Clay Resource Variability and Stallings Pottery Provenance along the Savannah and Ogeechee Rivers

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Introduction

An understanding of the raw materials available to ancient potters is essential to archaeological considerations of vessel production and provenance. Consequently, the collection and analysis of raw clay samples has become a common component of such studies. This poster presents the results of compositional analyses of clays from along the Savannah and Ogeechee Rivers in Georgia and South Carolina via petrographic point-counting and neutron activation analysis (NAA). These analyses were conducted as part of a larger project focused on reconstructing the ceramic social geography of Late Archaic Stallings societies, makers of North America's oldest pottery technology. While multiple studies have demonstrated the feasibility of geochemical sourcing in other parts of the American Southeast, this is the first systematic attempt to make provenance distinctions based primarily on mineralogical and geochemical variation along the length of a single river.

Sampling and Clay Processing Methods

A total of 24 clay samples were collected, including 21 from locations along the Savannah River (distributed across three contiguous subregions: the lower Piedmont/Fall Zone, the Upper/Middle Coastal Plain, and the Lower Coastal Plain), three from the upland Fall Zone near Aiken, SC, and three from the Ogeechee drainage (Figure 1).

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 and colleagues (2017). Grain-size data were also collected, indicating that the samples range from clay to sandy clay loam based on USDA standards and that all exhibit the minimum level of plasticity necessary for pottery manufacture (based on Rice 1987:39).

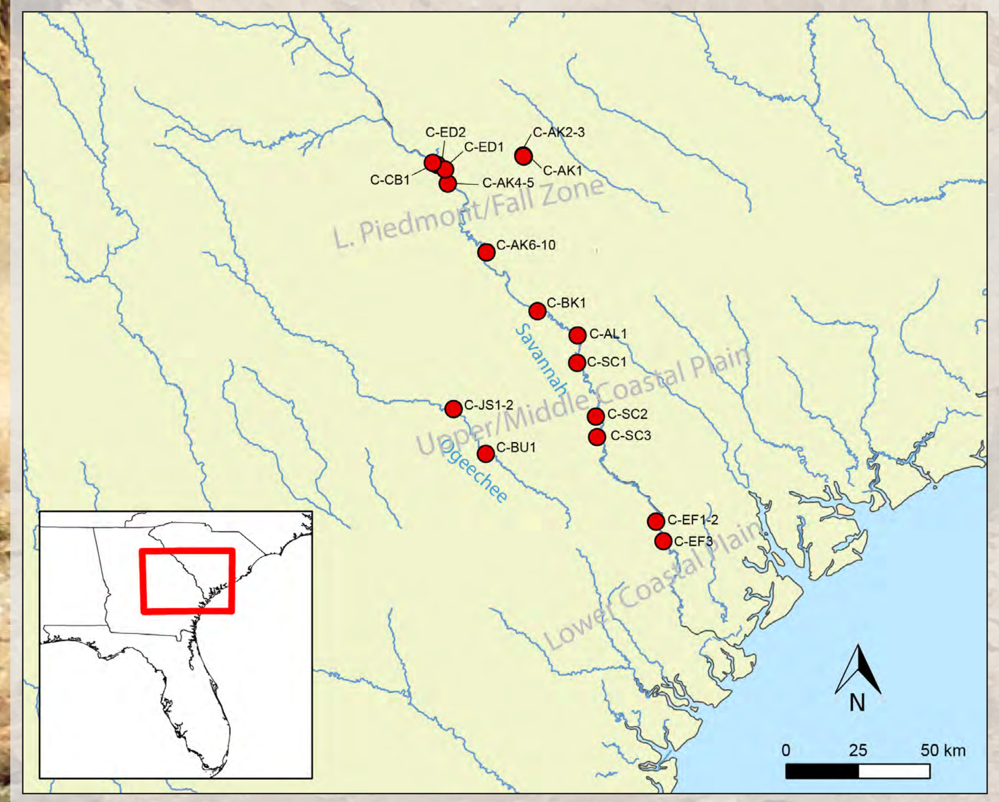

Figure 1. Map showing locations of clay resource samples.
Figura 1. Localización de las fuentes de muestras de arcillas

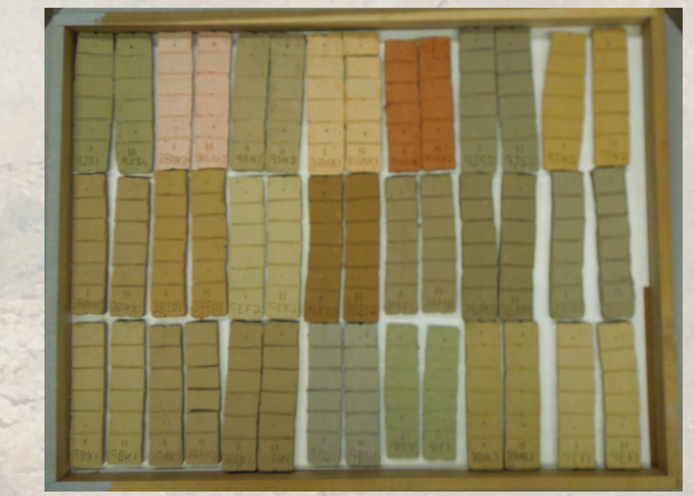

Figure 2. Molded clay briquettes subjected to compositional analyses.
Figura 2. Muestras de arcilla sometidas al análisis petrográfico y de activación neutrónica.

Sample	Subregion	Total Wt. (g)	% Clay	% Silt	% Sand	Soil Classification
C-CB1	Lower Piedmont/Fall Zone	63.6	47.2	19.0	33.8	clay
C-ED1	Lower Piedmont/Fall Zone	97.8	38.9	13.2	47.9	sandy clay
C-ED2	Lower Piedmont/Fall Zone	98.7	43.6	12.5	43.9	sandy clay
C-AK4	Lower Piedmont/Fall Zone	98.6	37.5	21.0	41.5	clay loam
C-AK5	Lower Piedmont/Fall Zone	97.8	58.3	11.5	30.2	clay
C-AK6	Lower Piedmont/Fall Zone	75.0	38.7	15.7	45.6	sandy clay
C-AK7	Lower Piedmont/Fall Zone	49.3	79.1	15.8	5.1	clay
C-AK8	Lower Piedmont/Fall Zone	86.4	92.6	2.4	5.0	clay
C-AK9	Lower Piedmont/Fall Zone	96.1	95.7	2.1	2.2	clay
C-AK10	Lower Piedmont/Fall Zone	96.4	77.8	9.9	12.3	clay
C-BK1	Upper/Middle Coastal Plain	89.3	91.8	2.1	6.1	clay
C-AL1	Upper/Middle Coastal Plain	95.1	53.6	2.0	44.4	clay
C-SC1	Upper/Middle Coastal Plain	97.7	82.9	11.5	5.6	clay
C-SC2	Upper/Middle Coastal Plain	97.2	56.6	12.4	31.0	clay
C-SC3	Upper/Middle Coastal Plain	97.0	81.5	1.2	17.3	clay
C-EF1	Lower Coastal Plain	91.1	51.6	11.1	37.3	clay
C-EF2	Lower Coastal Plain	95.3	61.9	19.6	18.5	clay
C-EF3	Lower Coastal Plain	92.8	53.9	26.5	19.6	clay
C-JS1	Middle Ogeechee	96.4	54.0	9.2	36.8	clay
C-JS2	Middle Ogeechee	98.5	26.3	7.7	66.0	sandy clay loam
C-BU1	Middle Ogeechee	87.4	57.3	9.1	33.6	clay
C-AK1	Upland Fall Zone	99.5	28.1	1.6	70.3	sandy clay loam
C-AK2	Upland Fall Zone	93.1	66.6	2.3	31.1	clay
C-AK3	Upland Fall Zone	98.6	77.1	1.3	21.6	clay

Table 1: Grain-size data and USDA soil classification for sampled clay resources.

Cuadro 1: Datos granulométricos y clasificación de suelos del USDA para los recursos arcillosos recolectados.

Petrography

Thin sections were cut from each of the 24 fired clay briquettes and petrographic point counts were obtained using the methods outlined by Stoltman (1989). These data show significant differences in the frequency of minerals and siliceous microfossils both along the length of the Savannah River and between the Savannah, the Ogeechee, and the Upland Fall Zone (Figure 3; Table 2).

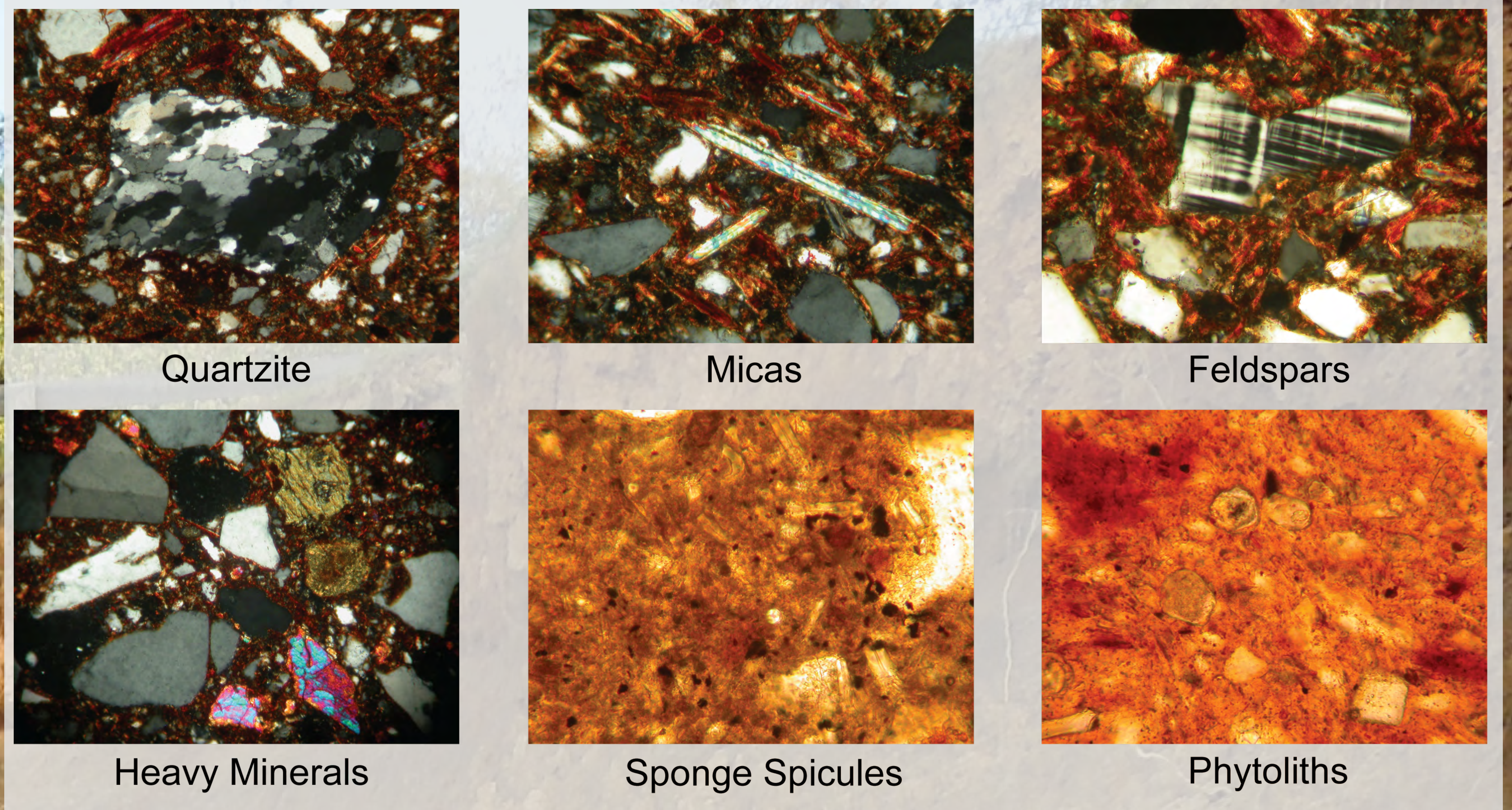

Figure 3. Photomicrographs of minerals and siliceous microfossils showing patterned variation between subregions.
Figura 3. Microfotografías de minerales y microfósiles silíceos que muestran variaciones de patrones entre subregiones.

Along the Savannah River, the clays with the most abundant and coarsest sand-sized inclusions occur in the Lower Piedmont/Fall Zone. These clays also contain the most abundant quartzite, micas, feldspars, and heavy minerals, all of which gradually decrease as one moves downriver. Conversely, sampled clays in the lower Coastal Plain are extremely fine-grained and contain substantial quantities of siliceous microfossils (sponge spicules, diatoms, and phytoliths), which gradually decrease in abundance farther upriver. Ogeechee River clays also contain siliceous microfossils. They are distinguished from Savannah River clays by their extremely coarse texture and dearth of mica, feldspar, and heavy minerals. And finally, clays from the upland Fall Zone contain very few non-clay mineral inclusions and no siliceous microfossils.

Table 2. Mean clay constituent abundances for sampled subregions.
Cuadro 2. Promedio de las abundancias de constituyentes de las arcillas para las subregiones donde se hizo la recolección.

Subregion	% Total sand	Sand Size Index	% PolyX quartz	% Mica	% Heavy minerals	% FMM	Sponge spicules	Phytoliths
L. Piedmont/Fall Zone	27.8	1.25	4.6	3.0	1.9	6.1	absent	rare-common
Upper-Mid Coast Pl.	19.7	1.21	1.1	2.9	0.3	3.8	absent	rare-common
Lower Coastal Plain	23.5	0.81	0.0	2.0	0.3	3.2	absent	rare
Ogeechee	41.7	1.43	1.1	0.0	0.2	0.3	absent-sparse	rare-sparse
Upland Fall Zone	21.7	1.42	0.4	0.2	0.00	0.2	absent	absent

Neutron Activation Analysis (NAA)

NAA of the clay samples was conducted at the University of Missouri Research Reactor (MURR) using standard procedures (described by Glascock 1992), which yielded compositional data related to 33 elements. Meaningful subregional variation in clay chemistry was identified through examination of bivariate scatterplots of both raw elemental and principal components data (Figure 4).

The NAA results show clearly patterned differences in the chemistry of clay resources along the length of the Savannah River. As might be expected based on the gradual sorting of riverine sediments, 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. Manganese (Mn) and the rare earth elements Terbium (Tb), Dysprosium (Dy), Ytterbium (Yb), and Lutetium (Lu) fit this pattern especially well. However, nine of the measured elements, and particularly chromium (Cr), Arsenic (As), and Antimony (Sb), exhibit the inverse pattern, meaning that they are most enriched in clays nearer the coast and gradually decrease upriver. Elsewhere, Upland Fall Zone samples yielded widely divergent clay signatures but generally exhibit relatively high levels of a few elements, such as aluminum (Al) and As, and substantially lower concentrations of most others. Samples from the Ogeechee River are compositionally similar to those of the Upper/Middle Coastal Plain of the Savannah River, but with marked depletions in Sodium (Na), Potassium (K), Scandium (Sc), Mn, Iron (Fe), and Rubidium (Rb)

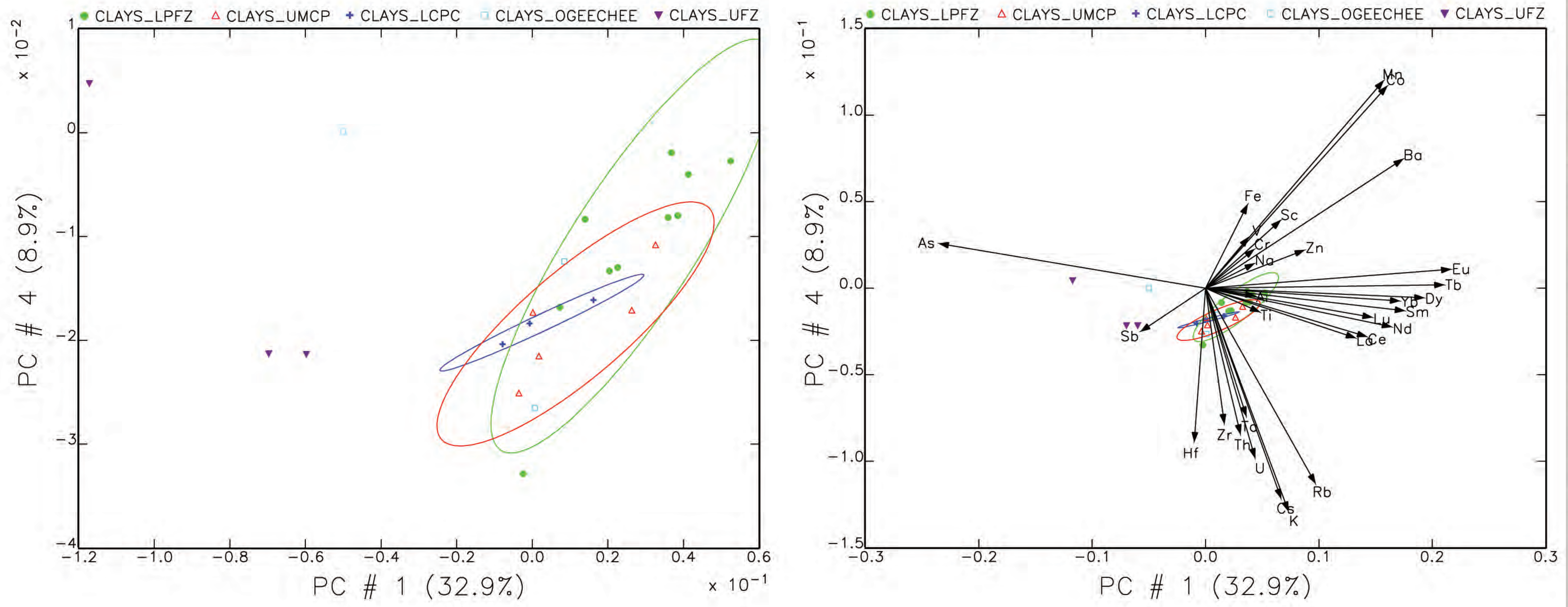

Figure 4. Sampled subregions plotted on Principal Component 1 and Principal Component 4 without (left) and with (right) element vectors.
Figura 4. Subregiones muestreadas trazadas en el componente principal 1 y el componente principal 4 sin (izquierda) y con vectores de elementos (derecha).

Conclusions

The results of petrographic analysis and NAA show strongly patterned variation in both the mineralogical and chemical composition of clay resources in and around the Savannah River valley (see Figure 5). Together, the data gathered using these complementary techniques provide a strong basis for not only distinguishing between local and nonlocal pottery within Savannah River sites but also for inferring the direction (i.e., upriver versus downriver) of vessel movement.

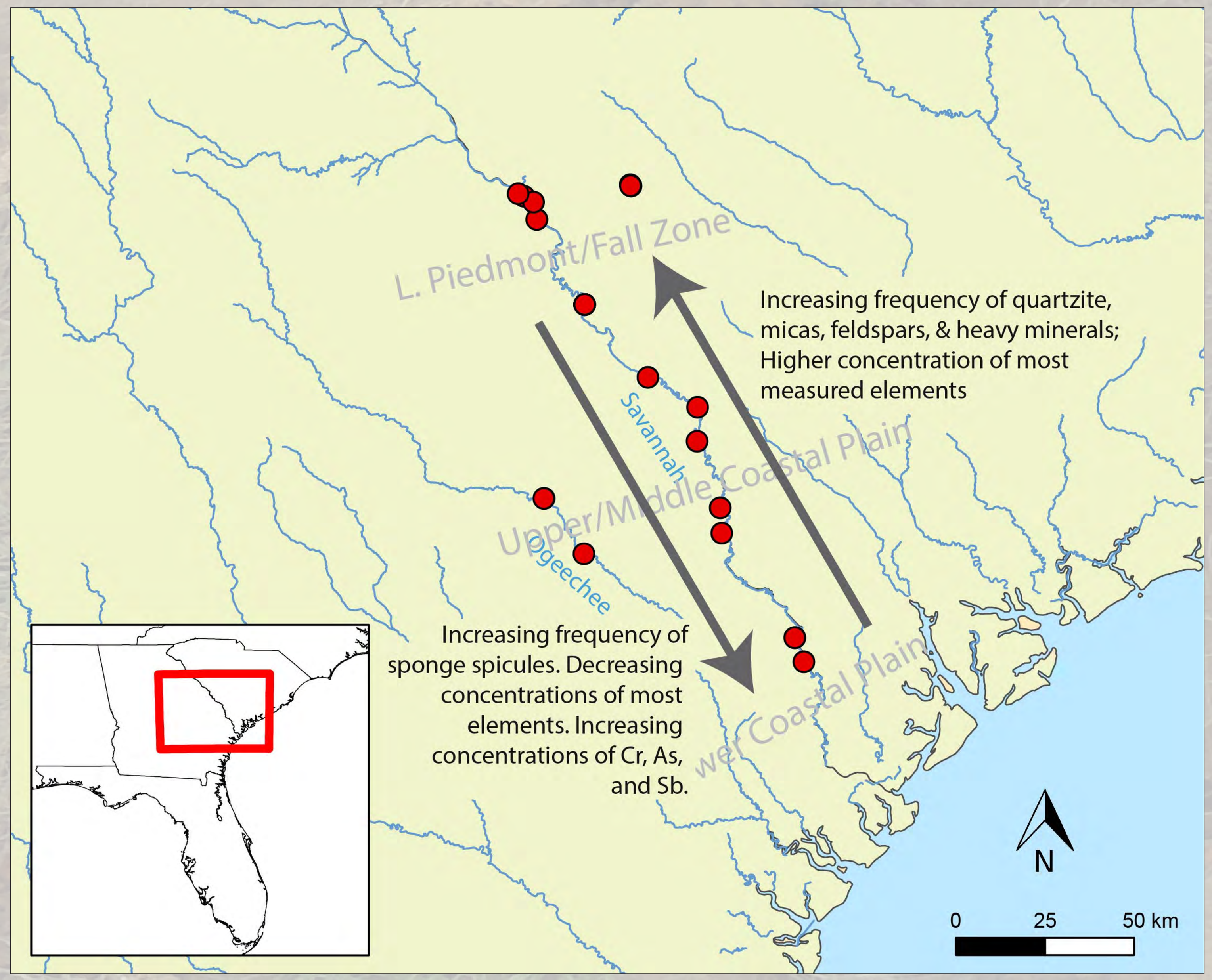

Figure 5. Map showing geographical trends in the chemical composition of clay resources.
Figura 5. Carta con las tendencias geográficas en la composición química de los recursos arcillosos.

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