Creek		4	11		15	4 (13.3%)	downriver (Upper-Middle Coastal Plain)
Total		9	39		42	9 (30%)	
CLASSIC STALLINGS							
Coast							
Chesterfield	29				1		
Total	29				1		
Lower Piedmont/Fall Zone							
Stallings Island			32	11	17	11 (18.3%)	upriver (outside of study area)
Lake Spring		4	14		12	4 (13.3%)	Downriver (Upper-Middle Coastal Plain)
Mims Point			20		10		
Ed Marshall			25		5		
Total		4	91	11	44	15 (10%)	
Ogeechee River							
Chew Mill		29			1		
Strange		29			1		
Total		58			2		
TOTAL	178	92	142	11	116	36 (8.0%)	

beyond the current study area. Importantly, 12 of the 15 nonlocal Classic Stallings vessels exhibit carinated forms and all 15 were recovered from either Stallings Island or Lake Spring, the only two confirmed Late Archaic mortuary sites in the region. It is also notable that, in contrast to the preceding period, pottery movement during Classic Stallings times appears to have had a dominant orientation, with vessel transport being directed into Middle Savannah River sites from both upriver and downriver locations.

6. Discussion: community organization and interaction

These results have significant implications for the structure and interaction of Late Archaic Stallings communities. It is important, though, to consider the various modes of interaction that could have precipitated the patterns of pottery movement suggested by the geochemical data. One possibility is that pottery vessels were exchanged by groups along the Savannah River without substantial travel by large numbers of people. This is, for example, the type of vessel exchange network noted by Wallis (2011; Wallis et al., 2010) for later Swift Creek communities in Georgia and Florida. In the present case, however, such a scenario seems unlikely. In contrast to soapstone and marine shell objects, which were frequently exchanged between Piedmont and coastal groups during the Late Archaic period (Sassaman, 2006), high quality clays are widely available along the Savannah River. Moreover, the largely redundant decorative motifs of Stallings pots would seem to make them unlikely candidates for traditional exchange tied to stylistic distinctiveness. Instead, when viewed within the broader context of Stallings societies, other explanations for pottery movement, including residential mobility and large-scale social gathering, come to the fore.

As already noted, multiple lines of evidence suggest that Early Stallings residential communities were relatively small and mobile and

were entangled in larger social networks predicated on the exchange of extralocal materials and artifacts. The compositional evidence presented here for the transport of undecorated Early Stallings pots up and down the river is consistent with this basic view. The interactions referenced by nonlocal vessels during this period were probably precipitated by the seasonal relocation of entire coresidential groups and—together with the exchange of soapstone and other materials—would have tied Early Stallings hunter-gatherers into open and flexible networks of interaction that spanned the length of the Savannah River valley from the lower coastal plain to the Piedmont. Seasonal movements of Early Stallings groups from the Coastal Plain into the Fall Zone likely took place in the early Fall, when mast that was limited in the former province became abundant in the latter. Flat-bottomed basins and soapstone slabs were used for the mass processing of hickory nut at places like Victor Mills (Sassaman, 2006:108–112).

The situation changed at the outset of the Classic Stallings phase with the appearance of the first circular and at least semipermanent villages in the Middle Savannah region. At this point, the overall frequency of pottery movement declined and its orientation became less random. Relatively small circular villages such as Mims Point and Ed Marshall apparently received few, if any, nonlocal vessels. Pottery movement instead seems to have been directed almost exclusively toward a few of the region's largest Classic Stallings sites, including Stallings Island and Lake Spring, which attracted vessels from both upriver and downriver locations during this period. As noted above, these two sites are also unique in housing the first formalized cemeteries in the Stallings region. Stallings Island, the better known of the two, contained scores of Late Archaic burials and hundreds of large pits, many of which held evidence for the mass harvesting and processing of sturgeon and other resources, perhaps related to communal mortuary feasts (Blessing, 2015; Sassaman, 2006:145; Sassaman et al., 2006). A

large majority of the nonlocal vessels identified in this study were carinated pots, an unusual and likely ritually significant form that, in later Mississippian Period contexts, is thought to have been designed specially for serving liquids within large-scale, highly social contexts (Hally, 1986). Stallings Island and Lake Spring are the only sites in the region with more than a trace of carinated vessels (Sassaman et al., 2006).

These data present evidence for a novel Classic Stallings sociality along the Savannah River, one that combined the relatively long-term occupation of small circular villages with periodic larger-scale aggregations involving mortuary ceremonialism and feasting. The apparently localized nature of coresidential village communities constitute a significant departure from the widely distributed and fluid social networks of Early Stallings times. Nevertheless, larger aggregation sites such as Stallings Island and perhaps Lake Spring appear to have served as central nodes in still-functioning regional networks, suggesting that the geographic scale of Stallings interaction may not have shrunk at all, but rather became reconfigured around and anchored to a few key places. In such a scenario, these gathering places would have played a vital integrative role, maintaining broader-scale relationships among groups whose social connections would otherwise have been severed by the adoption of a more settled lifestyle.

Further inferences concerning the scale and organization of Stallings communities are enabled by petrographic data on pottery and clay reference samples that we plan to present in future publications.⁵ For now we add one further observation about the circumstances by which pottery was deposited at sites of Classic Stallings communities. No pottery, local or nonlocal, was included in the graves of those buried in formal cemeteries, a practice that would later come to define the mortuary rituals of many societies of the American Southeast. In fact, the earliest examples of mortuary vessels in the greater region involved not pottery, but soapstone vessels that were displaced hundreds of kilometers from geological sources (Sassaman and Brookes, 2006). As the results of this study suggest, pottery transport associated with mortuary practice involved the gathering of persons at locations of formal villages and cemeteries, presumably for the purpose of mortuary feasting rituals, for which carinated vessels were particularly well suited. That carinated vessels at sites of gathering broke and were deposited in general midden contexts, as opposed to graves, suggests that vessels were not tied to particular persons but instead entire communities or perhaps lineages or clans. Later mortuary vessel caches of the Woodland period likewise evoke a communal orientation in their lack of association with particular persons (Wallis, 2011).

7. Conclusion

The results of NAA of raw clay and Stallings pottery sherds from sites of the Savannah and Ogeechee rivers of the American Southeast enable inferences about the scale and direction of the movement of early pottery as a proxy for community organization and interaction. Although not common, nonlocal pottery of the Early Stallings phase reflects small-scale movements of communities up and down the Savannah River valley, a pattern consistent with seasonal mobility attending the availability of mast and other food resources. Even lower frequencies of nonlocal pottery during the subsequent Classic Stallings phase suggest communities became more circumscribed around key sites, particularly in the middle Savannah River valley. However, the two sites with formal cemeteries, Stallings Island and Lake Spring, include sherds of carinated vessels of disproportionately nonlocal provenance, coming primarily from upriver locations. This shift in

⁵ The petrography results, which show a dominant pattern of decreasing grain size and mineral representation in a downriver direction, largely corroborate and help explain the elemental data presented here in terms of regional geology.

community organization and orientation may have been accompanied by greater social complexity, but the lack of mortuary elaboration suggests instead a continuation of regional-scale communal interactions. On balance, this shift in community organization and interaction appears to have been centered on mortuary feasting events that drew regional groups to places like Stallings Island. Even for the oldest pottery in North America, NAA provides a potent means for inferring regional interactions among mobile hunter-gatherer communities and we thus encourage use of this method for assemblages beyond those reported here.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jas.2018.08.009>.

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